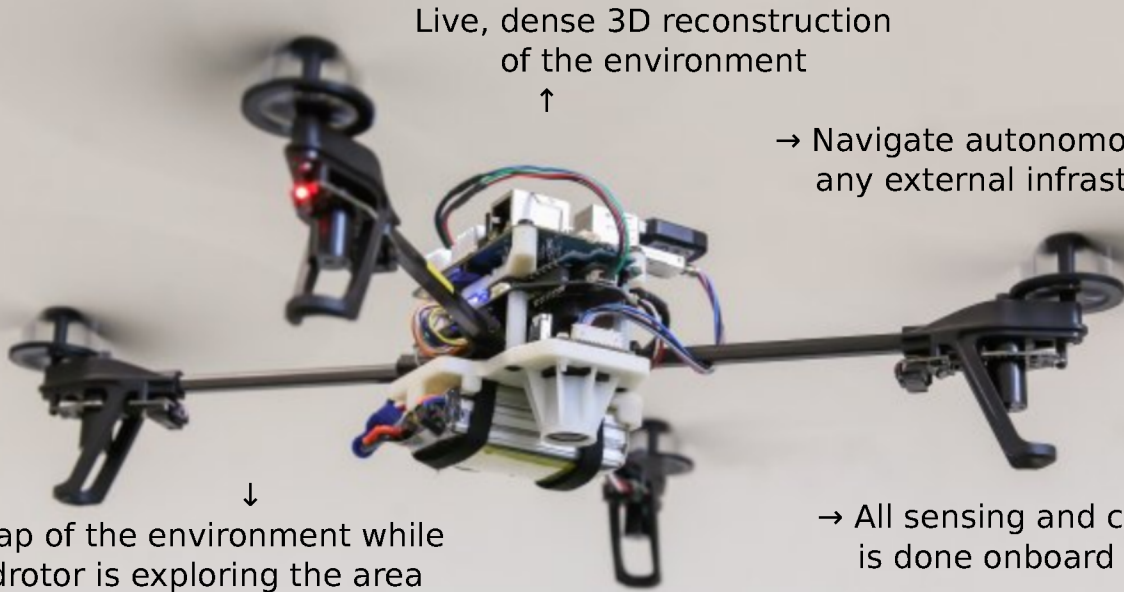


# NCCR Robot Capabilities For Search and Rescue

## Aerial Scenario

→ Autonomous, vision-based navigation in GPS-denied environments



Live, dense 3D reconstruction of the environment

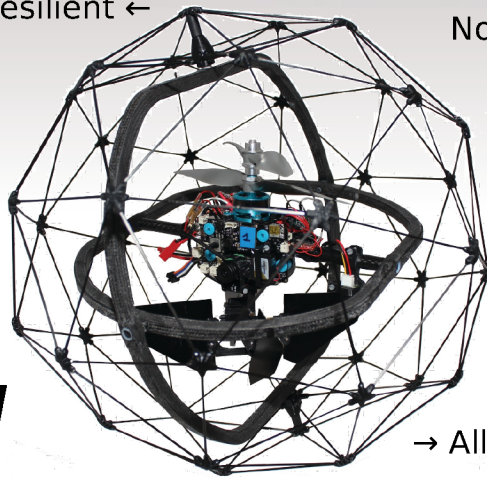
→ Navigate autonomously without any external infrastructure

Build a map of the environment while the quadrotor is exploring the area

→ All sensing and computation is done onboard



Resilient ←



No human intervention

→ Exploring very cluttered environments

→ Roll on walls and ceiling

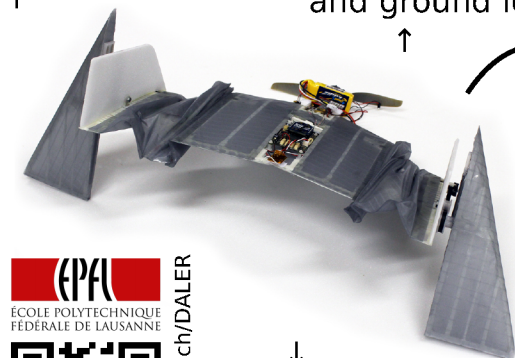
→ Providing video signal to rescuers

→ Allows collisions with obstacles while remaining stable

### GimBall

Adaptive morphology for optimized performances

Forward flight for covering long distances and ground locomotion for local exploration



### Daler

→ Integrated design approach for weight minimization

Aerial and terrestrial capabilities powered by a single locomotor apparatus



### Foldable Quadrotor

Easy storage and transportation



Autonomous self-deployment in 0.3 seconds





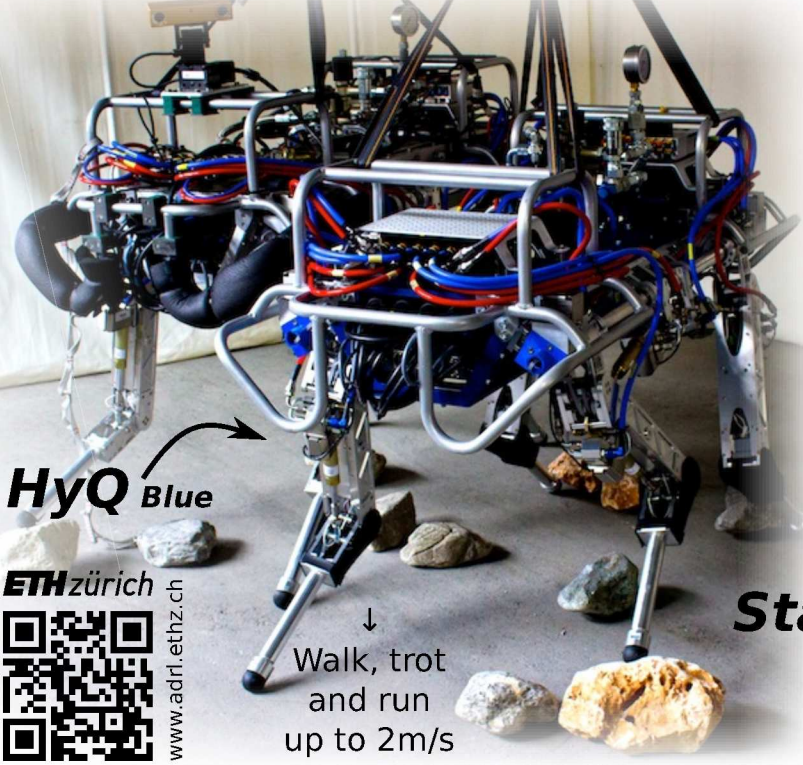
# Ground Scenario

→ Torque and position controlled joints

→ outdoor operation

→ Animal-like step reflex

Autonomous, laser and camera based navigation in rough terrain

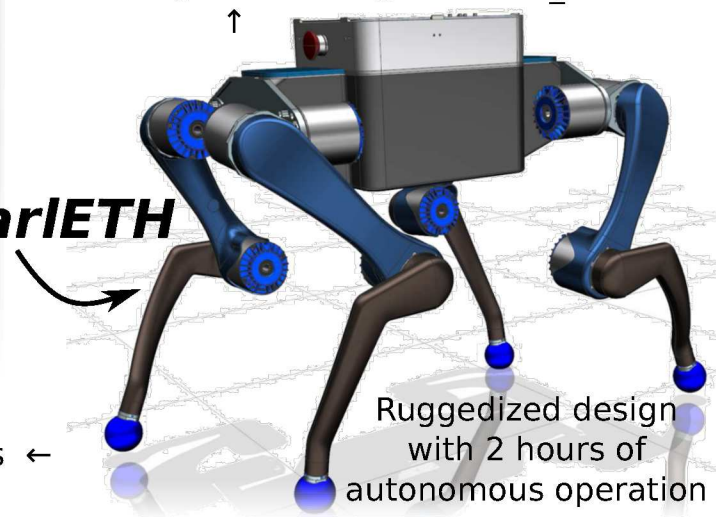


**HyQ Blue**



Walk, trot and run up to 2m/s

**StarLETH**



Ruggedized design with 2 hours of autonomous operation

Rear and jump up to 0.5m from squat

Real-time control systems

# Amphibious Scenario

**Amphibot**



Multi-modal (walking/swimming) locomotion



Equipped with sensors and GPS

Waterproofed

**Salamandra Robotica**

→ Target of several hours of swimming autonomy or reliable tethered operation



Motor skills for obstacle avoidance/overpass (leg reflexes, posture control)

# Multi-Robot Coordination

→ Flying robot guides ground robot step by step

Flying robot explores area and detects obstacles for ground robot

Fastest mission includes removal of obstacles by ground robot



More info: <http://www.nccr-robotics.ch/>



Swiss National Centre of Competence in Research