Creating Test Environments for Assessing UAS Performance

Flavio NOCA

Professor of Aerodynamics

hepia
Haute école du paysage, d'ingénierie et d'architecture de Genève
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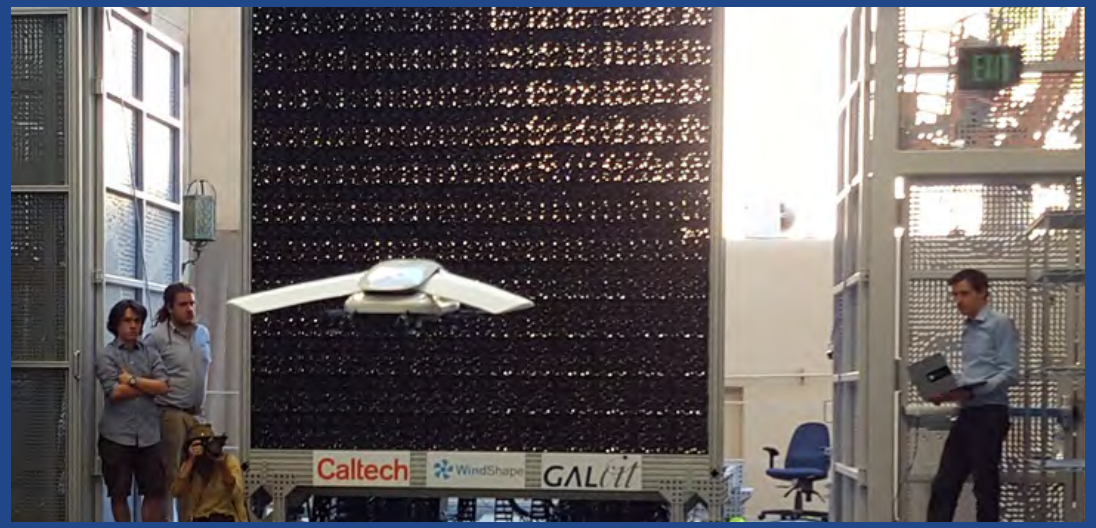
Guillaume CATRY

CEO

WindShape



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guillaume.catry@windshape.ch / http://www.windshape.ch

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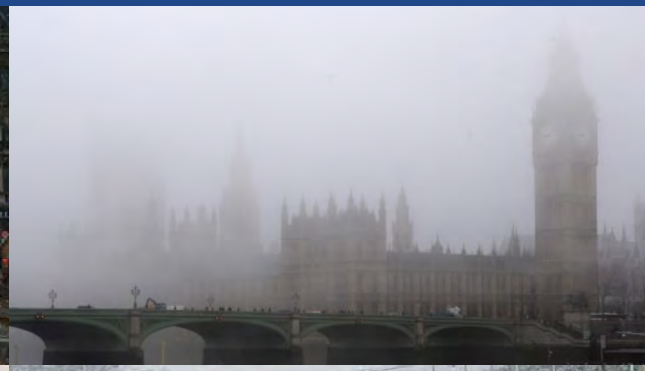
Perfect flight conditions… (Lugano, Switzerland)

… not so perfect flight conditions, but that is when UAS are most needed!



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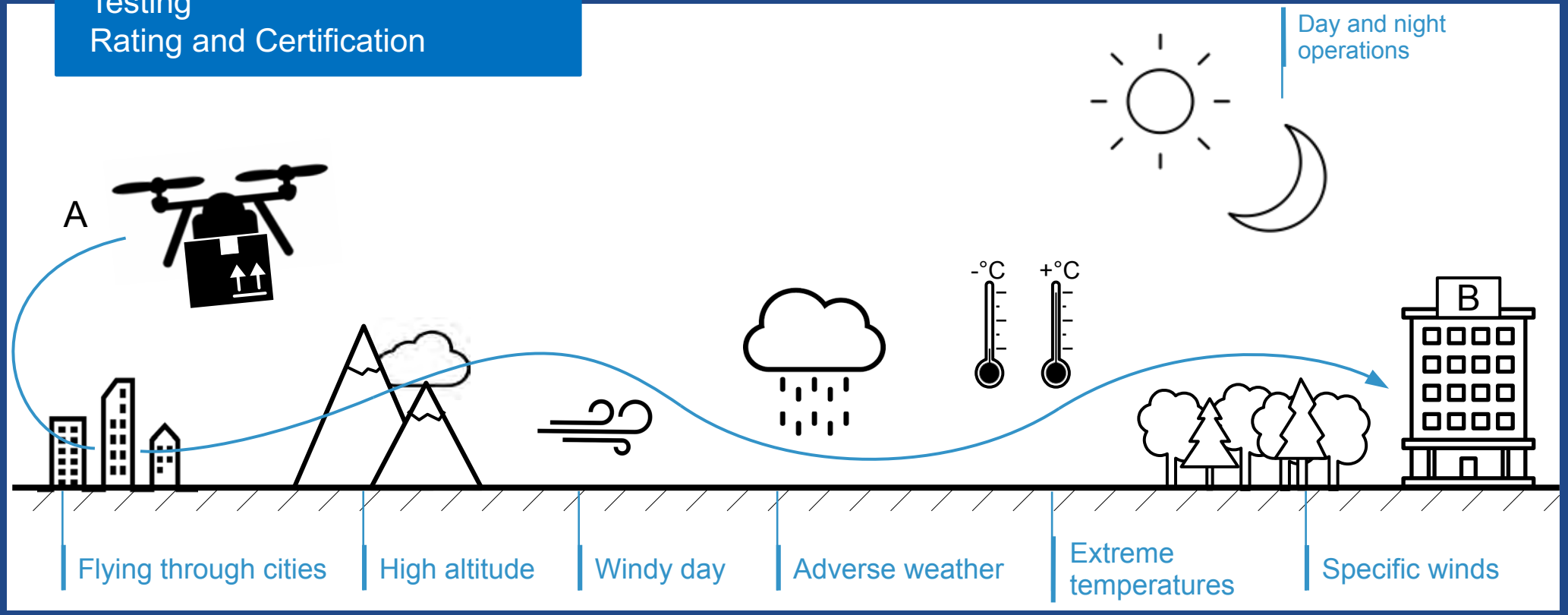
We need
Test Environments
in order to Assess UAS & UAM Performance

R&D
Testing
Rating and Certification



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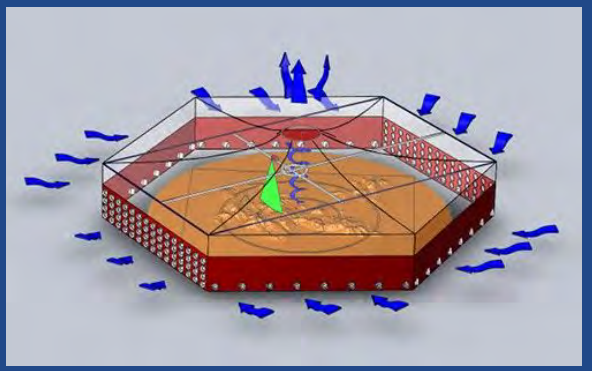
Classical Climatic Facilities
Large Fans, Simple Flows



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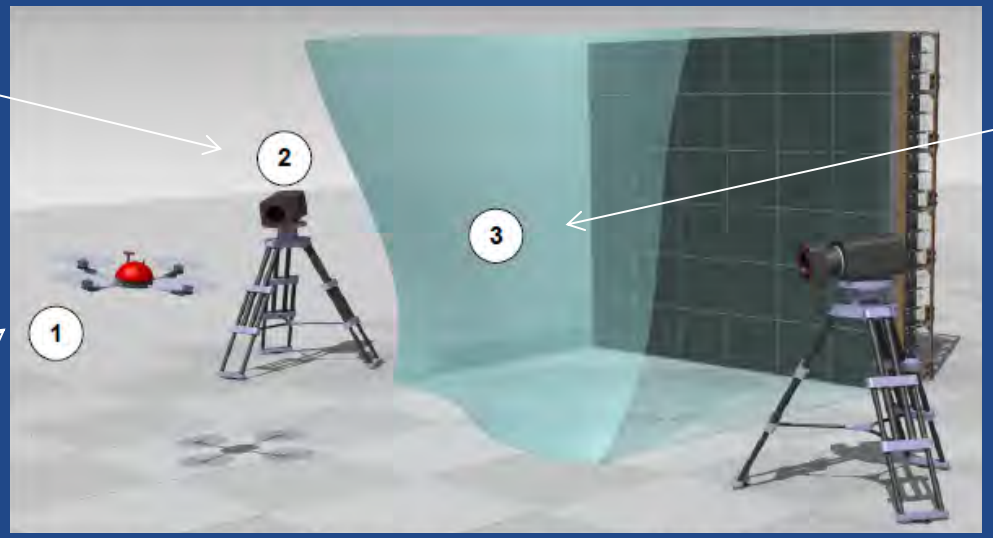
WindShape Technology

UAV & UAM
are more like birds than aircrafts:
they are small, fly unsteadily,
and are subject to
gusts and wind shears

In 2016, we developed* the concept of
a Wind & Weather Facility
in order to develop 21st century drones
in Controllable and Repeatable Atmospheric Conditions

- ✓ Emulated GPS
- ✓ Actual drone
- ✓ Free-flying
- ✓ No support



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- ✓ No walls
- ✓ Small footprint
- ✓ Wind Shear
- ✓ Gusts
- ✓ Weather (rain, hail, dust, snow…)

* **Noca F. & Catry G.** Wind Generation Means and Wind Test Facility Comprising the Same.*Patent Pending PCT/EP2017/064451*

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Wind Pixels and Wind Blocks

Each wind pixel (fan) is individually controlled

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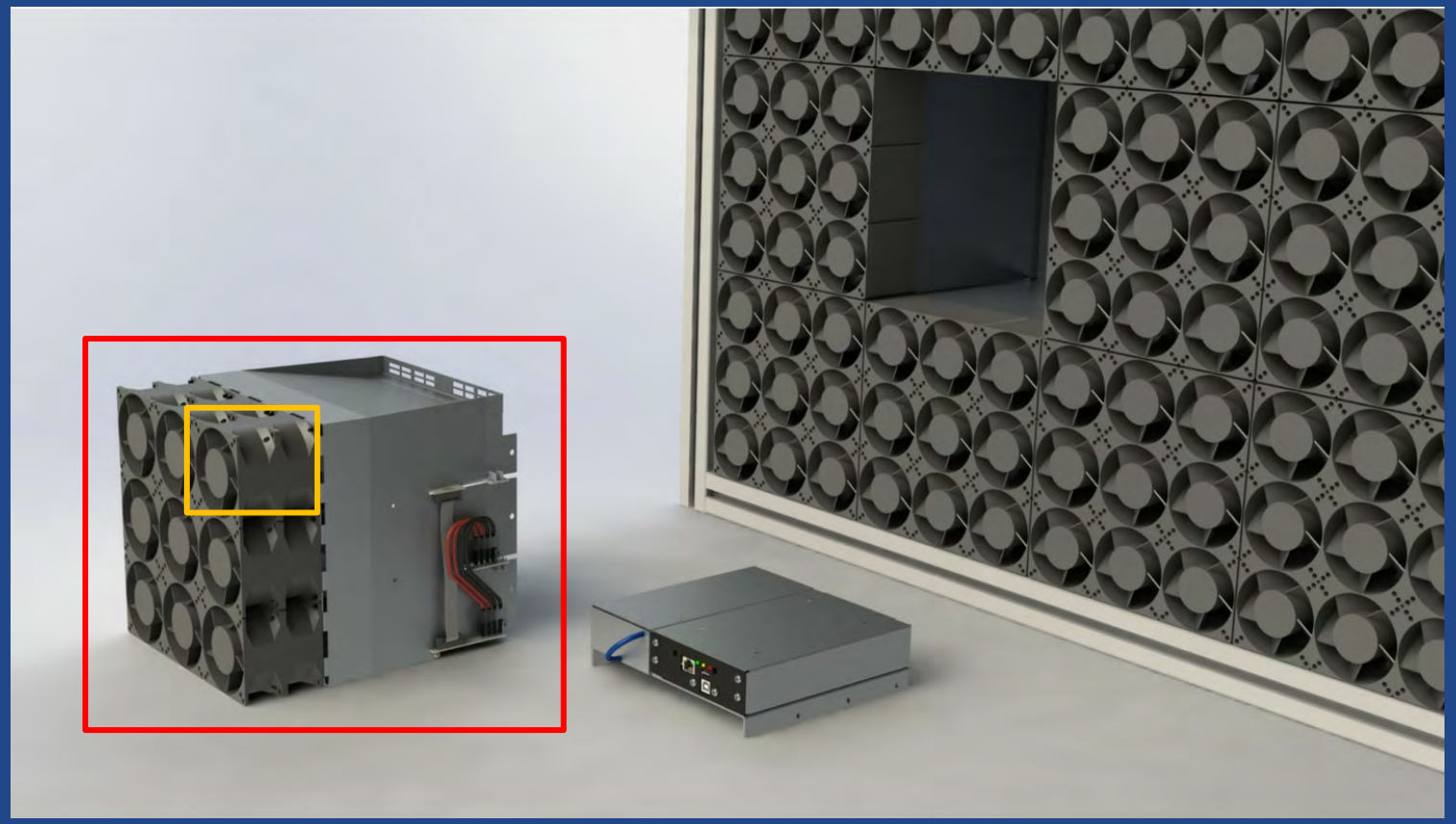

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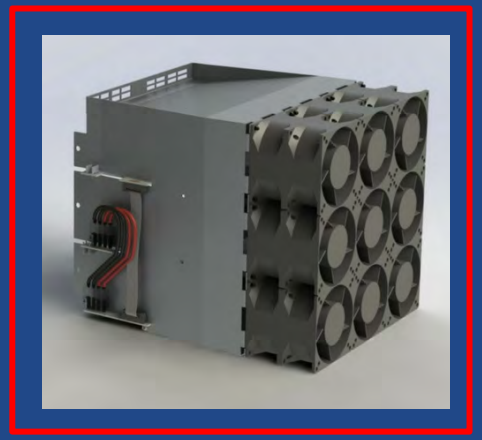
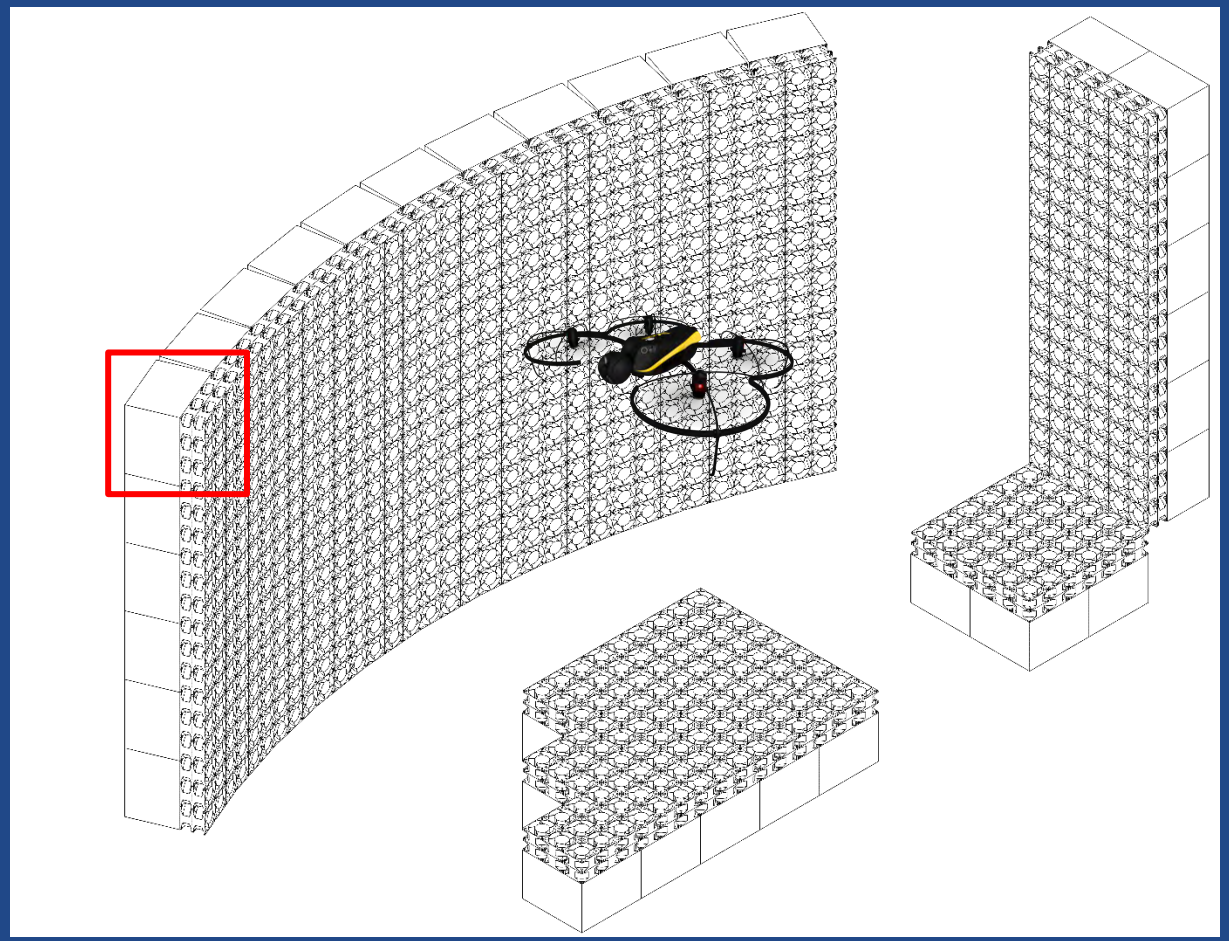
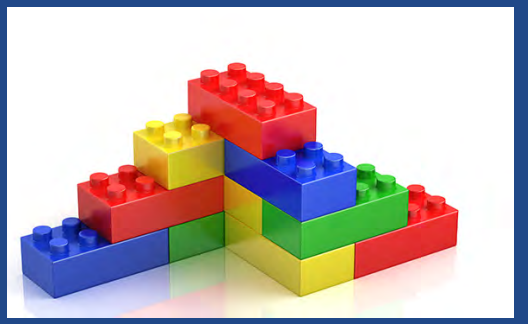
Wind Blocks = Lego Blocks







Wind Blocks can be setup in any arbitrary geometry

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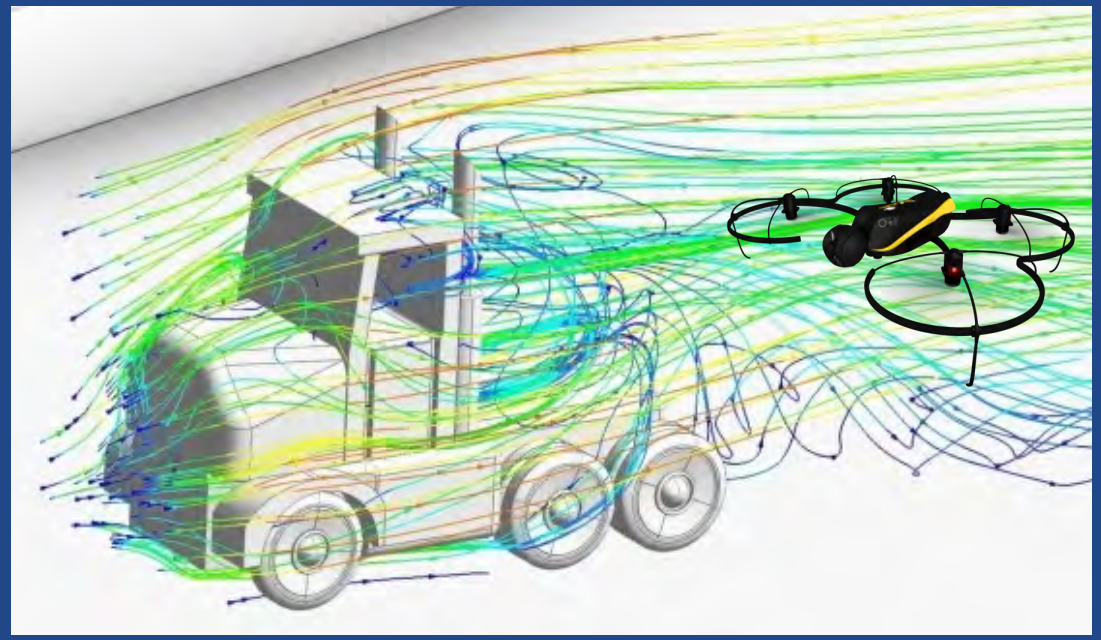
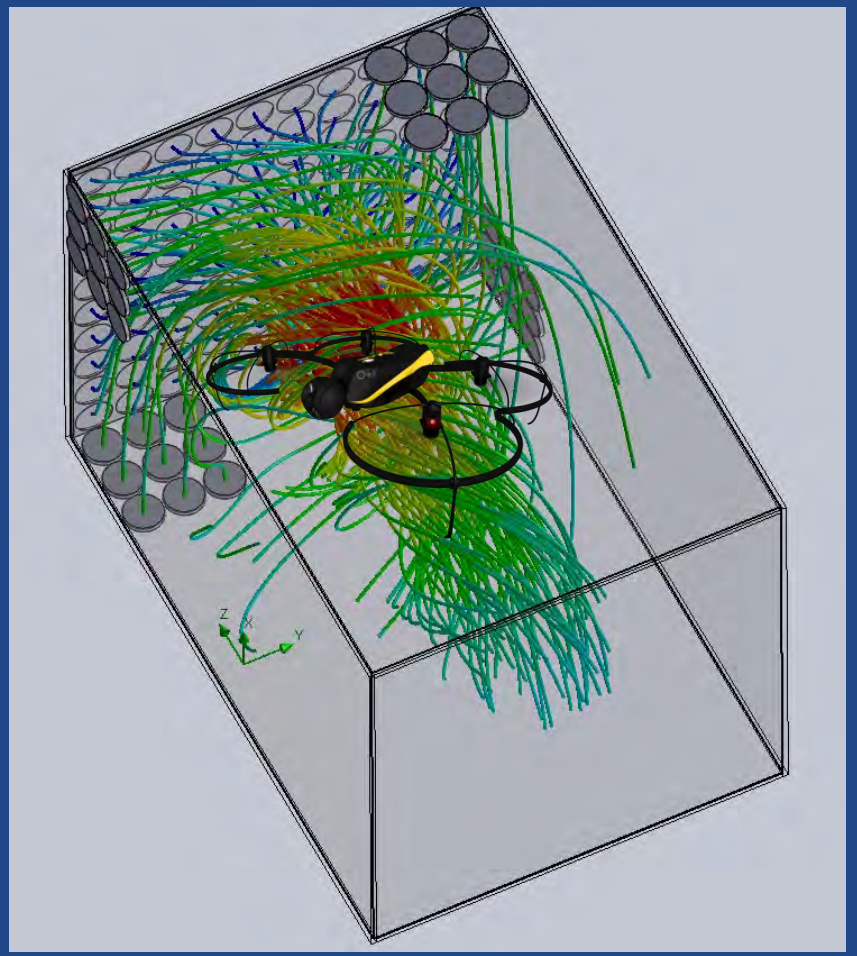
Fine-Tuning and Reproducibility of Arbitrary Atmospheric Flows





Veisman, Dougherty, Gharib 2016

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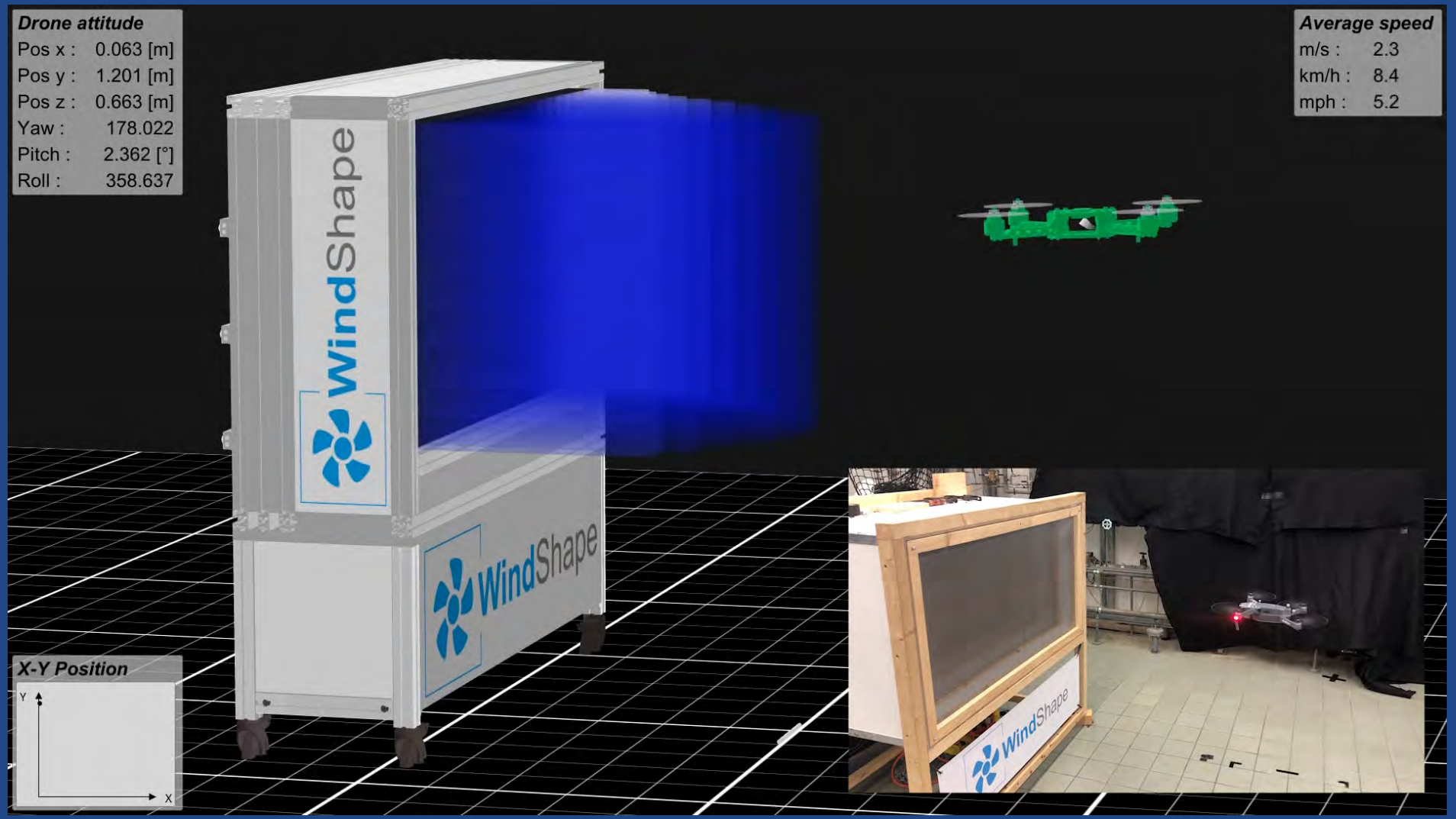
Gusts & Shear



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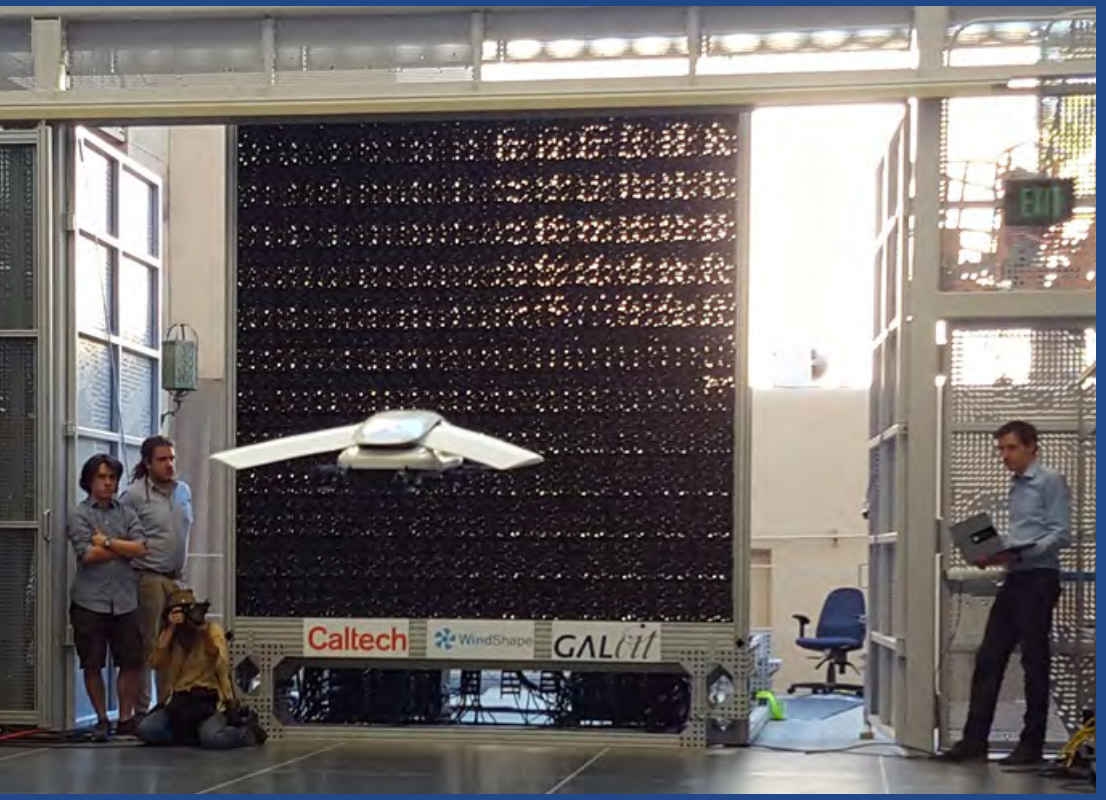
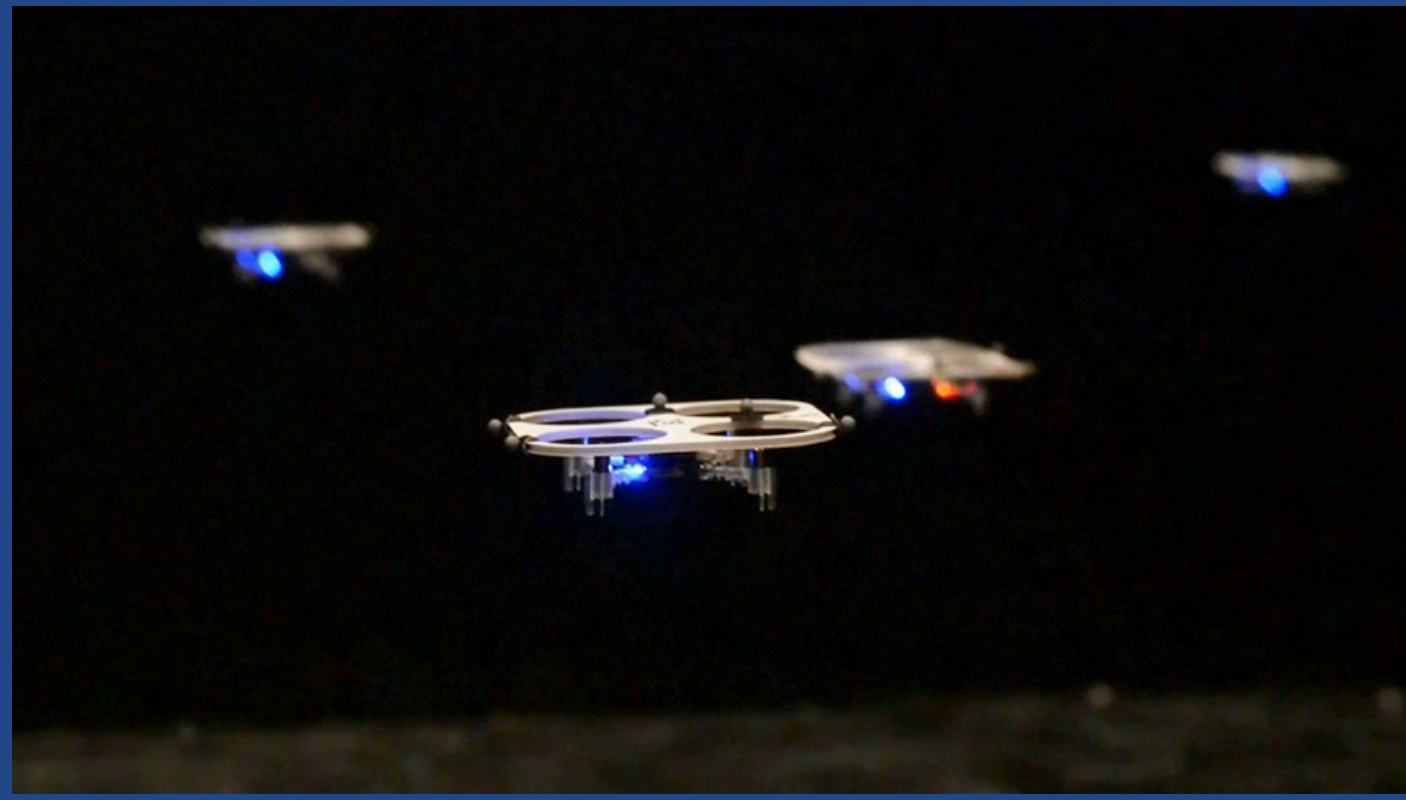
In 2017,
WindShape delivered its first product to
Caltech and NASA Jet Propulsion Laboratory
Center for Autonomous Systems and Technologies (cast.caltech.edu)

Caltech JPL





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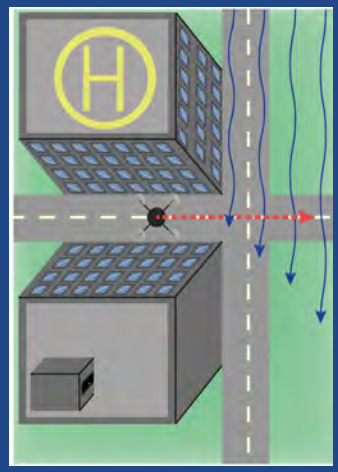
Testing & Rating

Drone stays in place
for optimal visual inspection & testing

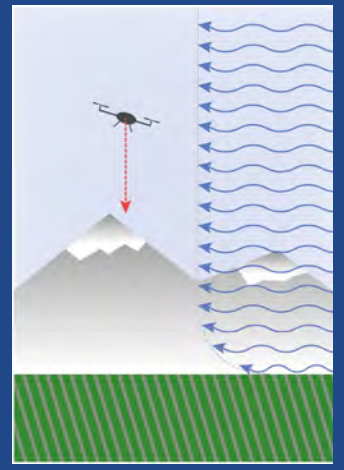
Stability in Arbitrary Winds

Stability in Urban Canyon Flows



Descent Stability

Flight in Windy Days



Stability in Unpredictable Flows

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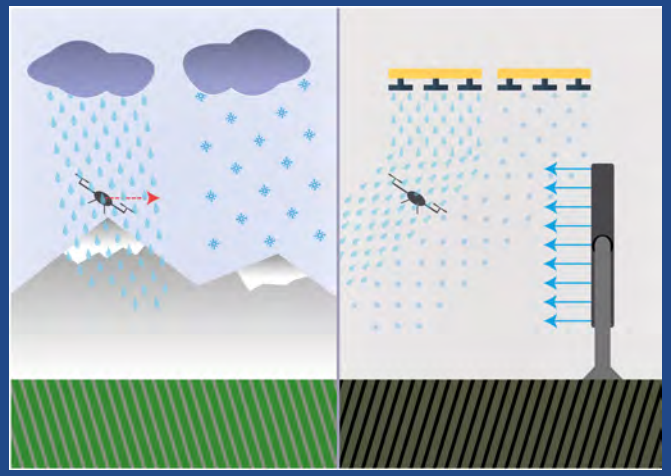
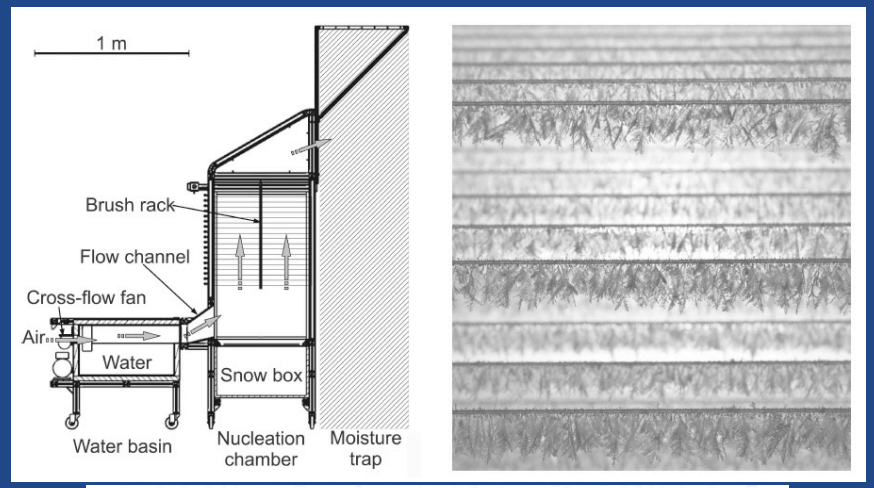
Testing & Certification





An improved machine to produce nature-identical snow in the laboratory

Stefan SCHLEEF, Matthias JAGGI, Henning LÖWE, Martin SCHNEEBELI

WSL Institute for Snow and Avalanche Research SLF, Davos Dorf, Switzerland
E-mail: schneebeli@slf.ch

Collaboration with
the Institute for Snow & Avalanche Research WSL – SLF
(Davos, Switzerland)

flavio.noca@hesge.ch / http://chachacha.ch

guillaume.catry@windshape.ch / http://www.windshape.ch

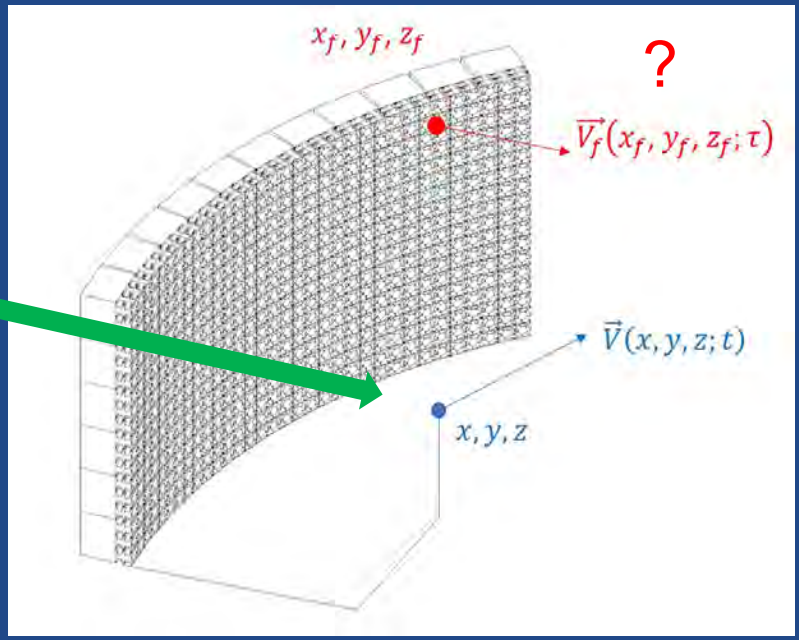
Next Steps

Characterize Actual UAS/UAM-Scale Meteorological Flows

BUBBLE – an Urban Boundary Layer Meteorology Project

M. W. Rotach[1,12], R. Vogt[2], C. Bernhofer[3], E. Batchvarova[4,7], A. Christen[2], A. Clappier[5], B. Feddersen[6], S.-E. Gryning[7], G. Martucci[9], H. Mayer[8], V. Mitev[9], T. R. Oke[10], E. Parlow[2], H. Richner[1], M. Roth[11], Y.-A. Roulet[5], D. Ruffieux[12], J. A. Salmond[13], M. Schatzmann[6], and J. A. Voogt[14]

«Teach» a WindShape Machine to Reproduce Meteorological Flows of Relevance to UAS/UAM Safety



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Many Thanks from the WindShape Team!

www.windshape.ch / guillaume.catry@windshape.ch

Guillaume CATRY
CEO
Co-founder
Co-inventor

Aerospace Engineer
MSc, EPFL, 2015

Dr. Flavio NOCA
Strategic & Tech. Advisor
Co-founder
Co-inventor

Aeronautics
PhD, Caltech, 1997

Albéric GROS
Marketing & Sales
Co-founder

Engineering
MSc, HES-SO, 2019

Luca J. BARDAZZI
Production & Rating
Co-founder

Engineering
MSc, HES-SO, 2018

Sergio MARQUEZ
Engineering & Admin
Co-founder

Engineering
MSc, HES-SO, 2016

Nicolas BOSSON
R&D and Testing

Propulsion Engineer
MSc, Soton*, 2017
****Southampton university***