What’s all the buzz about eVTOL?

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AHS International
The Vertical Flight Technical Society
www.vtol.org
What is an eVTOL?

- Electric Vertical Take Off and Landing aircraft, aka
  - Transformative Vertical Flight (TVF) aircraft
  - Urban Air Mobility
  - On Demand Mobility
  - Urban Air Taxi
  - *Not* a “flying car”!

- Includes hybrid/electric aircraft with a combustion engine to generate electricity for long range/endurance

- Creates new design freedoms by allowing power distribution through electrical cables instead of driveshafts ("power by wire" like "fly by wire")
Pre-Historic eVTOL (winged vs. wingless)


Volocopter VC1 Demonstrator (2010)

Photo courtesy of NASA

Photo courtesy of Volocopter GmbH
Multi-“Rotor” Configurations

NASA GL-10 Greased Lightning
(2014 tethered, 2015 transition)

Volocopter VC200
(2013 tethered - 2016 manned)

Photo courtesy of NASA

Photo courtesy of Volocopter GmbH
Volocopter 2x Multicopter
Now in flight test/pre-production

Photos courtesy of Volocopter GmbH
Karlsruhe, Germany

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Original 2-seat Joby S2
12 lift/cruise propellers + 4 cruise propellers
All electric

Current 4-seat Joby S4
6 lift/cruise propellers
All electric

Graphics courtesy of Joby Aviation
Santa Cruz, California, USA

www.eVTOL.news
Lilium Aviation

2-seat “Eagle” LiliumJet prototype
640 kg, all electric

- 36 electric fans
  - 24 on wings
  - 12 on canards
- 160 kt (300 km/h)
- “Eagle” first flight April 2017

New 5-seat LiliumJet concept

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A³ by Airbus: Vahana

Single-seat 8-propeller tandem tiltwing

23%-scale flight tests completed this summer

Two full-scale single-seat aircraft under construction

Graphics courtesy of A³

www.eVTOL.news
Single-seat full-scale "octo-copter" conducting extensive manned and unmanned flight testing. 

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Graphics courtesy of EHang
XTI Aircraft: TriFan 600
Regional hybrid-electric “bizjet”

2/3-scale technology demonstrator under construction to fly in 2019
Planned top speed is 340 kt and a range of 1,000 nm

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- Uber Elevate
  - Unveiled at AHS Workshop in Sep 2016
  - Summit in April 2017

- Developing an “Ecosystem”
  - Partnerships with cities, real estate companies, aircraft manufacturers, EV charger manufacturers and cities
  - Connecting innovators, investors, regulators, technical experts, media

- Smaller aircraft, but higher barriers
  - Technical, regulatory, environmental, economic, infrastructural and cultural

- 10-12 concepts looking at the Uber mission
- Another 2 dozen looking at other missions
Carter Aviation Technologies
Electric Air Taxi SR/C Concept
Aurora eVTOL

- 8 VTOL electric props
- 1 pusher electric prop
- 97 kt (180 km/h)
- First Flight 2018

Full Scale eVTOL concept
800 kg, all electric

¼-scale demonstrator
12.5 kg, all electric

Graphics courtesy of Aurora
Manassas, Virginia, USA

www.eVTOL.news
Factors Affecting Helicopter Noise Generation

- The number of rotor blades (blade loading)
- Gross weight
- Rotor blade shaping (tips)
- Tip speed
- Engine
- Tail rotor
- Aircraft attitude
- Aircraft speed/dynamic maneuvers
- Altitude/temperature

**Bold** = Factors expected to be ameliorated by eVTOL designs
eVTOL are expected to be quieter than helicopters

- Lots of small rotors a high frequency (may independently vary frequency)
- Buzz vs. “wop-wop”
- May mask sound in ambient noise

Some anecdotal testing seems to support this

Being nearly inaudible is a requirement for Uber: need to fly in communities

Still largely unproven

“Proof of the pudding” is in the operations
Key Points to Fly Neighborly

- Fly at an altitude that is as high as practical.
- Avoid residential areas when possible.
- Fly over industrial areas and major roadways to mask the sound of helicopters.
- Avoid late night/early morning flights.
- Fly at an altitude that is as high as possible over scenic and recreational areas such as parks and beaches.
- Identify noise-sensitive areas and adjust routes to avoid them to the extent possible.
- Adhere to published noise abatement approach/departure procedures when flying in and out of airports and heliports.

Graphics from the HAI Fly Neighborly Guide
Electric VTOL News
- www.eVTOL.news
- www.facebook.com/electricVTOL
- www.twitter.com/electricVTOL
- Email newsletter
- eVTOL News videos
- Comprehensive analytical report (coming Dec 2017)

Many missions beyond Uber Elevate

No one really predicted the drone revolution. History may repeat.