ALPEN-ADRIA UNIVERSITÄT
KLAGENFURT | WIEN GRAZ

Institute of Networked and Embedded Systems

The Drones are Coming: Aerial Imaging for Disaster Response

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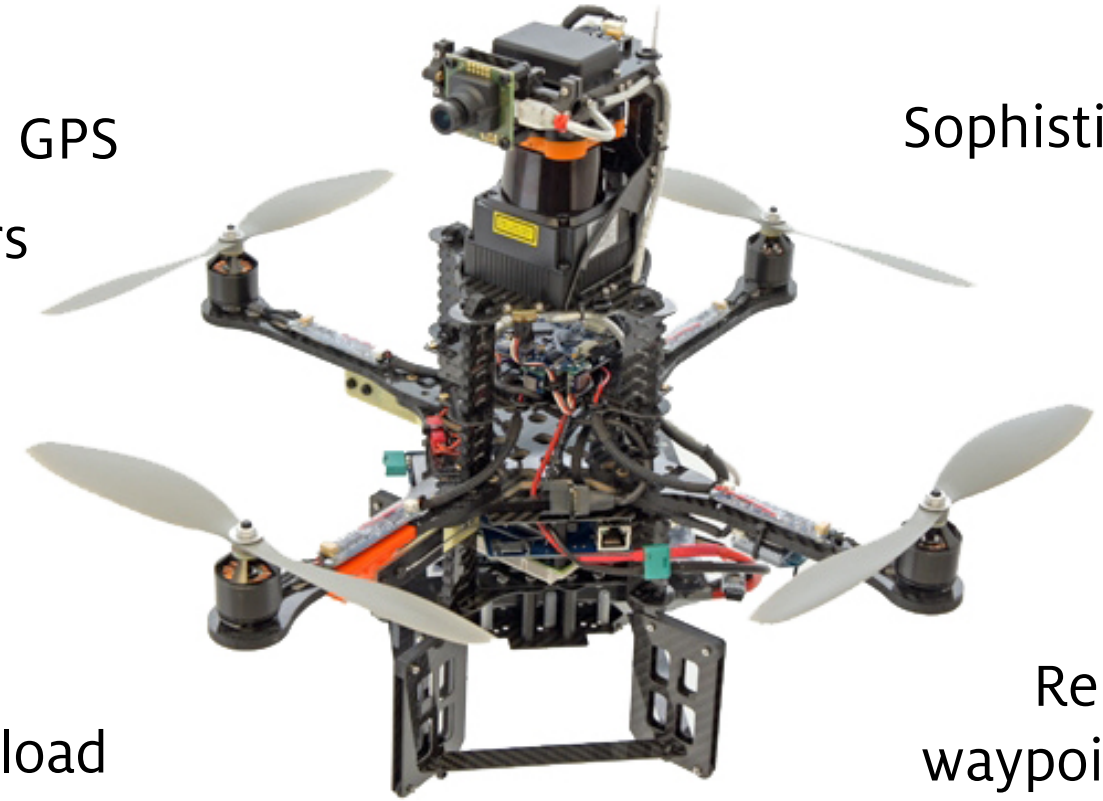
Berlin, 17 June 2013

Lakeside Labs

Small Unmanned Aerial Vehicle (UAV)

GPS

Sensors



Sophisticated control

Processors
Atom board

Remote control,
waypoint navigation

Payload
e.g. camera,
laser scanner

AscTec Pelican

Types of UAVs, Flying Robots

Parrot
AR.Drone

Microdrones GmbH

Gatewing
X100

AscTec
Hummingbird

AscTec Falcon

- Quadrocopter, octocopter, fixed wing
- Indoor, outdoor
- Commercial, research platforms, toys
- From 200 € to 30.000 € and above

Flying Machine Arena

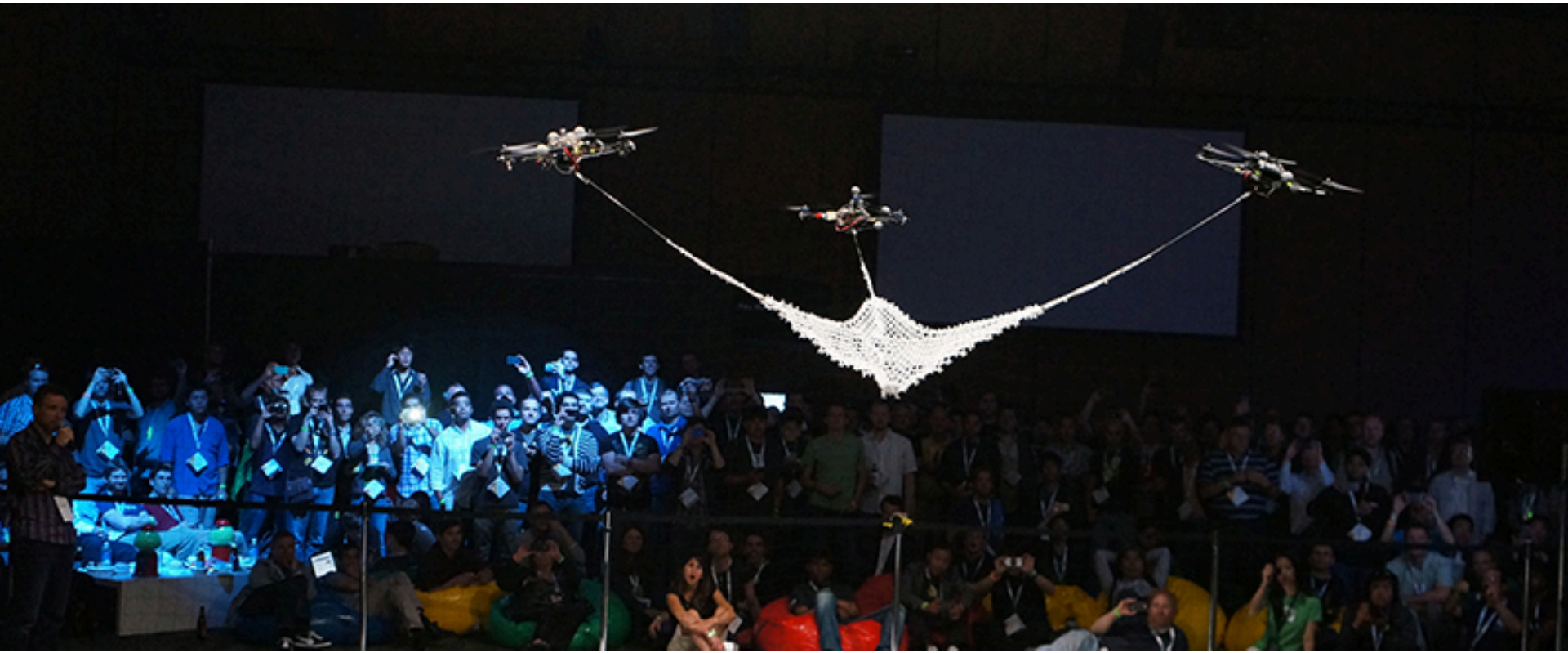
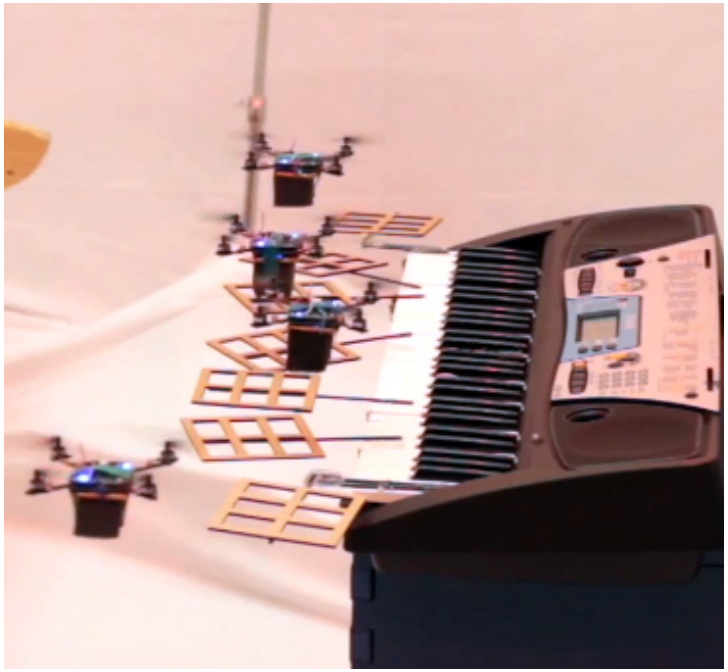
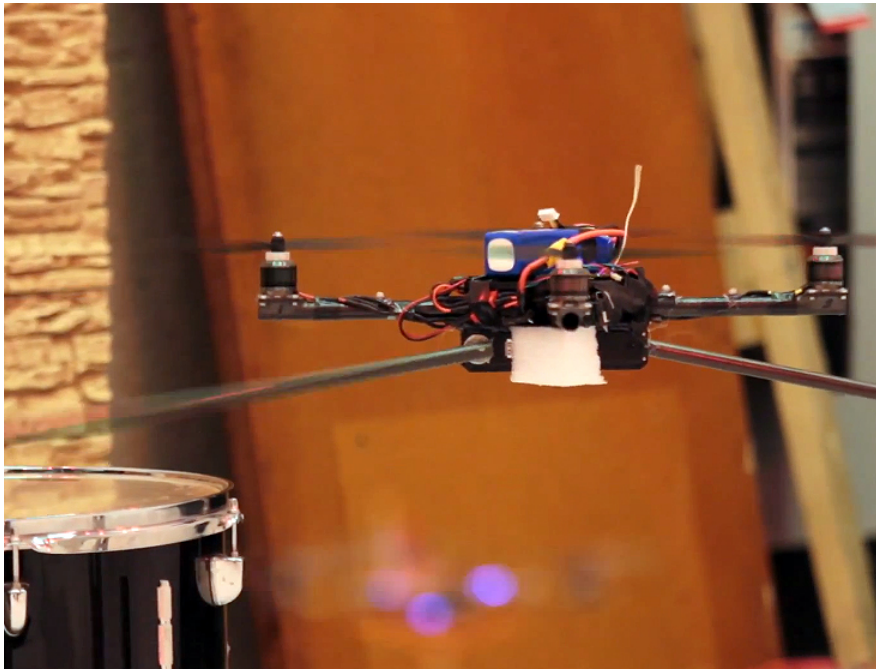


Photo with kind permission from R. D’Andrea, ETH Zürich

Small UAVs perform “James Bond theme”





University of Pennsylvania (2012)
3.5 Million hits on YouTube

Photos with kind permission from V. Kumar, U Penn

Formation Flight at Cultural Event

Voestalpine Klangwolke, Linz, 2012

Photo with kind permission from Ars Electronica Futurelab, Linz

Lakeside Labs – Disaster Management

User defines high-level tasks
(e.g. observation area)

User obtains real-time
high-quality overview image

Goals and Research Issues

- Develop autonomous system for aerial reconnaissance
- Support first responders in disaster management
- Use off-the-shelf, small-scale, low-altitude multicopters equipped with high-quality cameras and GPS
- Deploy multiple drones to achieve fast area coverage

Research Issues

Flying High: Multi-UAV Aerial Imaging

Challenges

- Strong resource limitations:
  Flight time, payload, computation
- Coordination of multiple drones:
  Centralized vs. distributed approach
- Multimedia network with dynamic, three-dimensional mobility
- Non-trivial user interface with prompt response
- Aspects of experimental research:
  Safety, legal issues
- Application partners, project funding

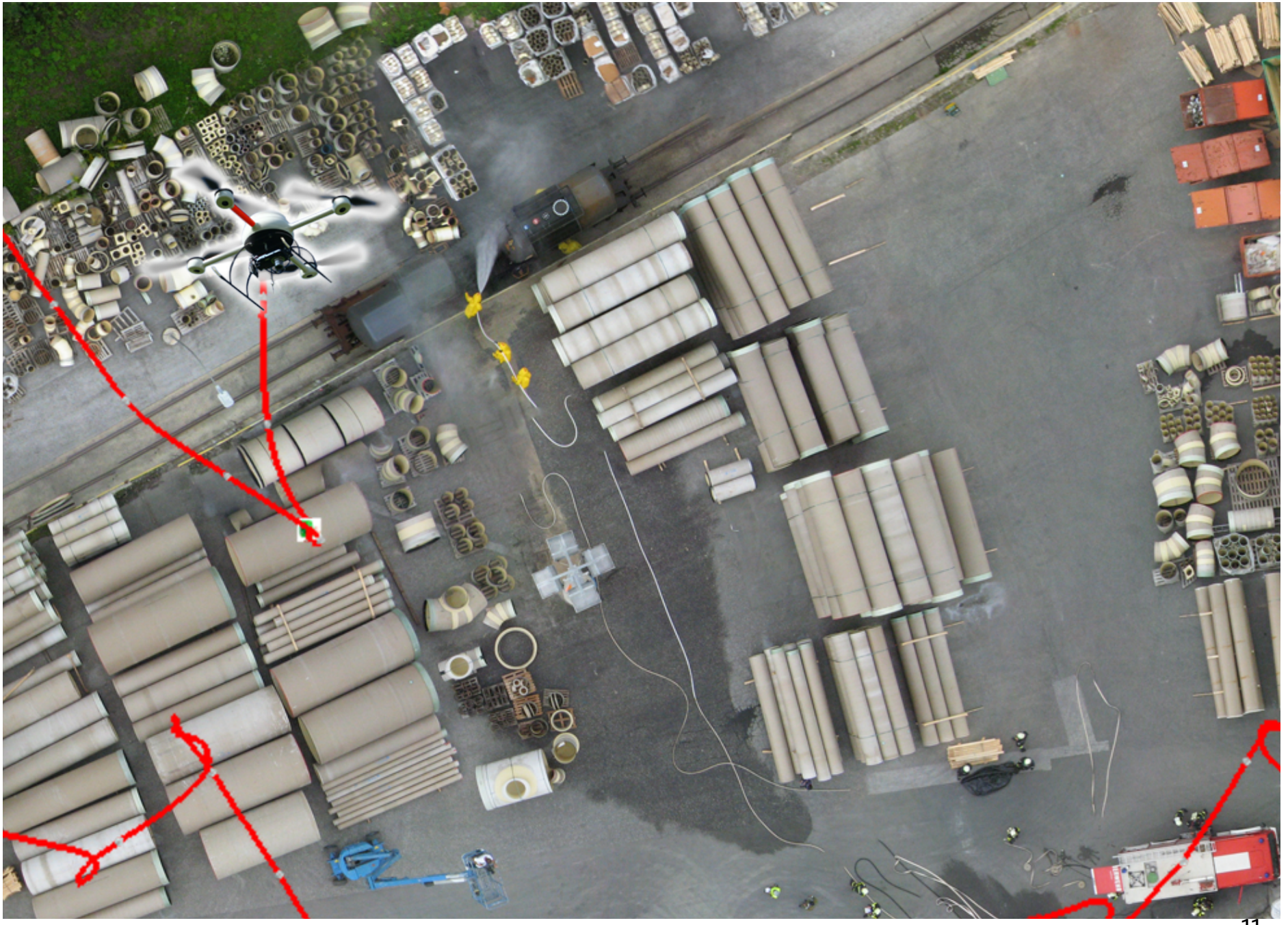
Image Processing: Stitching

Using position data
(GPS)

Using position and orientation
(GPS and IMU)

Exploiting feature detection
(Image data)

Apparatus and method for generating an overview image of a plurality of images using an accuracy information. European patent pending, EP2423871 (A1), 2012



3D Landscape Models in Disaster Areas

- Covering 45 km² in Haiti in six days
- System that local people can use
- E.g.: Understand flow of water

DRONE ADVENTURES

Switzerland

Photos with kind permission from Emanuele Lubrano

Transportation using a UAV Network

Matternet Inc., Palo Alto, CA
Transport of important goods, such as medicine

Photo from US Navy in the public domain

Applications Beyond Disaster Response

3D mapping

Person and object tracking

Industrial site monitoring, police support, accident documentation, and many others

Left photo with kind permission from C. Strecha, Pix4D.

Concluding Remarks

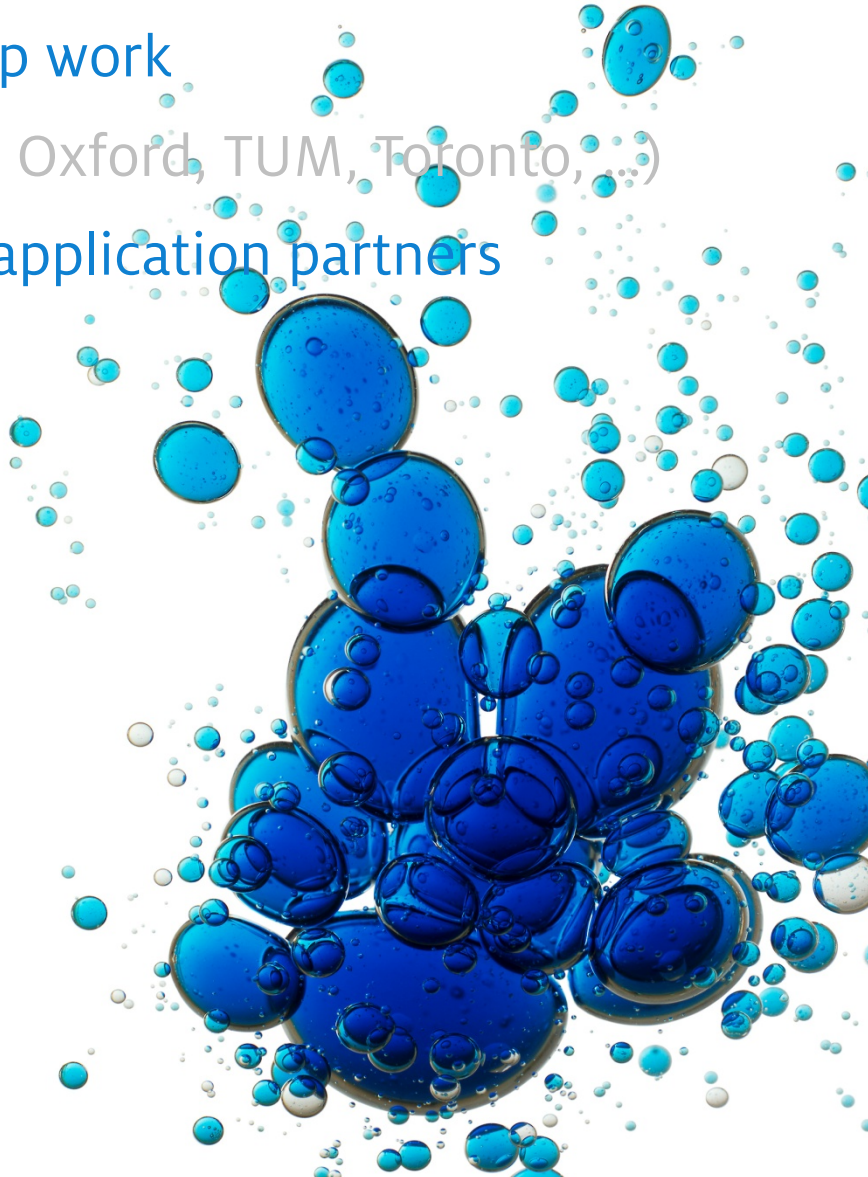
- Emerging area of research and development
- Challenges due to multidisciplinary and experimental character
- Various applications, several startup companies
- Various legal and privacy issues
- Attractive for students and PhD researchers

Research Days 2013: Multi-UAV Systems

- Full week of discussions and group work
- Keynotes from top experts (ETHZ, Oxford, TUM, Toronto, ...)
- Participation from academia and application partners
- Demo session and social events
- Potential for joint projects

Lakeside Labs GmbH

Klagenfurt am Wörthersee, Austria

July 8 – 12, 2013

researchdays.lakeside-labs.com