

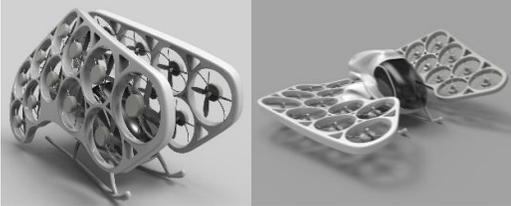
Appendix 3

Wingless, Electric-Powered, Vertical Take-Off and Landing (VTOL) Aerial Vehicles (AVs)

These eVTOL aircraft are Wingless (Multicopter) AVs with no thrusters for cruise, only for lift.

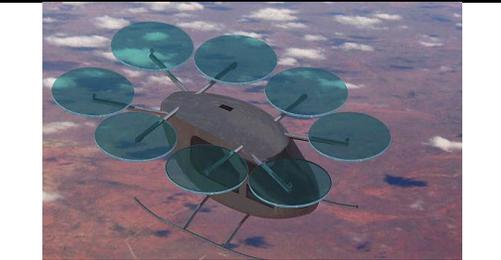
eVTOL.news information is current as of February 2019. Used with permission of the Vertical Flight Society. Please visit their website <http://evtol.news/aircraft>. Additional information was obtained from TransportUp (<https://transportup.com>) and from specific manufacture’s websites, listed in the table. Please visit their websites.

Note: The autonomous vehicles, prototypes or concepts presented herein are listed in alphabetical order, by manufacturer, and are presented for informational purposes only. OVER, LLC does not represent or endorse any particular vehicle, prototype or concept, and has not verified the information.

Make/Model and Brief Description	Image
<p>Airbus Helicopters CityAirbus The CityAirbus demonstrator has 8 propellers and 8 Siemens drivetrains, each direct-drive with 100kW of operating power. The 4-passenger CityAirbus has a cruise speed of about 120km/h (75mph), and a current flight time of 15 minutes. (Marignane, France; www.airbushelicopters.com)</p>	
<p>Alauda Airspeeder The Alauda Airspeeder race vehicle will have 4 propellers powered by custom 50MW brushless motors, with an expected top speed of 250km/h (~155mph) and a 10-minute flying time. Alauda intends to hold the world’s first Airspeeder World Championship in Australia in 2020. (Sydney, Australia; www.alaudaracing.com)</p>	
<p>Astro Elroy The Elroy is an operational, quiet, zero emission, autonomous eVTOL vehicle with touchscreen interface, having 16 individual rotors. The Elroy can transport 2 passengers, or up to 120kg (~265lb) cargo in the “Orbit” model. Max speed 70km/h (~43mph), flight time 20-25min. (Lewisville, TX; www.FlyAstro.com)</p>	
<p>Avianovations Heparid The 1-2 passenger Heparid (Azerbaijani for “cheetah”) has 22 electric motors/propellers. Range 400 km (~249mi), max payload of 240 kg (~529lb), cruise speed 150km/h (~93mph). The “wings” fold for compact parking. (Azerbaijani; www.heparid.avianovations.com)</p>	

Make/Model and Brief Description	Image
<p>Boeing CV2 The unmanned CV2 cargo aerial vehicle (CAV) will be autonomous, have 8 counter-rotating propeller blades and custom Boeing batteries. It will use LIDAR to see 10 miles ahead, and carry 225kg (~500 lb) of payload. (Chicago, IL; www.boeing.com)</p>	
<p>Cartivator SkyDrive The SkyDrive prototype is a 2-person compact flying car/VTOL multicopter with two forward and two aft vertical propellers extended beyond and below the fuselage sides. Expectations: max flight speed 100km/h (~62mph), average driving speed is 60km/h (~37mph), and payload capacity 400kg (~882lb). (Tokyo, Japan; www.cartivator.com)</p>	
<p>Davinci ZeroG The flight-tested ZeroG has 12 motors powering 12 vertical propellers (6 tractor and six pusher) within six fan ducts. Max speed 70km/h (~43mph), max payload 150kg (330lb), max flight time ~25 minutes. The ZeroG varies propeller pitch angles for maximum efficiency. (Hanoi, Vietnam; www.da-vinci.us)</p>	
<p>Dekatone The Dekatone 2-8 passenger flying car concept has 4 ducted fans on each corner, providing rapidly actuated, gimballed variable thrust so the vehicle will fly flat and behave like a car on a two-dimensional plane. To date, the company has not published additional technical specifications. (Toronto, Ontario, Canada)</p>	
<p>EHang 184 The 184 is a 1 passenger, 8 motor/prop, 4 arm battery powered autonomous vehicle which has conducted manned and unmanned flight tests since 2015. Payload 100kg (220lb), speed 100km/h (~62mph), flight time ~25 min. (Guangzhou, China; www.ehang.com/ehang184)</p>	
<p>EHang 216 The 216 is a 2 passenger, 16 motor/prop, 8 arm battery powered autonomous vehicle, scheduled for air-taxi operations in Dubai in 2019. As of July 2018, the 216 has made over 1,000 manned flights. Additional specs unavailable. (Guangzhou, China; www.ehang.com/ehang184)</p>	

Make/Model and Brief Description	Image
<p>Jetpack Aviation (unnamed). Jetpack Aviation’s electric VTOL concept is expected to have 6 folding arms, 12 motors/props, speeds up to 145km/h (90mph), and a 20-minute flight time. Endurance can be extended either using a small generator, or as battery technology develops. (Van Nuys, CA; www.jetpackaviation.com)</p>	
<p>Kármán XK-1 The XK-1 prototype is a 2-8 passenger electric VTOL vehicle having six 30Kw (40hp) motors and propellers for lift, and two rear mounted smaller propellers for propulsion. Payload 200kg (~440lb), speed 450km/h (~280mph), range ~40km (~25mi). (Scotts Valley, CA; http://karman.aero)</p>	
<p>Kenyan Passenger Drone This open-air prototype uses 6 vertical propellers, but the final design has an enclosed cabin with 4 arms. Its flown either autonomously, remotely, or with a joystick. Manned test flights began in 2018. (Kenya)</p>	
<p>Kitty Hawk Flyer The Flyer is a 1-occupant, easy to fly VTOL vehicle designed for water or land use. It has 10 battery-powered electric motors/propellers, weighs 113 kg (~250lb), speed 32km/h (~20mph), and flight time of 12-20 min. (Mountain View, CA; www.Flyer.aero)</p>	
<p>PAV-UL Ultralight The PAV-UL employs a strong but light adaptable frame system which can be fitted with skids, skis or floats for increased mobility. Dry weight 135kg (300lb), flight weight 230kg (507lb), max takeoff weight 330kg (728lb). (United Kingdom; www.pav-x.com)</p>	
<p>PAV-X The 1-passenger PAV-X prototype has 6 arms and 12 motors/propellers for lift and propulsion. Dry weight 168kg (370lb), flight weight 280kg (~617lb), max take-off weight 380kg (~838lb), flight time 15 min (battery only), or 75 min (hybrid). (United Kingdom; www.pav-x.com)</p>	

Make/Model and Brief Description	Image
<p>Pop.Up Next Audi, Italdesign and Airbus are developing a 2-passenger self-driving car/drone comprised of an air capsule, a cabin, and a ground module. The air capsule has 8 motors/propellers, speed of 150km/h (~93mph) and 70 kWh battery. Toulouse, France (Airbus); Moncalieri, Italy (Italdesign); Ingolstadt, Germany (Audi)</p>	
<p>Skypod Aerospace Skypod The Skypod concept is a high-mounted, six-ducted propeller system, with two lateral propellers that are more than twice the diameter of the ducts fore and aft. No other information is available at this time. (New York, NY; www.skypodcorp.com)</p>	
<p>Sky-Hopper The latest Sky-Hopper prototype contains 8 arms and 8 motors/propellers, is made of lightweight aluminum struts, and has a single central seat. The pilot uses a remote-control transmitter to control flight. The enclosed fuselage prototype was unveiled in Apr 2018. (Helioo, Netherlands; www.tinagebel.wixsite.com/sky-hopper)</p>	
<p>Volocopter 2X The 2X is a 2-person, 18-motor, VTOL AV with non-tilting propellers, having conventional joy-stick controls and autonomous capabilities. The Volocopter 2X is a refined version of the VC200. Payload 160kg (350lb), cruise speed 100km/h (~62mph), first manned flight Jan 2018. (Karlsruhe, Germany; www.volocopter.com)</p>	
<p>VRCO NeoXCraft The 2-person NeoXCraft is an autonomous land, air and water vehicle having 4 electric motors powering 4 ducted fans, VTOL ability, payload 180kgs (397lb), aerial speed 333km/h (210mph), 60+ minutes flight duration, can legally drive on roads, can take-off and land in water, and has an emergency parachute. (Nottingham, England; https://www.vrco.co.uk/the-project)</p>	
<p>Workhorse SureFly The 2-passenger SureFly has 8 independent counter-rotating motors driving 8 fixed-pitch propellers, a 150 kW (200 hp) gas combustion engine driving dual generators, and dual Lithium battery packs for (5-min) backup emergency landing. Speed 113km/h (70mph), payload 181kg (400lb), range 113km/h (70mi). (Loveland, OH; www.workhorse.com)</p>	

