NAVIGARE 2014

Drones - today and tomorrow

A novel approach for search and rescue

Przemyslaw Kornatowski

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Laboratory of Intelligent Systems, EPFL, Switzerland

Prof. Dario Floreano

http://lis.epfl.ch/

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Motivation

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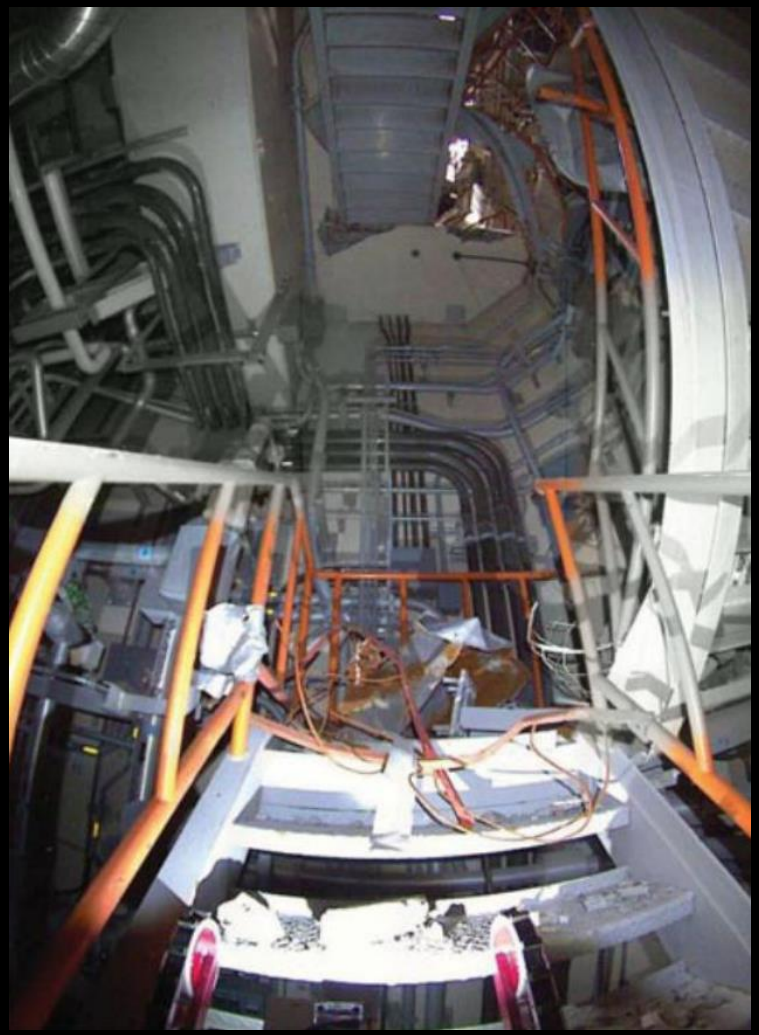
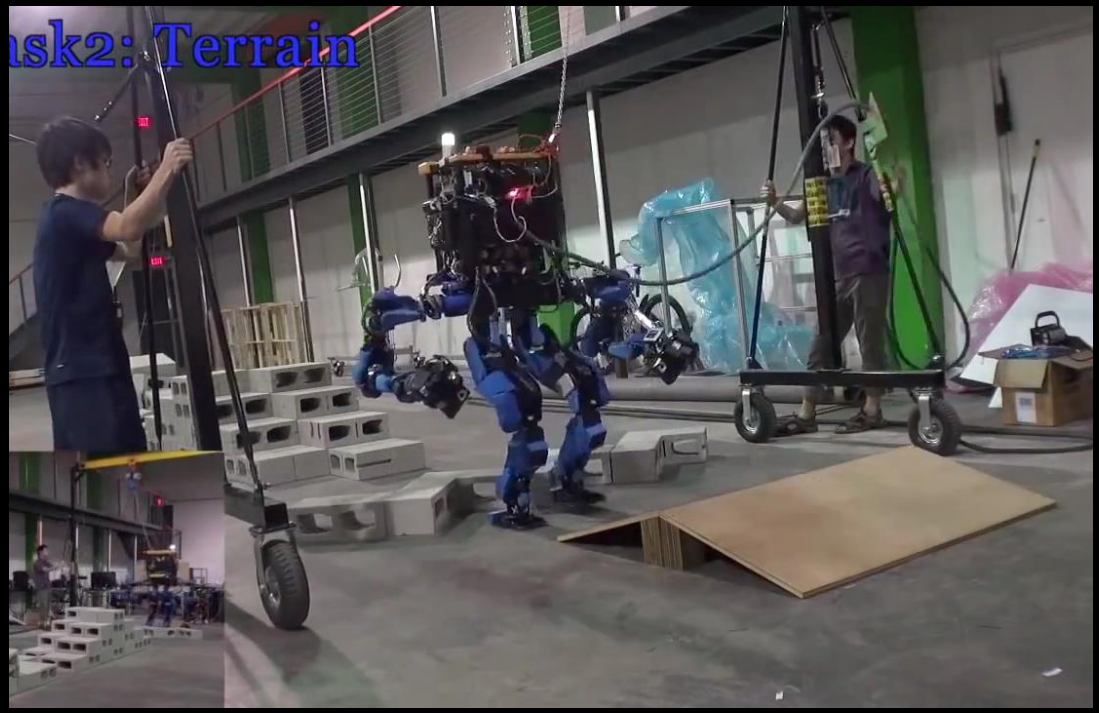
Limitation for terrestrial robots





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Flying robot in Fukushima

T-Hawk MAV, 8kg

Fukushima Daiichi, Japan, 2011

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Audio-based Swarming MAVs

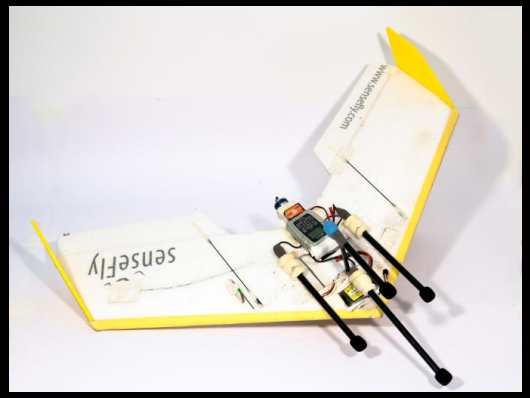
Felix Stephan Schill

Meysam Basiri

Goal:

Motion coordination and mid-air collision avoidance for a swarm of MAV's using:

- Audio-based relative positioning
- Distributed control



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FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

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SMAVNET

Iliana Spartali

Heitz Grégoire
Hilaire Marie

Sabine Haubert

Severin Leven

Goal:

- The SMAVNET project aims at developing swarms of flying robots that can be deployed in disaster areas to rapidly create communication networks for rescuers.

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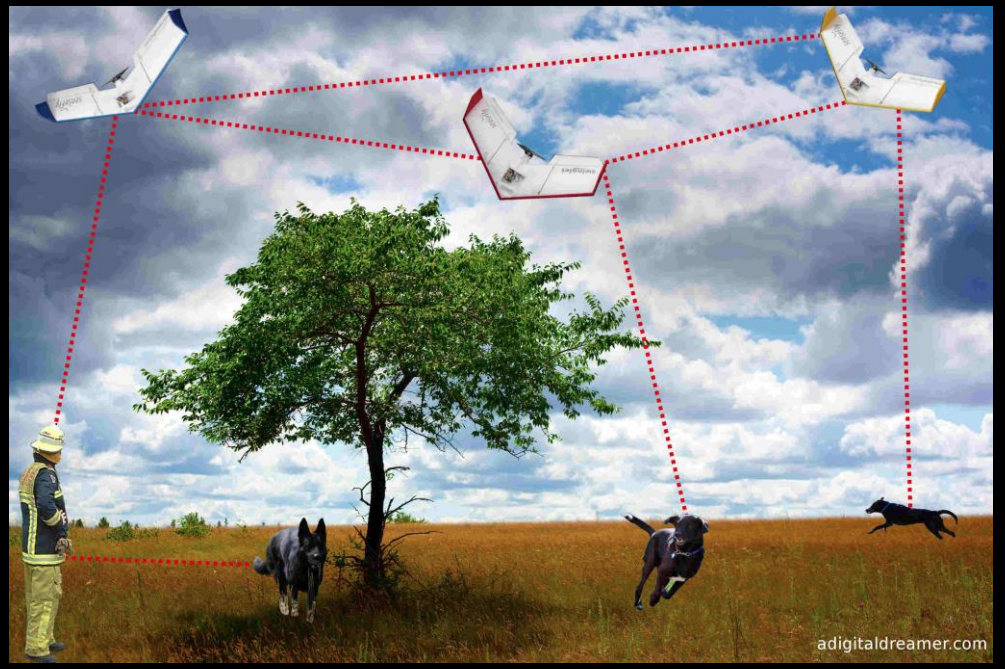
SWARMIX

Varga Maja

Heitz Grégoire
Hilaire Marie



Goals:

- Heterogeneous swarm - humans, flying robots and animals in search-and rescue operation.

Method:

- Agents are connected in wireless network.
- Flying robots provide communication relay, serve as eye in the sky, guide, monitor and attract dogs.

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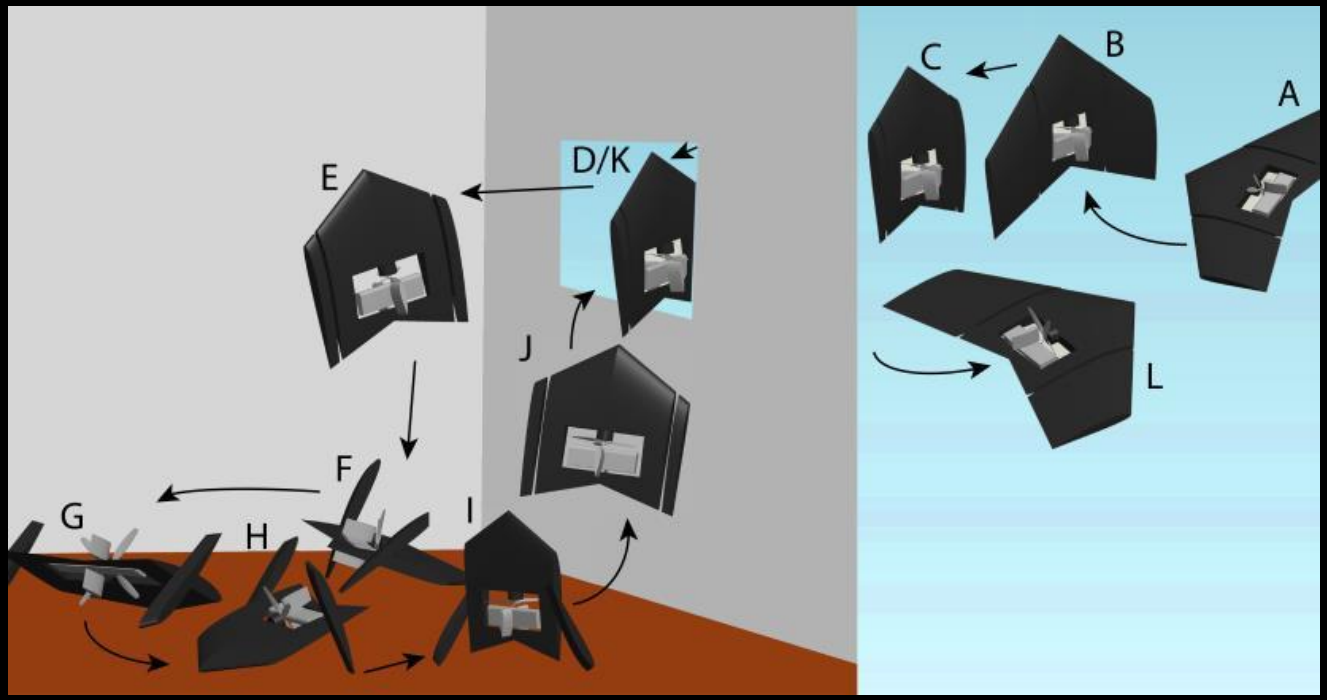
Adaptive Morphology for Multi-Modal Locomotion

Daler Ludovic



Goal:
Create a robot that is capable of exploring multiple terrains by exploiting adaptive morphology.

DALER

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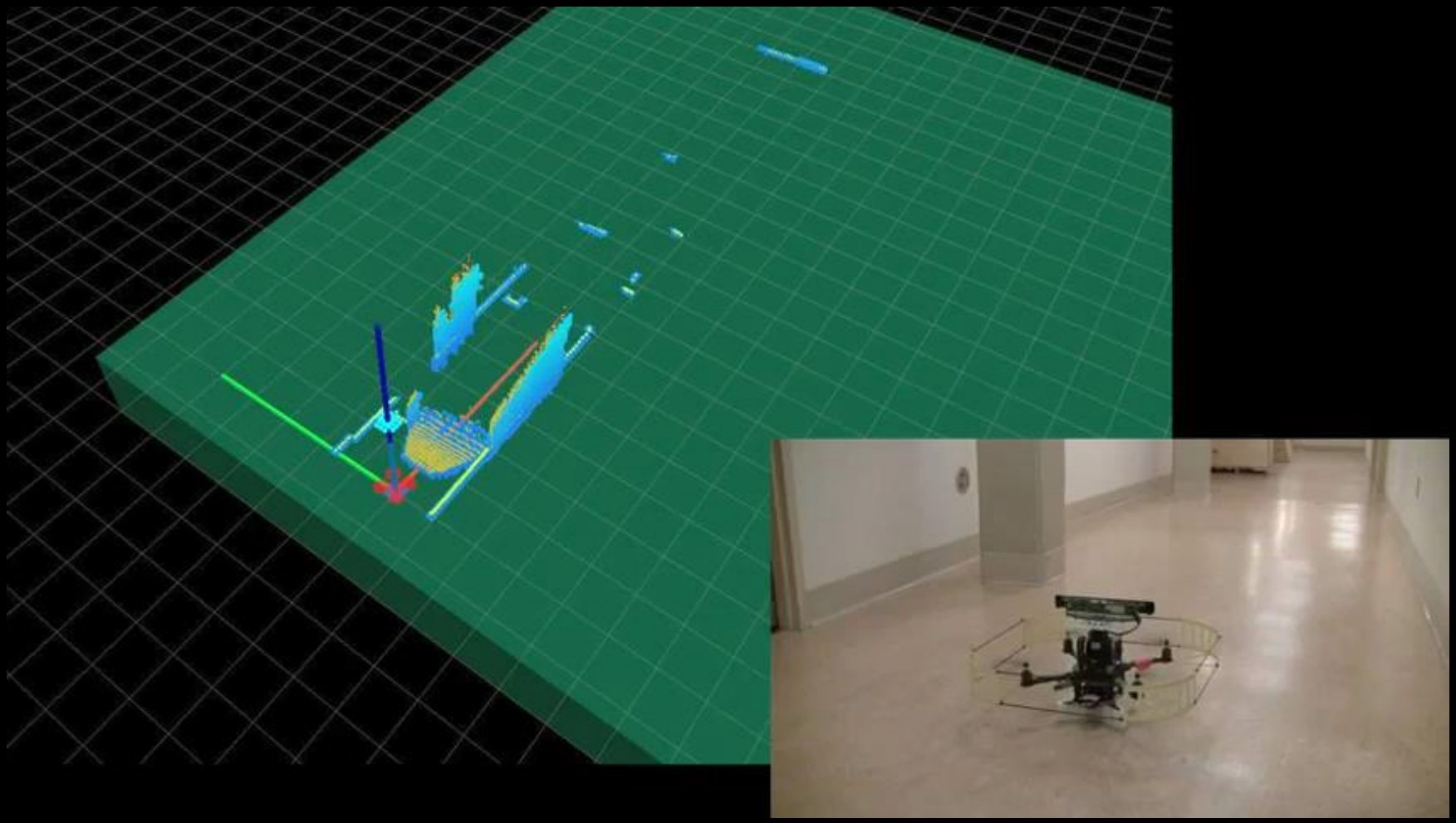
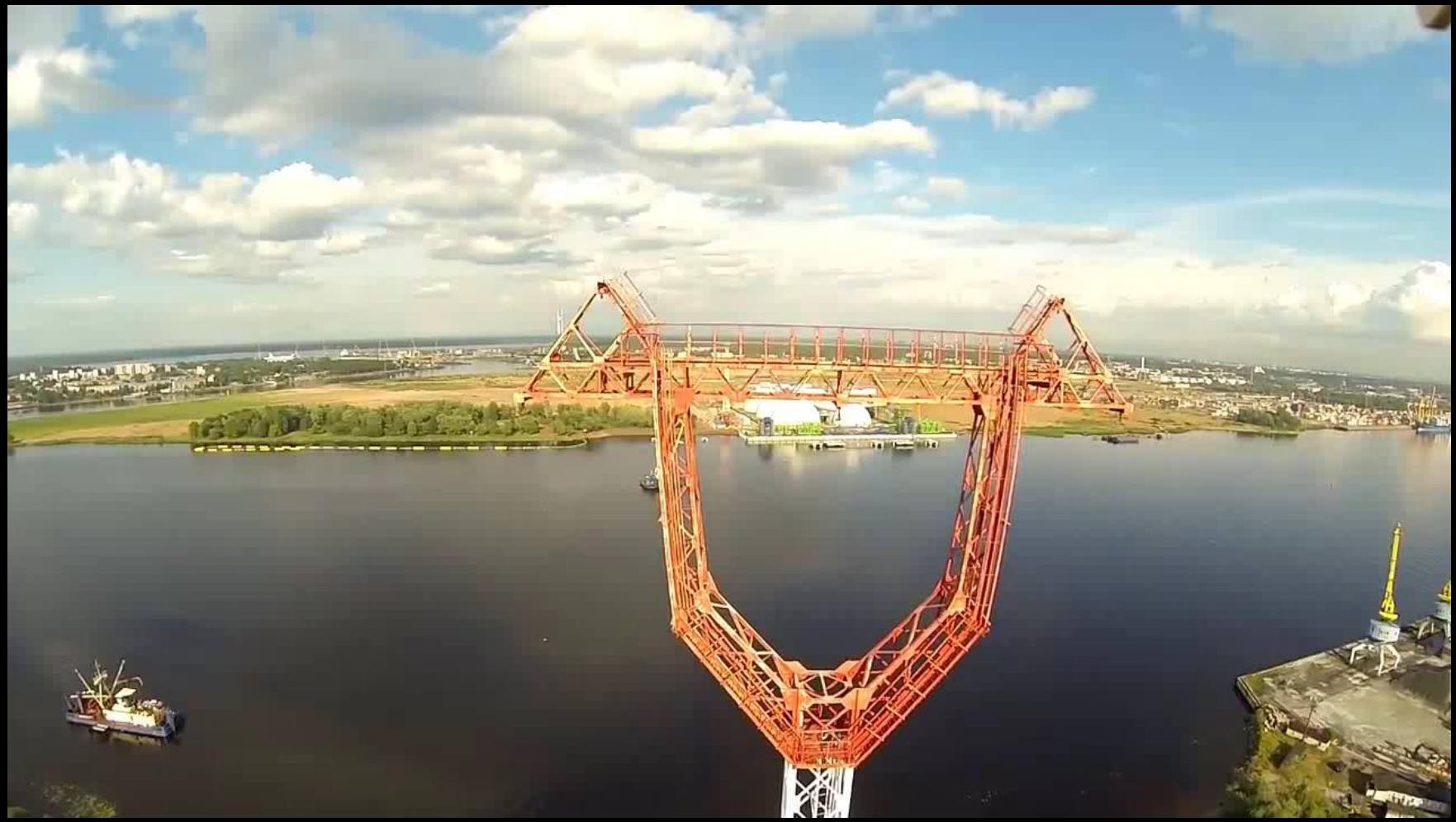
Conventional approach



V. Kumar, U. Penn., 2011

A lot of space doesn't solve the problem



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Insects don't just fly

Briod, Harvard, 2008

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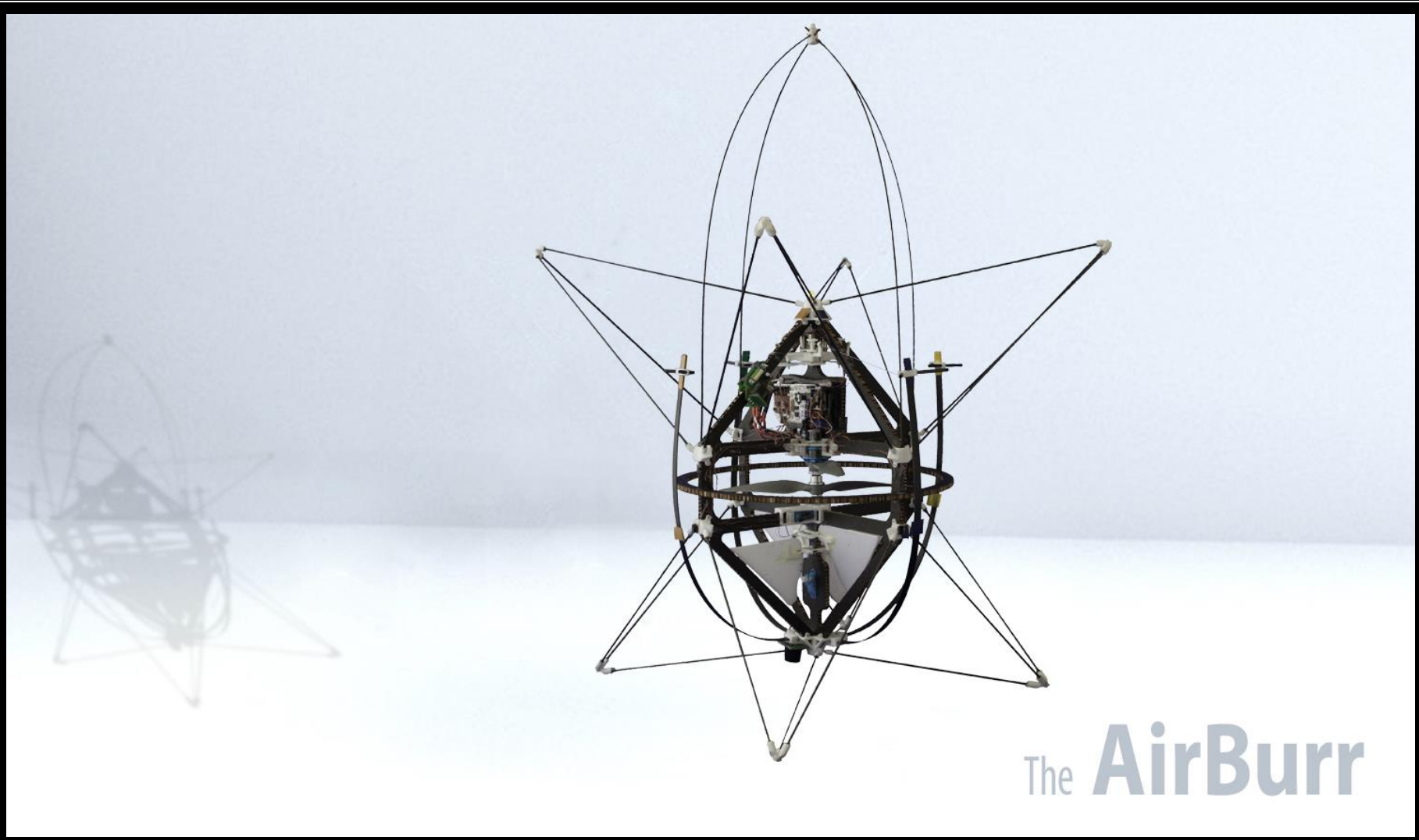
Collision-Robust Flying Robot



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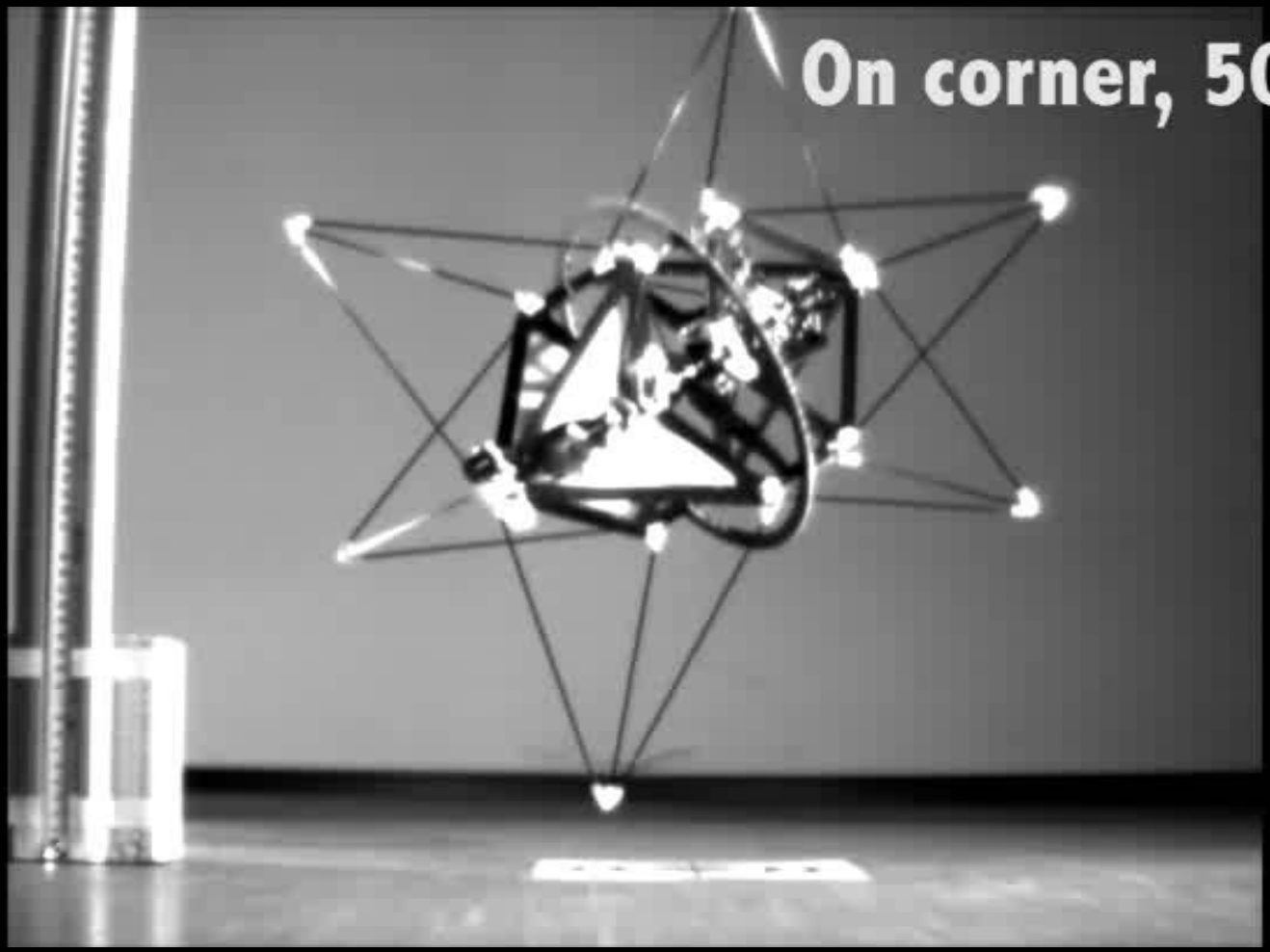
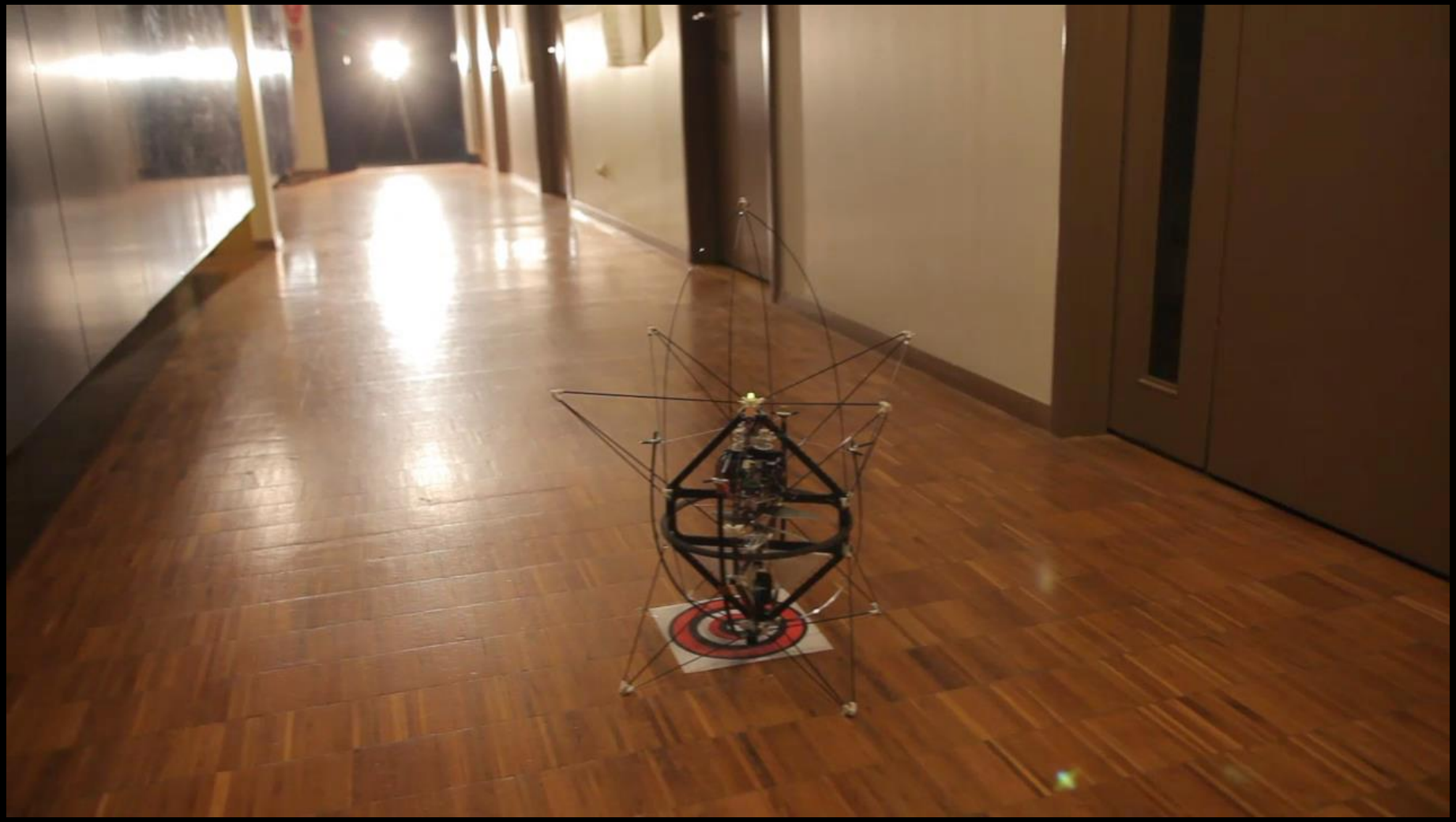
Collision-Robust Flying Robot (2)



Collision-Robust Flying Robot (3)



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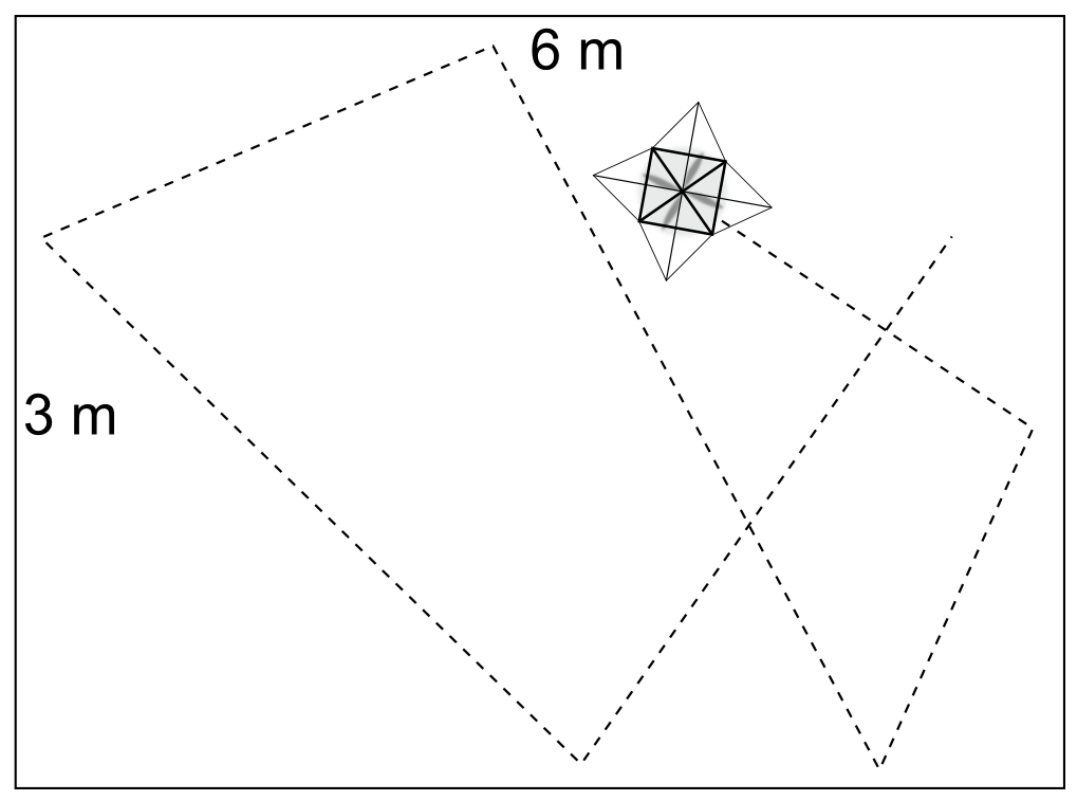
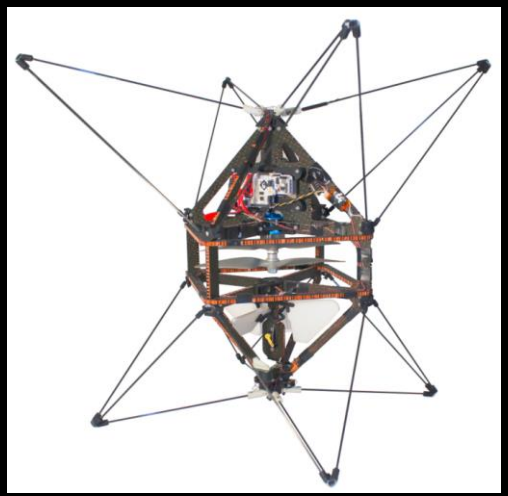
Contact-based navigation

- Goal: Exploit contacts for autonomous navigation
- Scenario:



Roomba-like:



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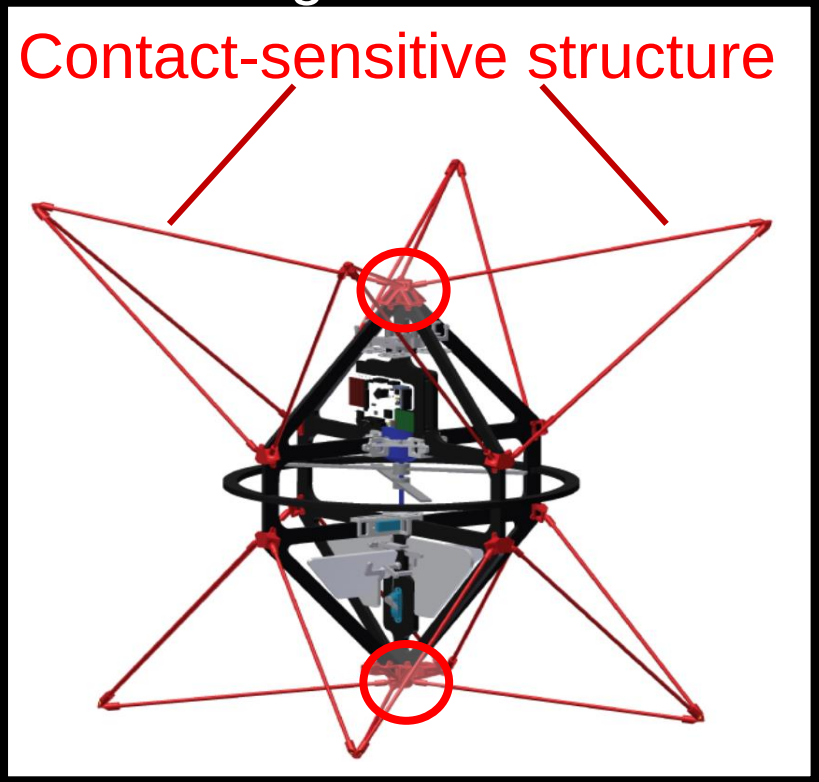
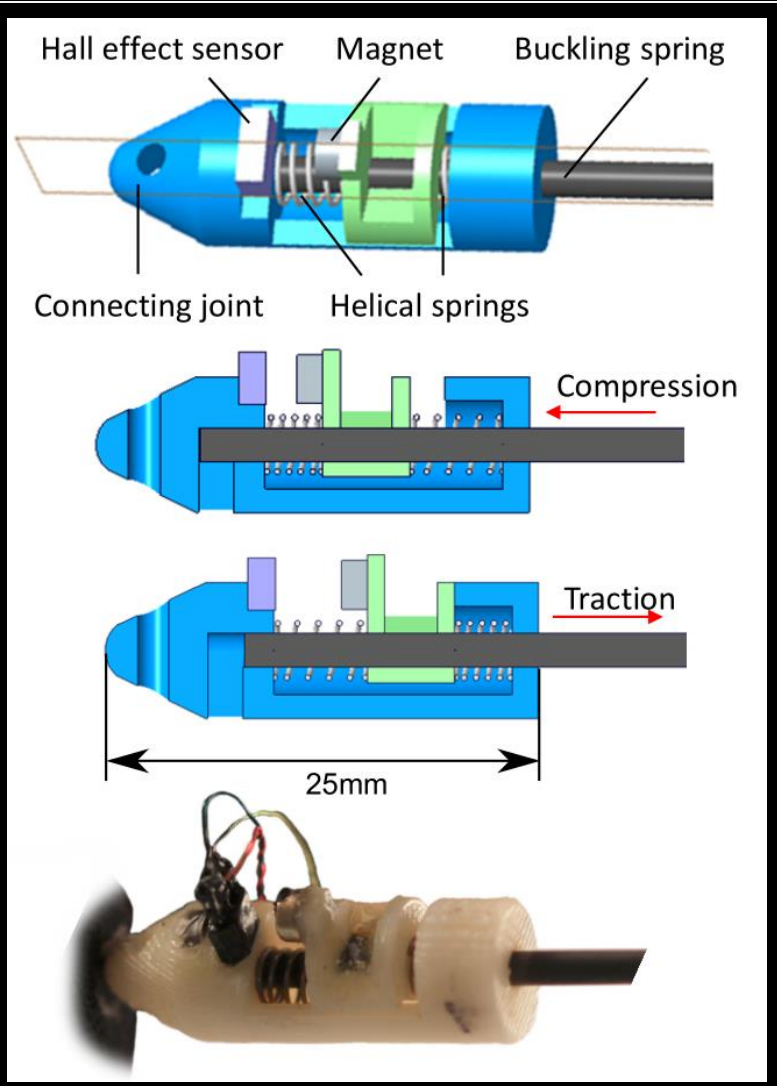
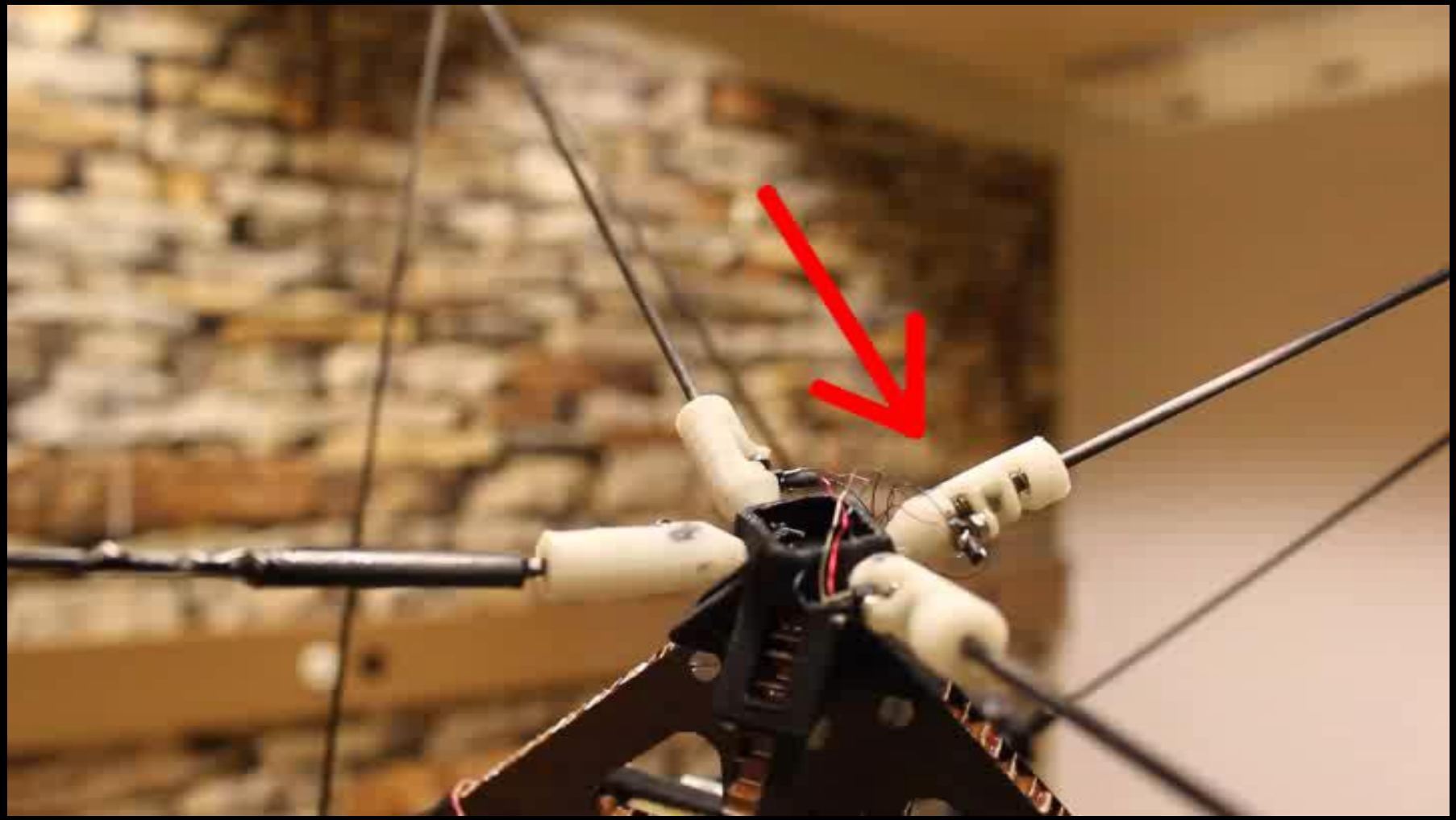
Contact-based navigation

- Contact sensors
  - » 0.03 N sensitivity
  - » 0.9 g each





Contact-based navigation



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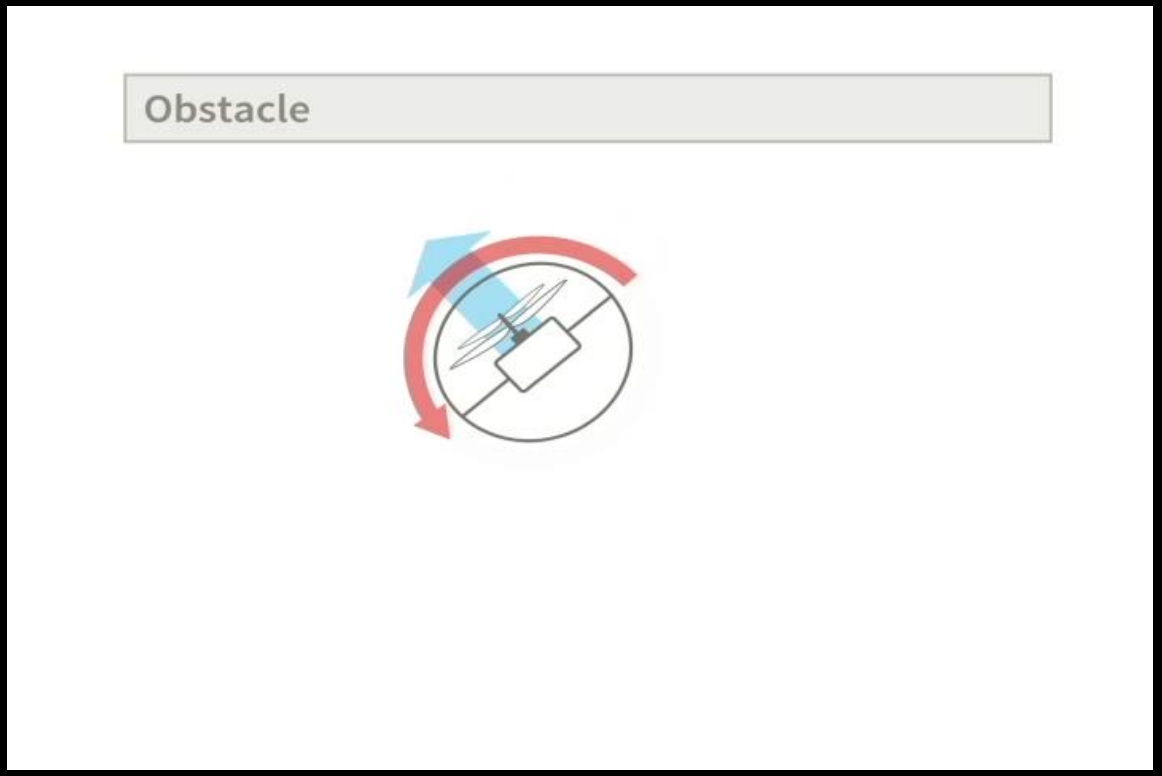
Instability from collisions

- Problem:



- Goal: Stabilize flying robots after collisions
- Collision resilience vs. collision robustness

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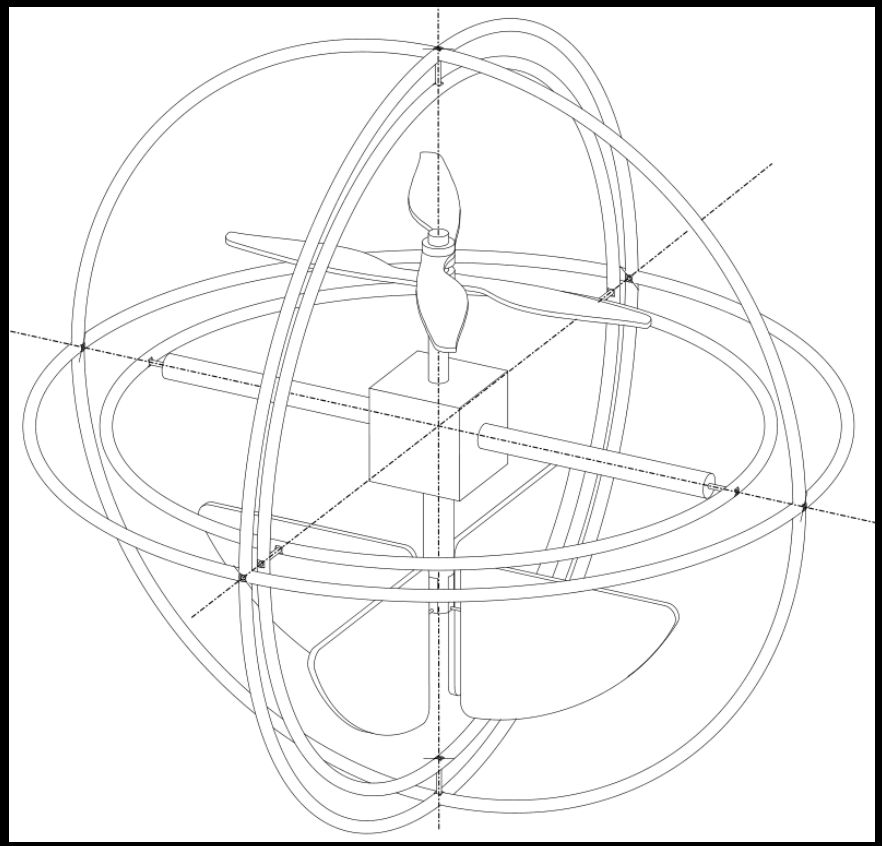
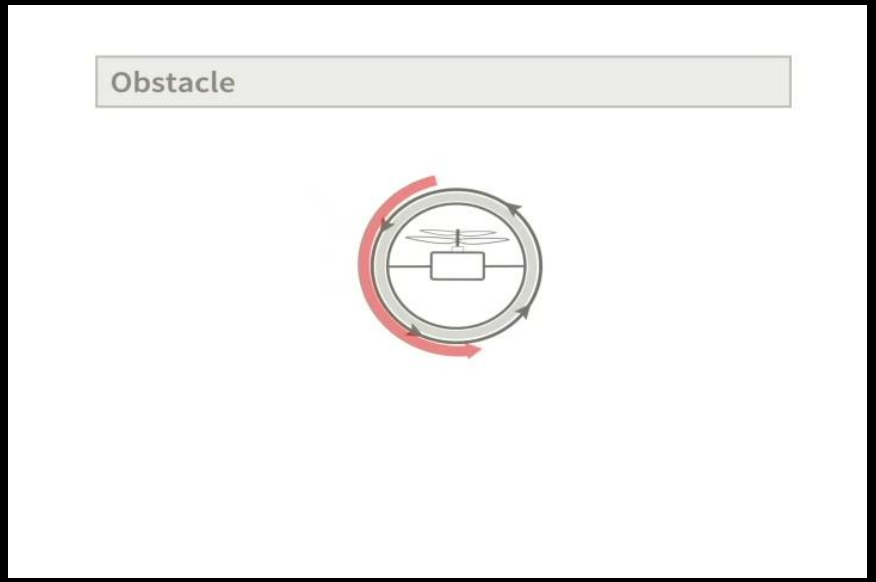
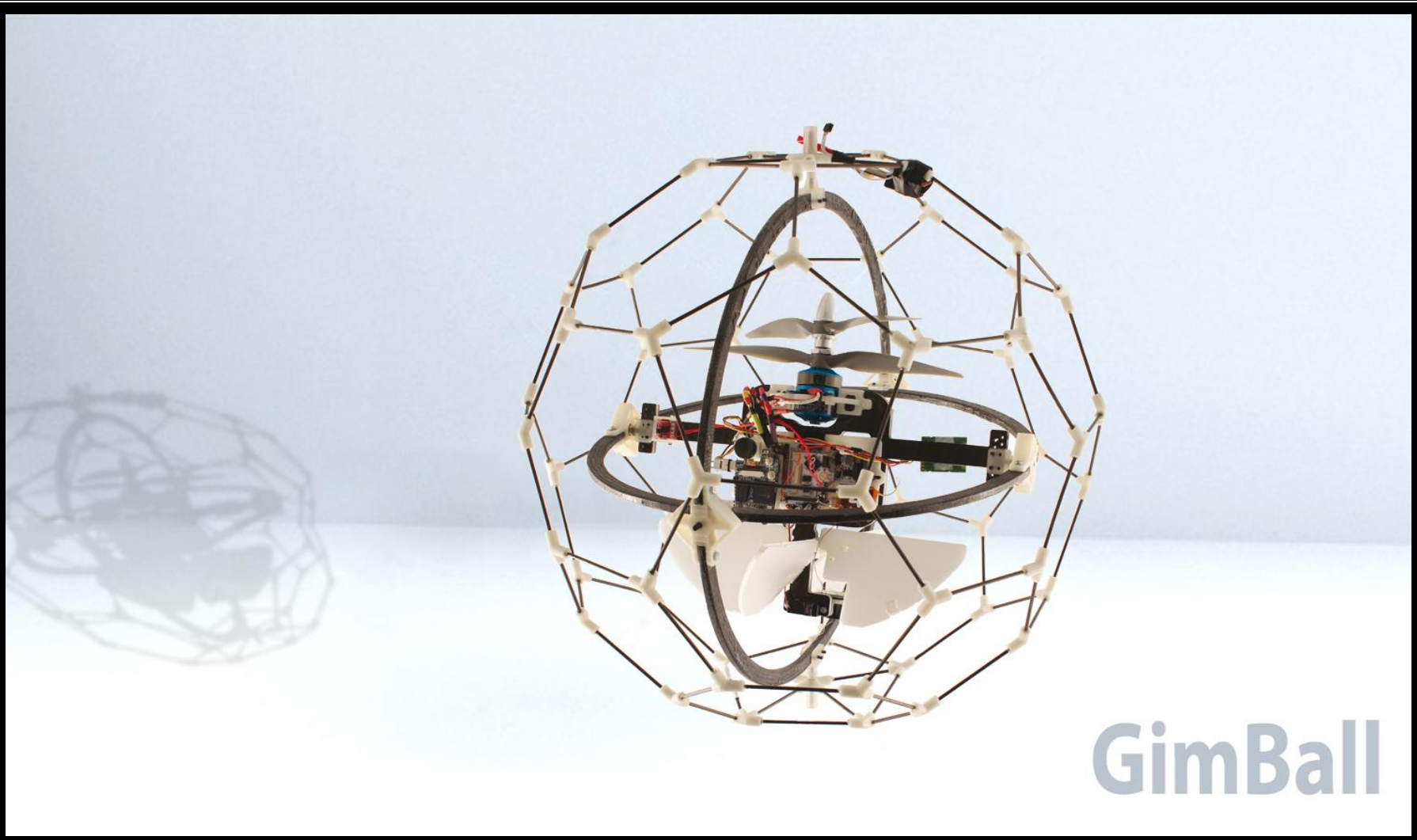
Gimbal system





Collision-Resilient Flying Robot



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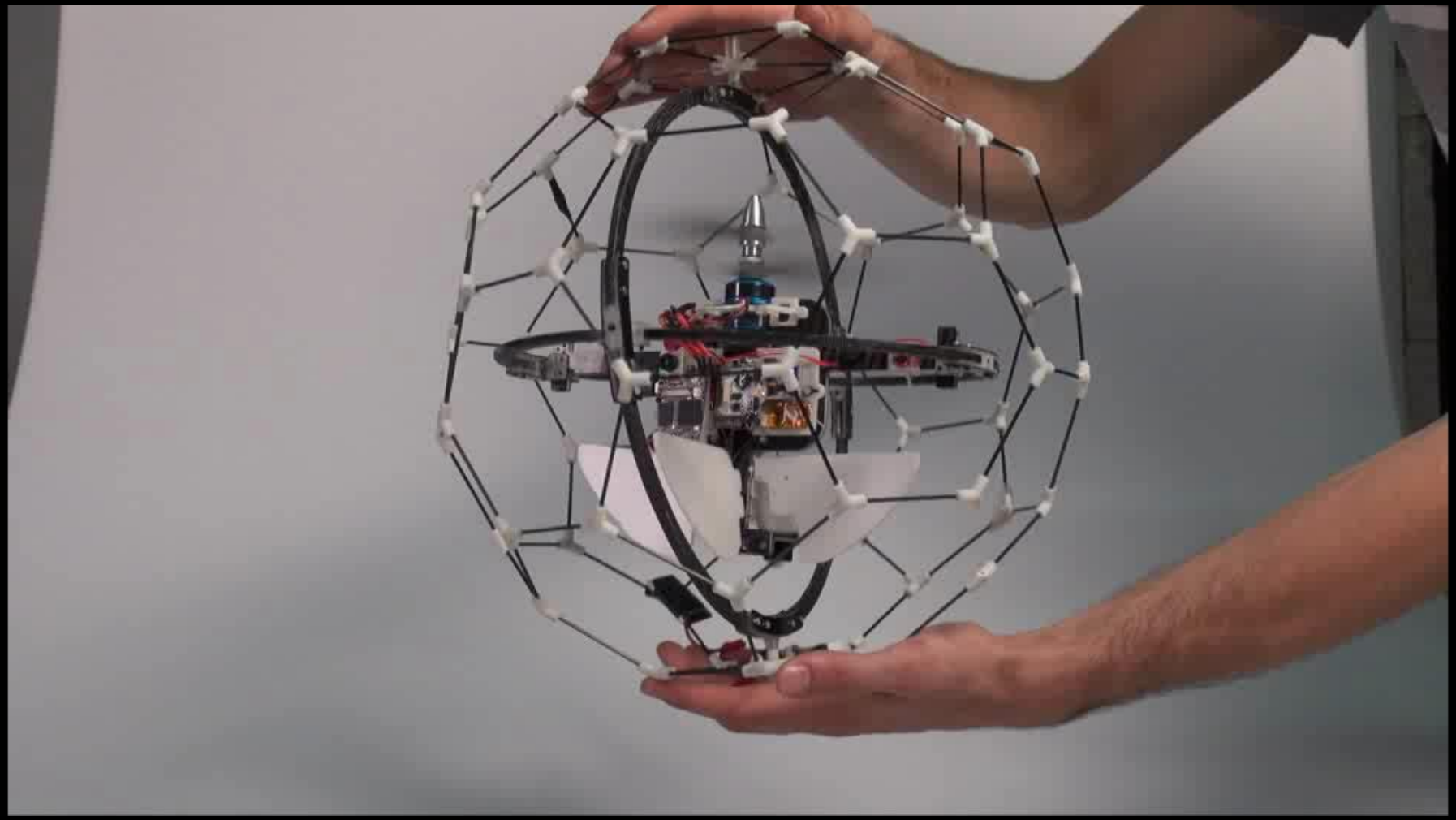
Collision-Resilient Flying Robot (2)



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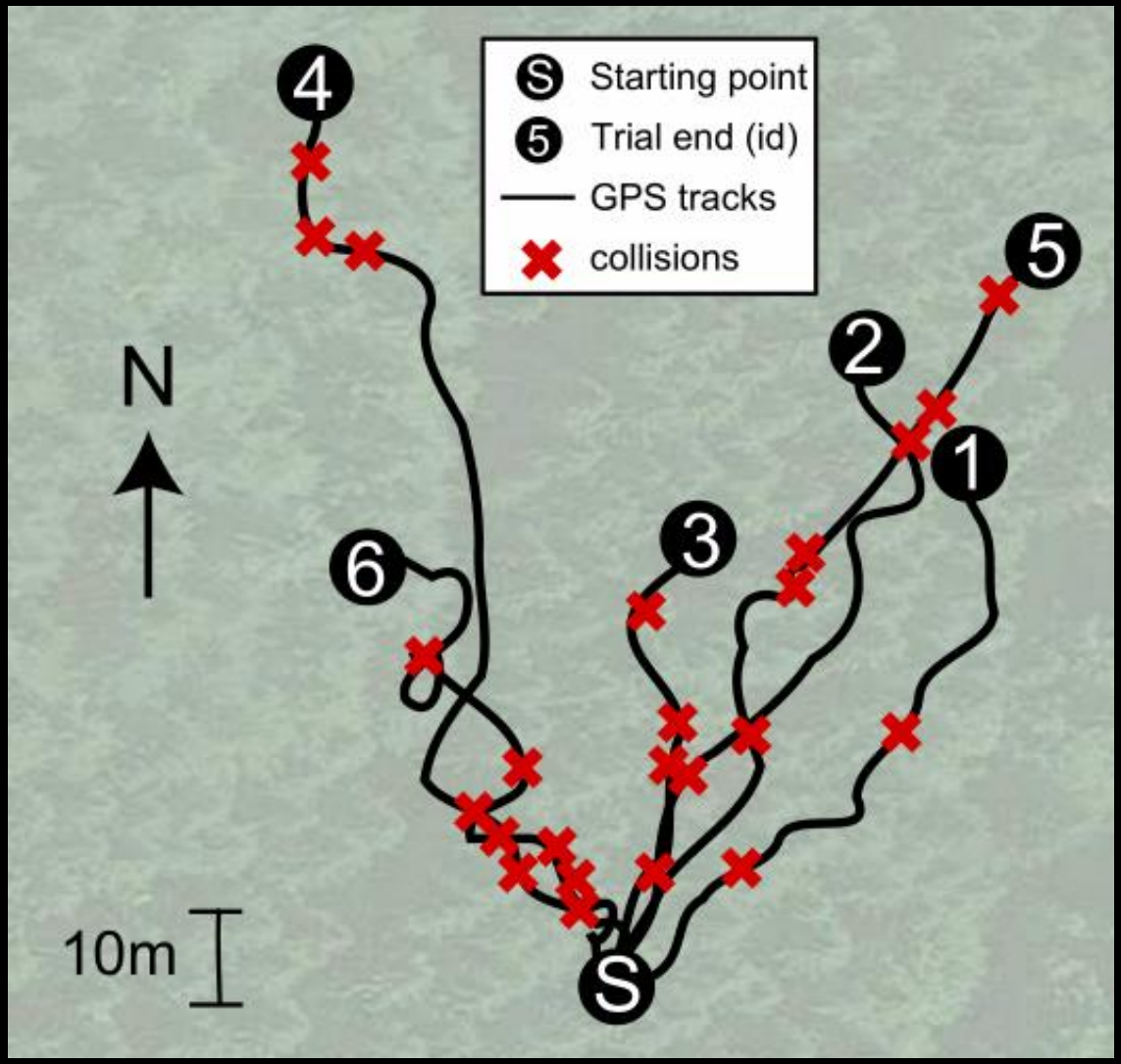
Field tests



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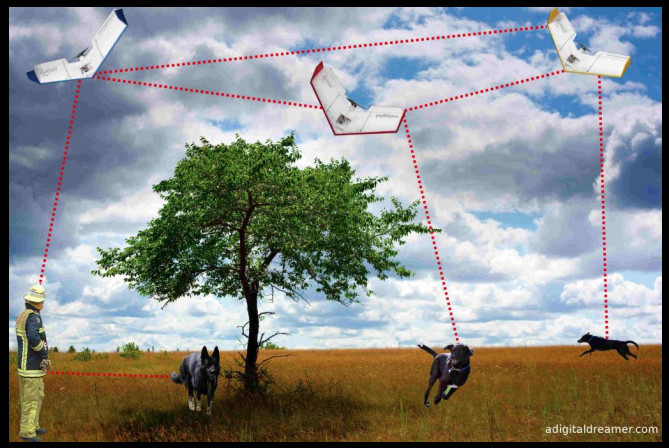
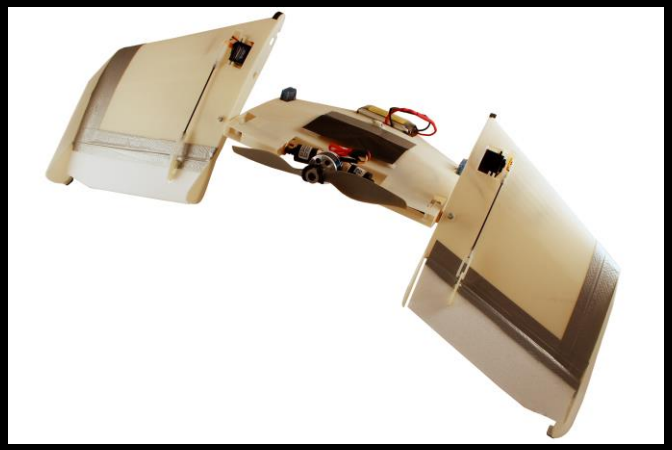
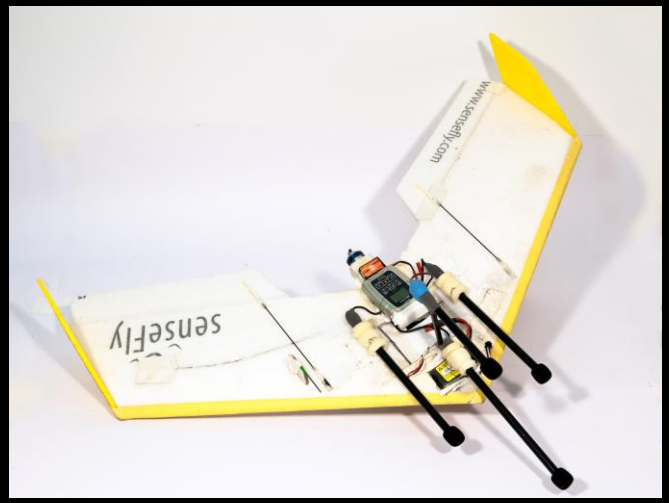
Commercial version

Future vision

Swarm of all the robots working together







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People involved in projects AirBurr and GimBall

Dario Floreano, Jean-Christophe Zufferey, Adam Klaptocz, Adrien Briod, Ludovic Daler and Przemyslaw Kornatowski

Thank you for your attention

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