The Volocopter flies!

And is Ready to Take the Next Step to Urban Mobility

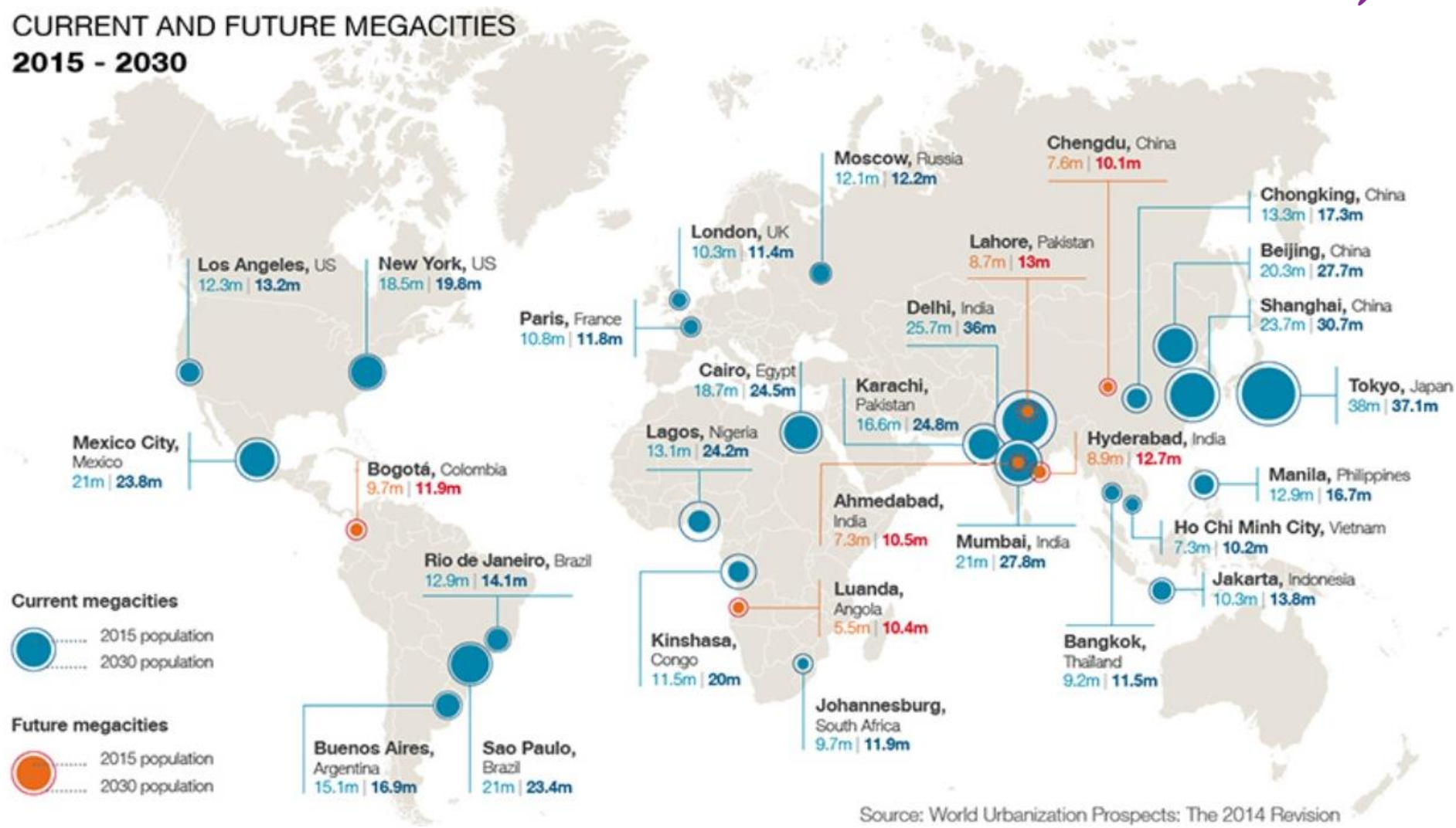
- by e-volo GmbH -

Florian Reuter | NASA ODM Workshop, Hartford, CT, USA | 29 September 2016

Content

The world urgently needs innovation in urban mobility

Urban mobility needs are growing worldwide



The Volocopter offers revolutionary simplicity in piloting, unprecedented safety, low noise, and the absence of emission

Cost effective

» Superior operating costs

Simple

» Automatic flight stabilization
» Operation of VTOL[1] via single joystick
» Significantly reduced piloting skills required

Safe

» Multiple redundancy in all critical components and networks
» Significant reduction of human errors
» Full aircraft emergency parachute

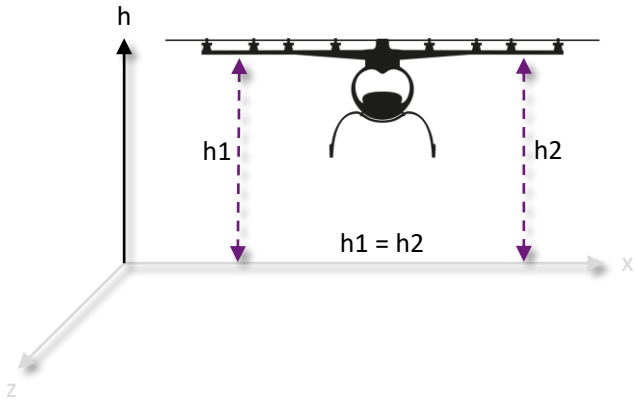
Green

» Purely electric
» Significantly reduced acoustic signature

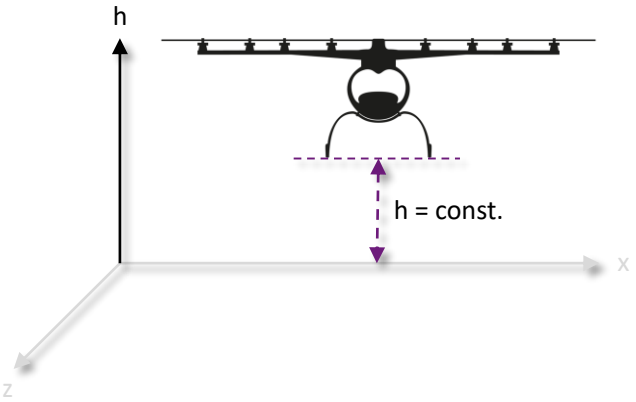
1 Vertical take-off and landing vehicle

The Volocopter already masters revolutionary fully automated maneuvers

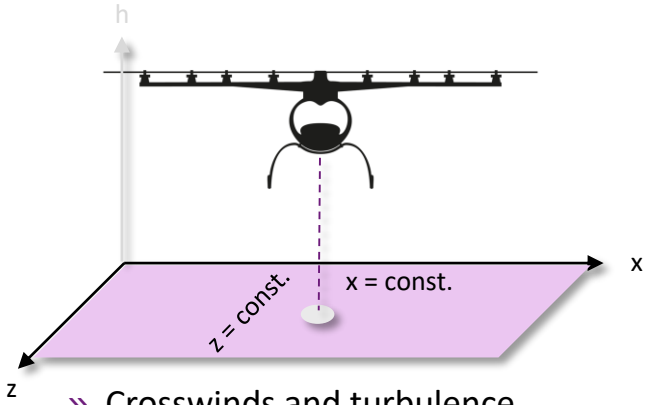
Automatic Attitude Control



Automatic Altitude Control

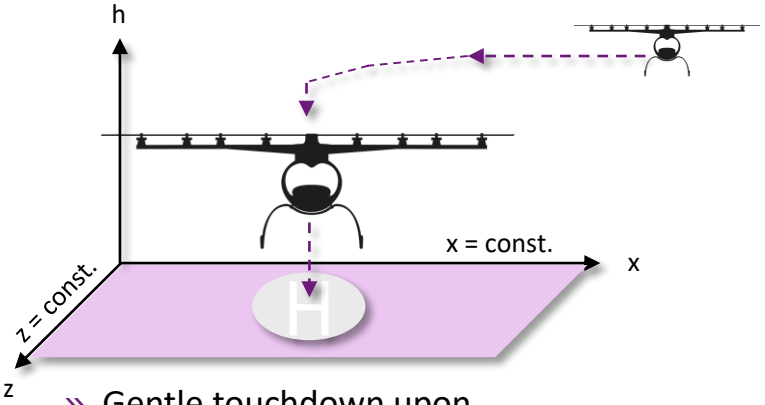


Automatic Position Hold



» Crosswinds and turbulence automatically compensated

Automatic Landing



» Gentle touchdown upon pilot command

The propulsion system of the Volocopter is mechanically far simpler than in a conventional helicopter

Volocopter vs. Helicopter

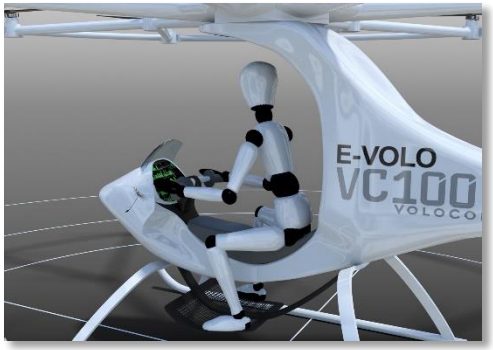
- Direct drive
- Brushless motors

Simple mechanics:
Less failures, less maintenance, lower operational costs

- Swashplate
- Pitch control
- Gear-box
- Rudders
- Push rods
- Tail rotor

The Volocopter platform can be extended into a range of innovative aerial vehicles, both manned and unmanned

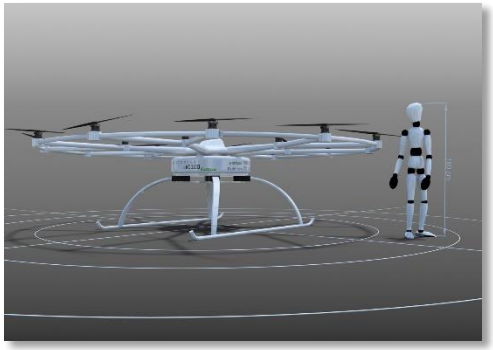
VC100



VC200

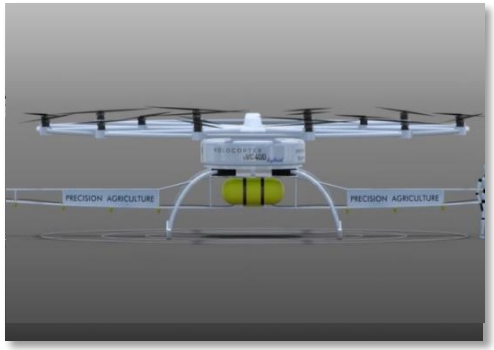
VC400

uVC100



uVC200

uVC400

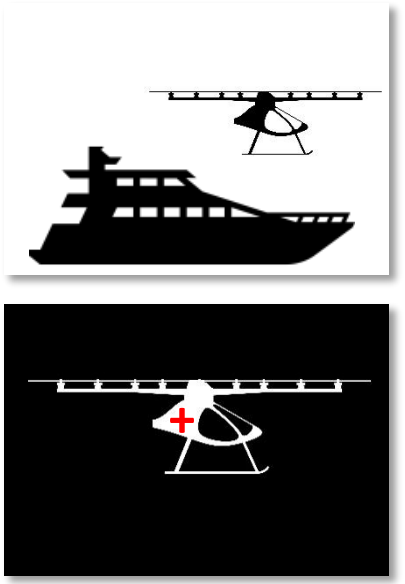


All vehicles can be equipped with a purely electric or hybrid propulsion system

The Volocopter enables revolutionary use cases in urban mobility

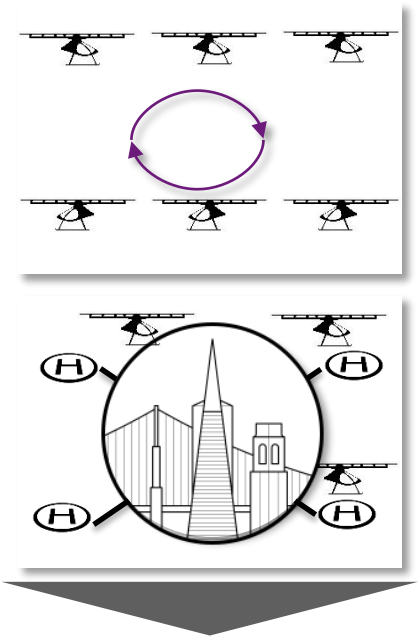
e-volo will lead to create these markets with a deliberate 3-step approach towards fully autonomous aircraft

Existing Aircraft (private and govt.) 1



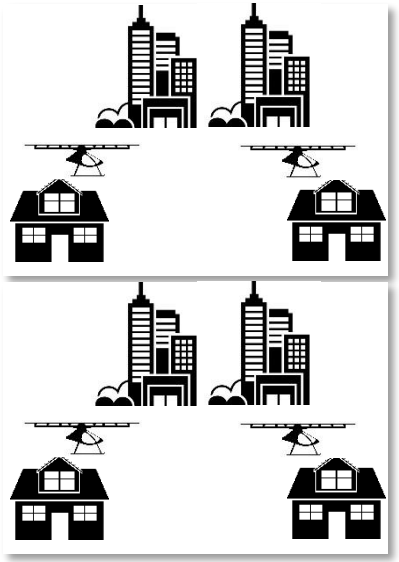
- » Expand existing markets for gyrocopters and helicopters
- » Existing regulation
- » Served by Volocopter starting in 2018

Urban Aircraft (incl. commercial) 2



- » Lead emerging markets for personal flight in urban areas
- » Modifications to regulation
- » Served by Volocopter starting in 2020

Personal Aircraft/ Autonomous Aircraft 3



- » Lead emerging markets for autonomous flight
- » New regulation required
- » Served by Volocopter starting in 2022(?)

1 Personal Air Transportation System; cp. to EU project MyCopter by Max Planck, ETH, KIT, DLR et al.

Content

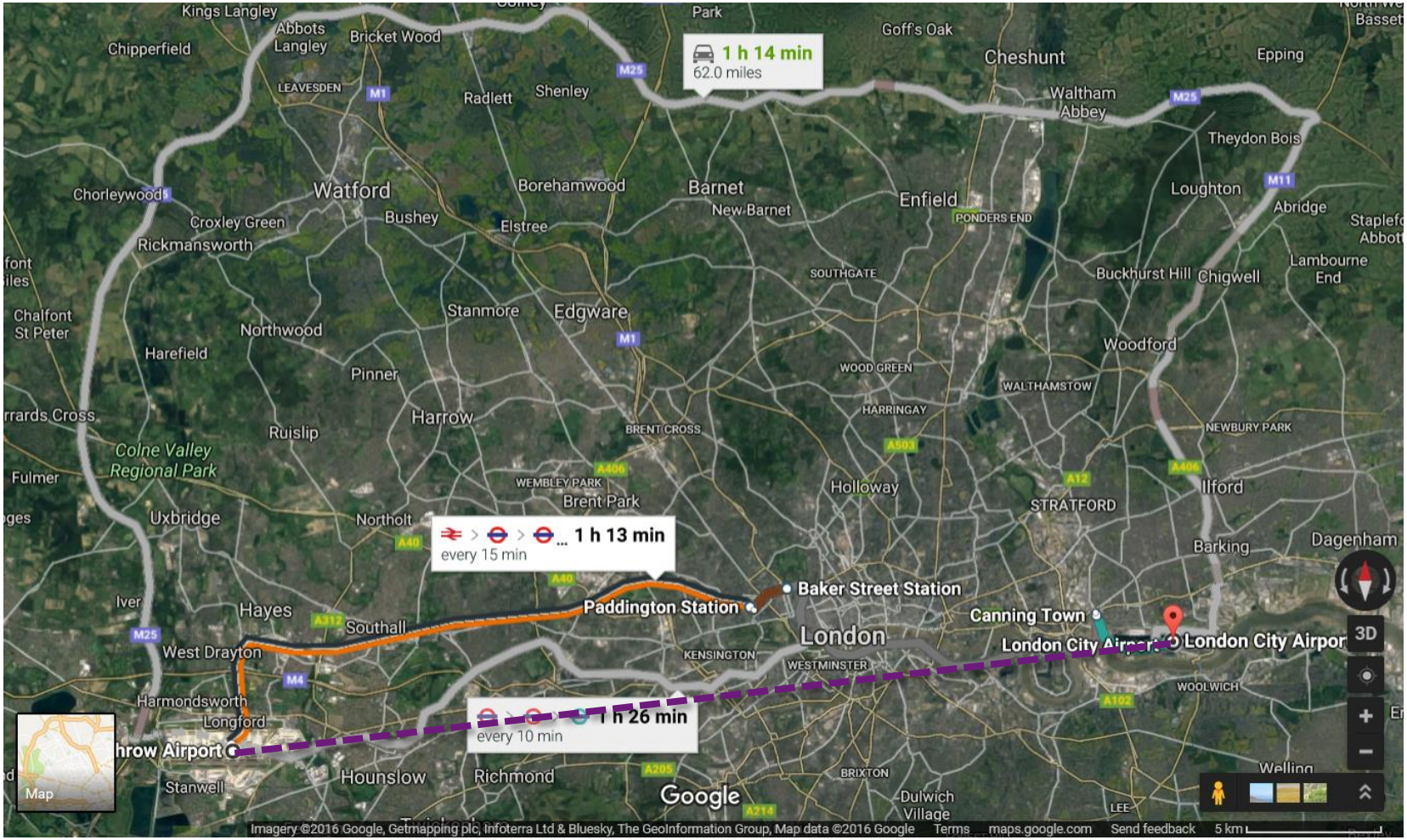
In order to successfully implement an aerial shuttle service in an urban setting, several prerequisites need to be met

Prerequisites for operating in urban centers

- Safety ✓
- Noise/Emissions ✓
- Cost/Benefit ✓
- Feasibility ✓

An exemplary case study for London illustrates the value of a Volocopter shuttle service

Shuttle from Heathrow to London City Airport, Distance to cover: ~ 20 miles



Source: Google Maps

VOLOCOPTER

A Volocopter service can offer the service at 1/3 of the time required by ground transport

Comparison of transportation modes

Passenger car

» Distance: 62 miles

» Trip time: 1:14 hrs

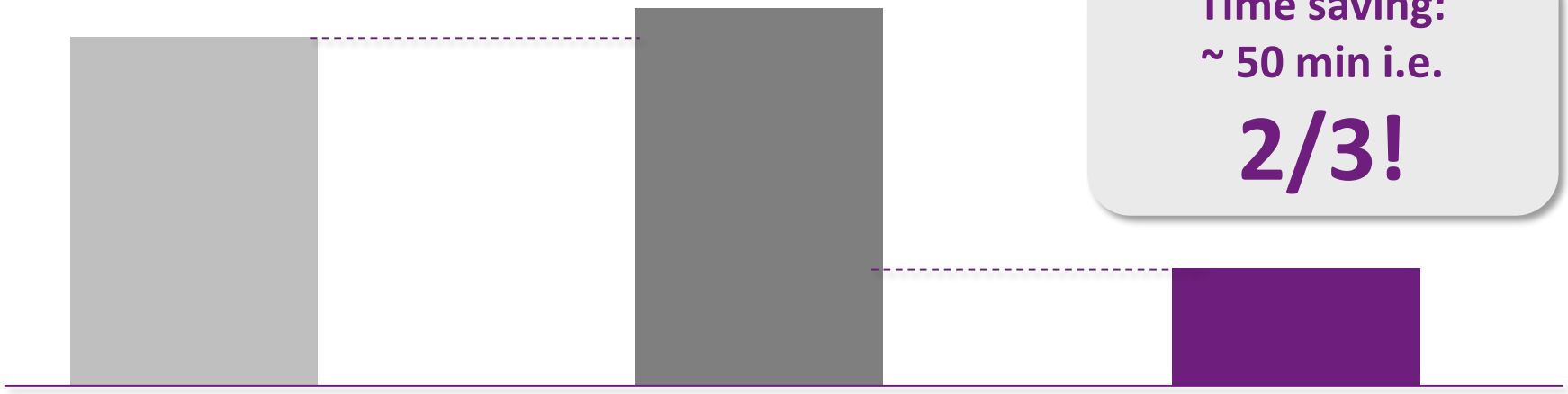
Public transport

» Trip time: 1:13 hrs
– every 15 min

Volocopter service

» Distance: 20 miles

» Trip time: 25 min



Time saving:
~ 50 min i.e.
2/3!

Source: Google Maps

Content

A brief acoustic test flight program indicated significant noise advantages of the Volocopter over a conventional helicopter

vs.

- Capacity: 2 passengers
- MTOM: 450 kg
- Diameter of rotor circle: 7,60 m

- 18 fixed pitch blades
- 18 battery-powered electric motors

- Capacity: 2 passengers
- MTOM: 650 kg
- Rotor diameter: 7,70 m

- 1 main rotor and 1 tail rotor (pitch variable)
- Single piston-engine

Acoustic test

Vertical climb from ground level to 75 meters above ground level

The VC200 proved to be half as loud on takeoff and about one-third as loud at altitude versus the R22

vs.

A-weighted sound pressure measurements:

- **$L(AS_{max})$ = 80 dB during climb**
- **$L(AS_{max})$ = 65 dB at 75 m distance**

- **Series of tones clustered around a tight frequency band**
- **Near complete absence of blade-vortex interaction noise (BVI.)**

A-weighted sound pressure measurements:

- **$L(AS_{max})$ = 90 dB during climb**
- **$L(AS_{max})$ = 82 dB at 75 m distance**

- **3 sound sources with distinct frequencies**
  - **Main rotor at 17 Hz**
  - **Tail rotor at 113 Hz**
  - **Engine at 180 Hz**

Source: Confidential Report by Josephson Engineering

The Volocopter represents a breakthrough in the design of novel, quieter VTOL aircraft

Preliminary conclusion

18 Volocopter rotors are only 2 x as loud as a single one

A VC200 takeoff at 75 m is about as loud as an R22 at 225 m

Overflight of a VC200 at 75 m is roughly as loud as an R22 at 500 m

Using PNL measurements the differences between the VC200 and a helicopter with a turbine engine would be even greater!

Source: Confidential Report by Josephson Engineering

We aim to conduct first pilot cases in 2018