

Appendix 1

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

The following eVTOL aircraft use thrusters for both lift and cruise.

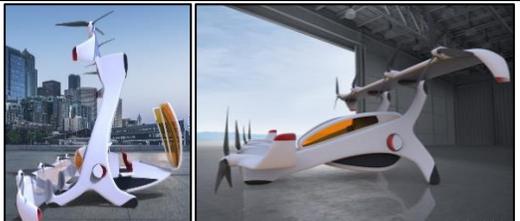
eVTOL.news information is current as of February 2019. Used with permission of the Vertical Flight Society. Please visit their website <http://evtol.news/aircraft>. Additional information was obtained from TransportUp (<https://transportup.com>) and from specific manufacture’s websites, listed in the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

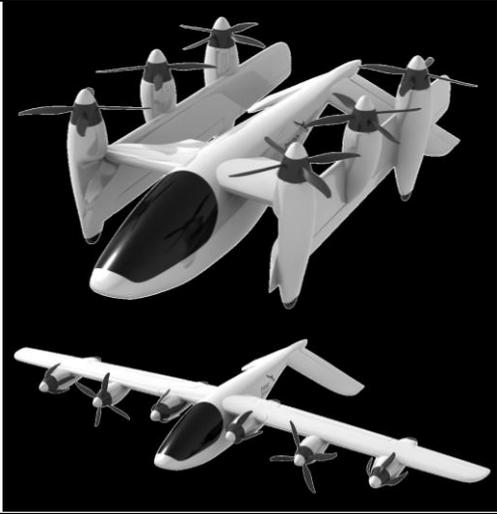
Note: The autonomous vehicles, prototypes or concepts presented herein are listed in alphabetical order, by manufacturer, and are presented for informational purposes only. OVER, LLC does not represent or endorse any particular vehicle, prototype or concept, and has not verified the information.

Make/Model and Brief Description	Image
<p><u>Airbus A³ Vahana</u> The A³ Vahana (pronounced “A-cubed”) is a full-scale self-piloting 8-prop tilt wing prototype, intended to fly a single passenger or cargo. It completed its first test flight in Jan 2018. The A³ Vahana’s goal is to be utilized as a single (eventually double) seated air taxi for urban mobility. (San Jose, CA; www.vahana.aero).</p>	
<p><u>aeroG Aviation aG-4</u> The aG-4 is a concept aircraft, using two 1,000 hp turbine engines to generate electric power for the four adjustable rotors for transporting cargo and passengers. In 2018, they completed design for a passenger model. (Woodland Park NJ, www.f6s.com/aerogaviationllc)</p>	
<p><u>AgustaWestland Project Zero</u> (defunct). Project Zero was a hybrid tilt-rotor/fan-in-wing technology incubator, whose first flight was in 2011. The rotors and electric motors used electromechanical actuators, not hydraulics. (Cascina Costa, Italy)</p>	
<p><u>Airis Aerospace AirisOne</u> The AirisOne is a 5-passenger wheelchair accessible aircraft, capable of autonomous flight. It will utilize a single counter-rotating coaxial lift fan for take-off and eight articulating thrusters for winged flight. (Hamilton, Bermuda; www.airisaero.com).</p>	

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<p>AirspaceX MOBi The MOBi is a tilt-wing aircraft with a modular payload design, using six propellers on a tilt-wing. It will be able to fly autonomously or with pilot assisted. Its modular design will let it fly five passengers or 453 kgs (1,000lb) of cargo, and allows switch-out pods to expand utility. (Birmingham, MI; www.airspacex.com).</p>	
<p>Aston Martin Volante The Volante Vision is luxury 3 passenger fixed-wing concept vehicle, employing hybrid-electric motors powering four tilting propellers in front and two large lift propellers in back. It will fly autonomously or manually by pilot interaction. (Gaydon, UK; www.astonmartin.com)</p>	
<p>Autonomous Flight Y6S The 2-passenger Y6S will be a short range winged and tilt-propeller vehicle designed for autonomous air taxi service. The electric, lithium-battery powered Y6S has expected speed of 113km/h (~70mph) and range of 130 km (~81 mi). Manned test flights are planned in 2019. (Sevenoaks Kent UK; www.autonomousflight.com)</p>	
<p>Bartini Flying Car Bartini unveiled its concept in July 2017, announcing that it is working on 2-seater and 4-seater variants. They plan to launch the 2-seat version for a demonstration flight by the end of 2018, followed by a possible 4-seater in 2020. (Zhukovski, Russia; www.bartini.aero).</p>	
<p>Bell Nexus Air Taxi Unveiled in 2018, the Nexus Air Taxi (supposedly) comes in a 1-passenger plus pilot model, and a 6-passenger plus pilot model. The Nexus could reach top speeds of ~278km/h (~173mph) and recharge wirelessly once on a landing pad. (Fort Worth, TX; www.bellflight.com)</p>	
<p>Carter Aviation Air Taxi The Carter Aviation Technologies Air Taxi is a winged, forward propeller and helicopter/auto-gyro, low noise electric vehicle which can carry up to 499kg (~1,100lb) of payload, 1 pilot and 5 passengers, and cruise at speeds up to 281km/h (~174mph). (Wichita Falls, TX; www.cartercopters.com)</p>	

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<p>DeLorean Aerospace DR-7 The DR-7 employs twin forward and rear counter-spinning tilt propellers, carries 2 passengers, has a top speed of 389km/h (~242mph), and a range of 193km (~120mi). (Laguna Beach, CA; www.deloreanaerospace.com)</p>	
<p>Digi Robotics DroFire The DroFire UAD M470 is a tilt propeller, autonomous vehicle for manned and unmanned uses. It has six tilting 58 kW electric engines, top speed of 215km/h (~134mph), range of 500 km (~311mi), carries up to 177 kg (~390lb) payload, and can fly for 152 minutes or hover for 95. (Dubai, UAE; www.digirobotics.com)</p>	
<p>Dufour aEro2 The aEro2 will use a proven tilt-wing design concept, and a modular hybrid-electric power system to power four motors (two on each side) for redundancy. Each motor can temporarily provide enough power to hover and land, in case of a failure. (Visp, Switzerland; www.dufour.aero).</p>	
<p>EVA X01 The X01 is an all-electric, fully autonomous vehicle with 26 electric motors/propellers. The X01 will carry 2 passengers or a payload of 250 kg (550lb) at 400km/h (249mph) with a range of 250 km (155mi). The X01 is designed for private ownership and/or taxi service. (Toulouse, France; www.eva.xyz).</p>	
<p>HopFlyt Venturi The electric-powered concept Venturi has a canard style, variable incidence channel wings, designed to move passengers 5X faster than ground transportation, with a range up to 322km (200mi). (Lusby, MD; www.hopflyt.com).</p>	
<p>JAXA Hornisse 2B The Japan Aerospace Exploration Agency (JAXA) Hornisse 2B is a scaled 1-seat prototype having 6 fans in cylindrical ducts. JAXA is also looking into the feasibility of a 2-seat version. Testing in progress. (Chofu, Tokyo, Japan; www.aero.jaxa.jp/research/basic/propulsion/liftfan)</p>	

Make/Model and Brief Description	Image
<p>Jetoptera J2000 The J2000 prototype has fluidic propulsion powered by a gas generator providing speeds up to 322km/h (200mph), payloads up to 181kg (400 lb), and range of ~322km (200 miles). In Sep 2018, Jetoptera and GE Aviation are developing a 500-pound-force (lbf) model. (Edmonds, WA; www.jetoptera.com).</p>	
<p>Karem Butterfly The Butterfly uses the company's patented Optimum Speed Tiltrotor (OSTR) technology to control 4 variable-speed tilting electric rotors. In May 2018 Uber announced a partnership with Karem Aircraft, who has been a significant contributor to various VTOL vehicles. (Victorville, CA; www.karemaircraft.com)</p>	
<p>Lilium Jet The Lilium Jet is the first electric-powered jet VTOL vehicle. The 2-seat prototype has 36 electric fans, a cruising speed of 300km/h (186mph), a range of more than 300 km, and zero emissions. A 5-seat version is being developed. (Gilching, Germany; www.Lilium.com)</p>	
<p>Moller Skycar M400 The Skycar is a 4-passenger, electric-hybrid vehicle with 2 forward and 2 rear tilting ducted ethanol fueled Freedom Motor Rotapower® engines generating 720 hp. Cruise speed is 496km/h (~308mph) and range is 1,295 km (805 miles), with a payload of 327 kg (721 lb). Plans include 2- and 6-passenger models, and adding an autonomous mode. (Dixon, CA; www.moller.com; www.freedom-motors.com)</p>	
<p>Neoptera eOpter The first eOpter prototype was flown in Oct 2017, having 8 electric motors and a unique vertical-to-level folding design. The full-size version transports 2 to 5 passengers or equivalent payload. (Neoptera Ltd; Bristol, UK and Toulouse, FR; www.neoptera.aero)</p>	
<p>Opener BlackFly The BlackFly V2 is a tilt-wing, 8-motor, 1-passenger vehicle having a 90.7 kg (200 lb) payload capacity, 128+km/h (80+mph) speed, and 64km (40+ mile) range. It's flown over 10,000 miles with a 200-lb payload. The newer BlackFly V3 model has payload capacity of 113.4 kg (250 lb). (Opener, Inc.; Palo Alto, CA; www.opener.aero)</p>	

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<p>PteroDynamics Transwing The Transwing prototypes takeoff and land like a multicopter, and transition to/from a fixed-wing aircraft for forward flight. With wings folded, the full-scale 4-passenger models can carry 267kg (500lb) of payload. They can use either carbon-based fuel or distributed electric propulsion, to achieve an 800-mile or 100-mile range respectively. At max takeoff weight (MTOW), cruise speed is ~130km/h (~80mph) and max speed is 352km/h (~218mph). According to PteroDynamics, it will fly at least twice as far as any VTOL competitor. (Boston, MA; www.pterodynamics.com)</p>	
<p>Rolls-Royce EVTOL This concept vehicle uses gas turbine technology to generate 500kW electricity to power 6 electric motors, can carry 4-5 pass at speeds up to 400km/h (250mph) with an 800 km (500mi) range. In cruise, wing propellers stop and fold, and tail propellers provide all power. (London, UK; Rolls-Royce Electrification)</p>	
<p>Sabrewing Draco-2 The DRACO-2 technology demonstrator is a highly redundant, semi-autonomous VTOL vehicle designed to fly non-stop and un-refueled for 8800 km (5468 mi). Although unmanned, it's large enough for passengers. (Camarillo, CA; www.sabrewingaircraft.com)</p>	
<p>SKYLYS Aircraft AO The SKYLYS AO prototype will be a small electric, piloted or autonomous aircraft having multiple/redundant electric motors embedded in its wings. Expected max speed is 240km/h (~149mph) with a range of 150 km (~93 mi) and will carry 3-passengers or cargo. (Dover, DE)</p>	
<p>Starling Jet The Starling Jet will be a 10-passenger, 5-engine electric/gas hybrid business jet (2 electric motors in wings) to provide 740km/h (~460mph) speeds and 2,414 km (~1500mi) range. Autonomy is planned, as is a full-scale test model in 2019. (Bedfordshire, UK; www.samadaerospace.com).</p>	

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<p>Terrafugia TF-2 The TF-2 is a 3-part system consisting of a passenger or cargo cabin, transported by an air vehicle and a road vehicle. It has 8 electric tilt-rotor motors, carries 4 passengers or 635kg (1400lb) of cargo, max speed of 230km/h (~143mph) and max range of 300km (~185 mi). (Woburn, MA; www.terrafugia.com)</p>	
<p>Transcend Air Vy 400 The Vy 400 prototype has fully tilting wings and employs a collective and a 30kW electric pusher prop at its tail. It will eventually carry 1 pilot and 5 passengers. Speed 650km/h (~404mph), range 725km (~450mi), and payload 1000kg (~2205lb). (Rancho Santa Fe, CA; www.transcend.aero)</p>	
<p>VerdeGo Aero PAT200 The Personal Air Taxi 200 (PAT200) is a quiet, 2-seat, tilt-wing, hybrid-electric VTOL aircraft with 4 pusher propellers on the rear wings and 4 tractor propellers on the canard. Development is currently on hold. (Daytona Beach, FL; www.verdegoaero.com)</p>	
<p>Vertiia The Vertiia features an auto pilot navigation system for 2 passengers. It will be completely electric with a top speed of ~300km/h (~186mph) and a range of 250km (~155miles). The company provides no additional information. (New South Wales, Australia; www.vertiia.com).</p>	
<p>Vickers WAVE eVTOL The Water Air Vertical Electric (WAVE) is a 4-seat, semi-autonomous hybrid eVTOL with folding wings, and amphibious capabilities. It can carry 227kgs (500lb) payload, with a cruise speed of 222km/h (138mph), and a range of 1,333km (828 miles). (Hamilton, Waikato, New Zealand; www.vickersaircraft.com).</p>	
<p>Vimana AAV The Autonomous Aerial Vehicle (AAV) prototypes have fore and aft tilting wings, each with 4 electric/hybrid-electric motors, and a 1- and 4-seat design. Range is 900km (~550mi), speed 244km/h (~152mph), and payload is ~408kg (900lb). (Redwood City, CA; www.vimana.global)</p>	

Make/Model and Brief Description	Image
<p><u>XTI Aircraft TriFan 600</u> The 1 pilot + 5 passenger TriFan 600 lifts off vertically using 2 wing fans (which rotate for forward flight) and 1 fuselage-mounted fan (which is covered for forward flight). Cruise speed is ~556km/h (345mph) and range is ~2222km (1381mi). It has collision avoidance technologies and the ability to fly with one engine if required. (Englewood, CO; www.xtiaircraft.com)</p>	
<p><u>Zenith Altitude EOPA</u> The Electrically-Powered Optionally-Piloted Powered-Lift Aircraft (EOPA) tiltwing VTOL aircraft has 8 electric propellers on the wing, augmented by four on the tail. Range is expected to be 463 km (~288 miles). (Bromont, Québec, Canada; www.zenith-altitude.com).</p>	