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
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» Introduction to the Volocopter and its potential

» Exemplary Use Case

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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 VTOL¹ 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**
- $h_1 = h_2$

**Automatic Altitude Control**
- $h = \text{const.}$

**Automatic Position Hold**
- $z = \text{const.}$
- $x = \text{const.}$

**Automatic Landing**
- $x = \text{const.}$

» Crosswinds and turbulence automatically compensated

» 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.

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

1. **Existing Aircraft (private and govt.)**
   - Expand existing markets for gyrocopters and helicopters
   - Existing regulation
   - Served by Volocopter starting in 2018

2. **Urban Aircraft (incl. commercial)**
   - Lead emerging markets for personal flight in urban areas
   - Modifications to regulation
   - Served by Volocopter starting in 2020

3. **Personal Aircraft/Autonomous Aircraft**
   - 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.
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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
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!
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A brief acoustic test flight program indicated significant noise advantages of the Volocopter over a conventional helicopter.

- **Capacity:** 2 passengers
- **MTOM:** 450 kg
- **Diameter of rotor circle:** 7.60 m
- **18 fixed pitch blades**
- **18 battery-powered electric motors**

**Volocopter**

- **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

A-weighted sound pressure measurements:

- \( \text{L}(\text{AS}_{\text{max}}) = 80 \text{ dB during climb} \)
- \( \text{L}(\text{AS}_{\text{max}}) = 65 \text{ dB at 75 m distance} \)

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

A-weighted sound pressure measurements:

- \( \text{L}(\text{AS}_{\text{max}}) = 90 \text{ dB during climb} \)
- \( \text{L}(\text{AS}_{\text{max}}) = 82 \text{ dB at 75 m distance} \)

- 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!
We aim to conduct first pilot cases in 2018