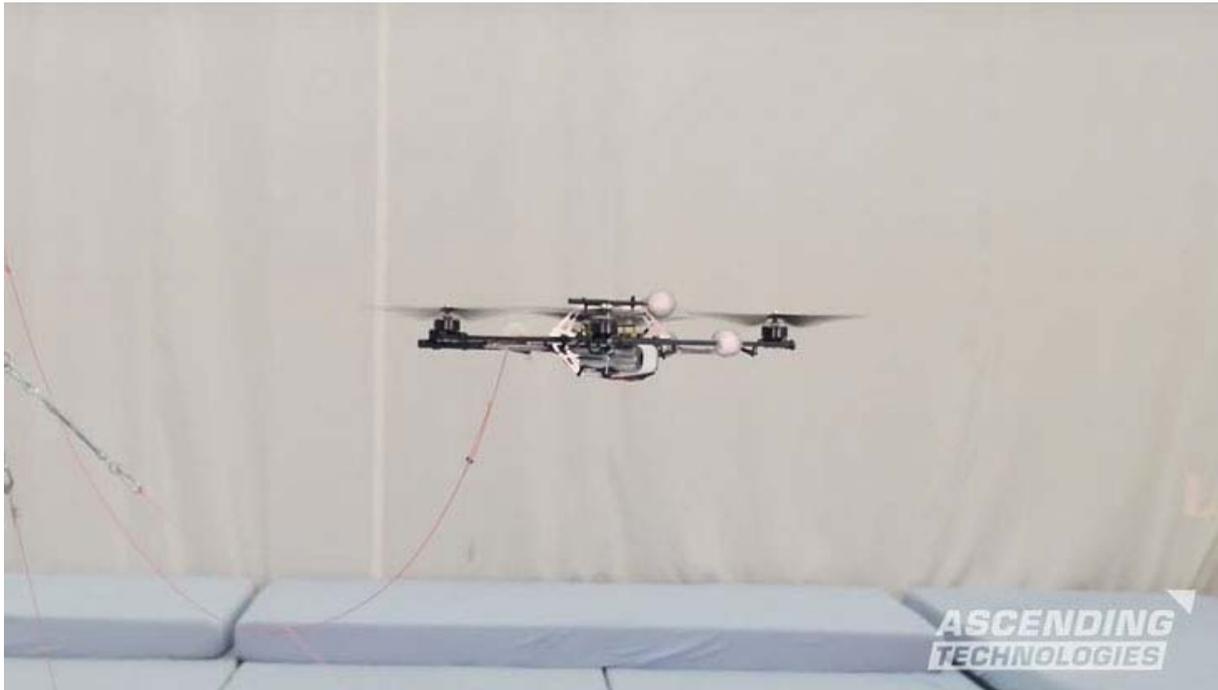


Back to the Future 10 – Drones at the limit

21. August 2015



Exploring the limits of drones: The AscTec Hummingbird has been part of various revolutionary drone tricks. Most of the videos including our tiny unmanned aerial vehicle are made possible by the ETH Zurich. Now the researchers are training the drone to the very limits of the possible.

The Swiss university is one of the world's leading universities for technology and the natural sciences. It has more than 18,500 students from over 110 different countries, including 4,000 doctoral students. Albert Einstein and Ferdinand Piech did their graduation and studies there.

Centripetal forces & drone airspeeds at up to 50 km/h

The video shows high-speed steady flight in confined spaces for tethered quadcopters. Due to the centripetal force exerted by the tether, high-speed trajectories along circles at different

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orientations in space can be flown. Velocities exceeding 50 km/h and centripetal accelerations of more than 13 g are achieved in steady flight, within a sphere of radius 1.7 m.

<https://youtu.be/iJPylgeXu4M>

High-g quadcopter training in the Flying Machine Arena at ETH Zurich.

High airspeeds & emergency braking

The testbed allows the characterization of the flight behavior of quadcopters at high airspeeds, identifying for example drag characteristics and propeller efficiency. Furthermore, the physical limits of the machine can be identified. The testbed can also be used to safely develop high-speed maneuvers, such as emergency braking.

Note that it is possible to remove the central pole by balancing the forces acting on the strings; this could be then used in performance settings, possibly enhanced by light and sound effects.

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Institute for Dynamic Systems and Control (IDSC), ETH Zurich, Switzerland – <http://www.idsc.ethz.ch>
- **Video:** Federico Augugliaro, Maximilian Schulz
- **Location:** ETH Zurich, Flying Machine Arena – <http://www.flyingmachinearena.org>
- **Technical details:**
 - Frame, motor, and motor controllers: Hummingbird, Ascending Technologies
 - Propellers: 8", flexible, Ascending Technologies
 - Electronics: PX4 FMU and custom electronics
 - Infrastructure: Flying Machine Arena
- **Acknowledgments:** This work is supported by and builds upon prior contributions by numerous collaborators in the Flying Machine Arena project. See <http://www.flyingmachinearena.org/people>. This work was partially supported by the Hartmann Müller-Fonds on ETH Research Grant ETH-30 12-1 and by the SNSF (Swiss National Science Foundation).
- **Source:** <http://flyingmachinearena.org/videos/>

About Flying Machine Arena: The Flying Machine Arena offers a safe, controlled sandbox environment allowing the testing and validation of mobile robots. Thanks to its large size, it allows the testing of fast-paced motions, be it on the ground or in the air. The Flying Machine Arena offers ideal conditions to test novel concepts thanks to a high-precision localization system, high-performance radio links, easy-to-use software structure, and safety nets enclosing the space.



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The Flying Machine Arena is used in a range of projects carried out at the Institute for Dynamic Systems and Control and other research laboratories. Thanks to its versatile nature, it is used both as an experimental test bed in its own right and to validate other experiments.

Tags: [UAV Research and Development Projects](#), [UAV Technology Trends and Visions](#)

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