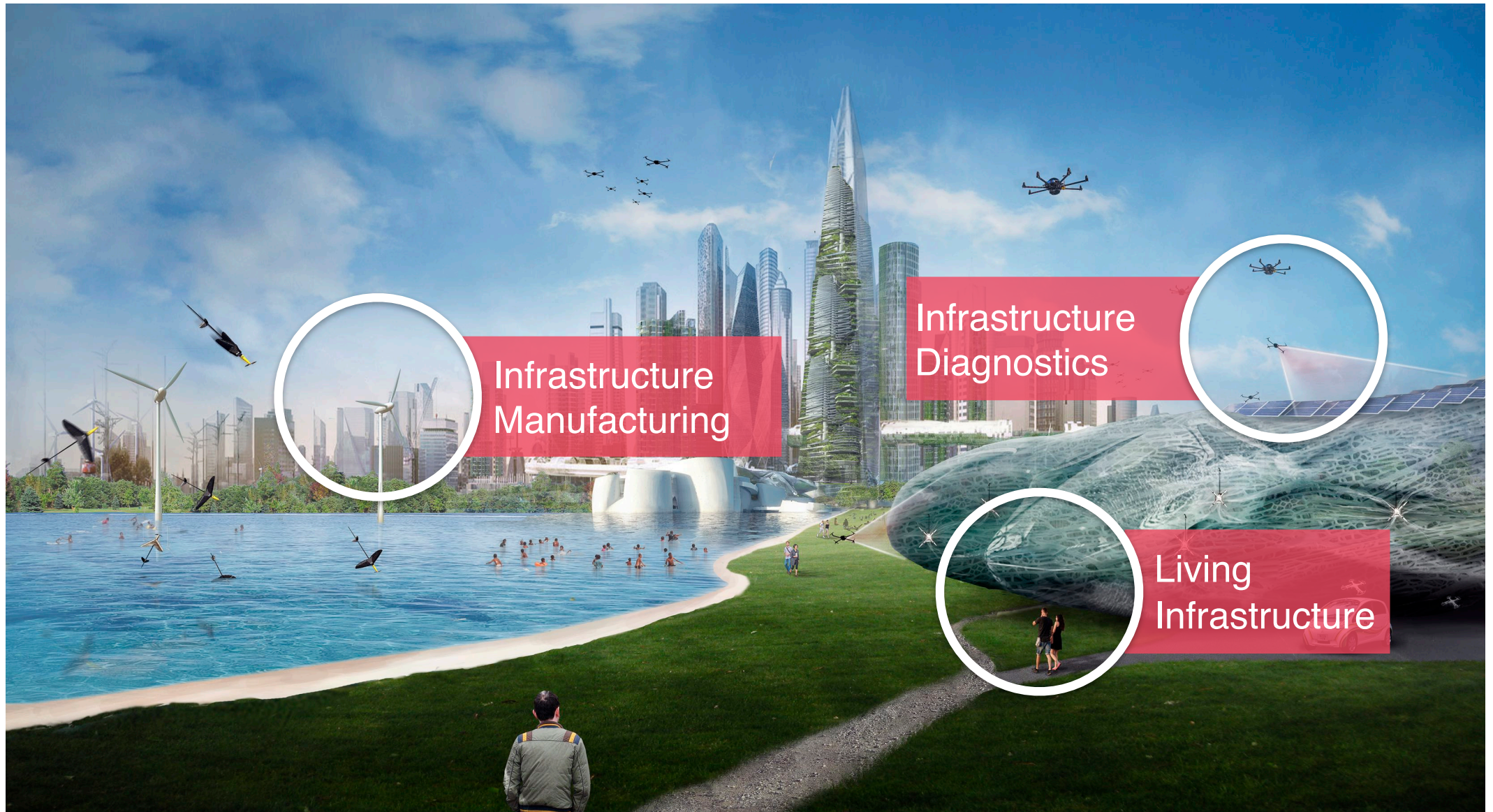


# Aerial Robotics for Infrastructures



# Remote sensor placement

## From complex control to mechanical intelligence

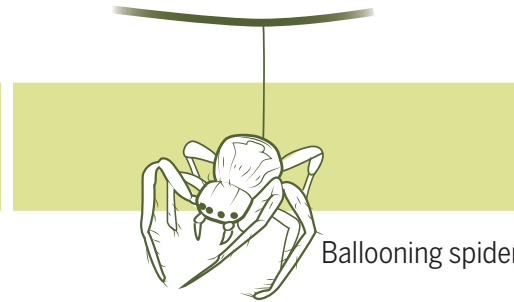
### Comparable biological systems



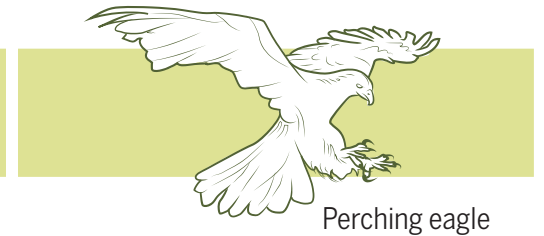
Bumblebee



Fly

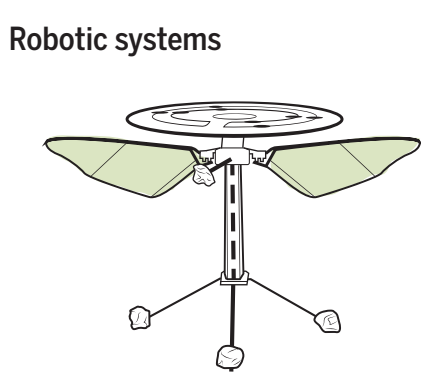


Ballooning spider

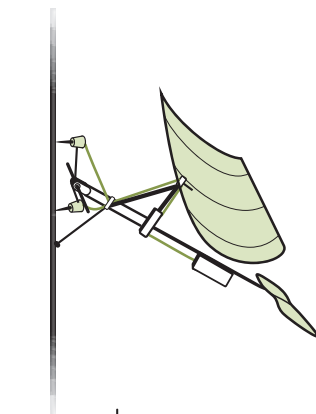


Perching eagle

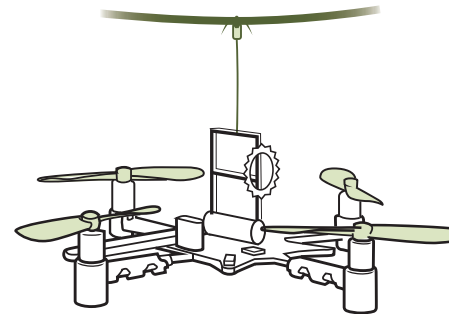
### Robotic systems



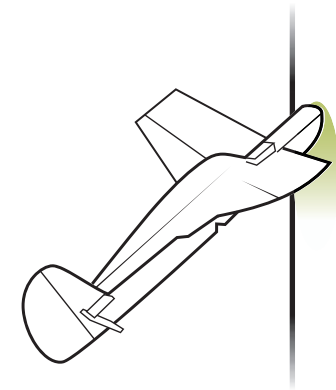
1 g



10 g



0.1 kg



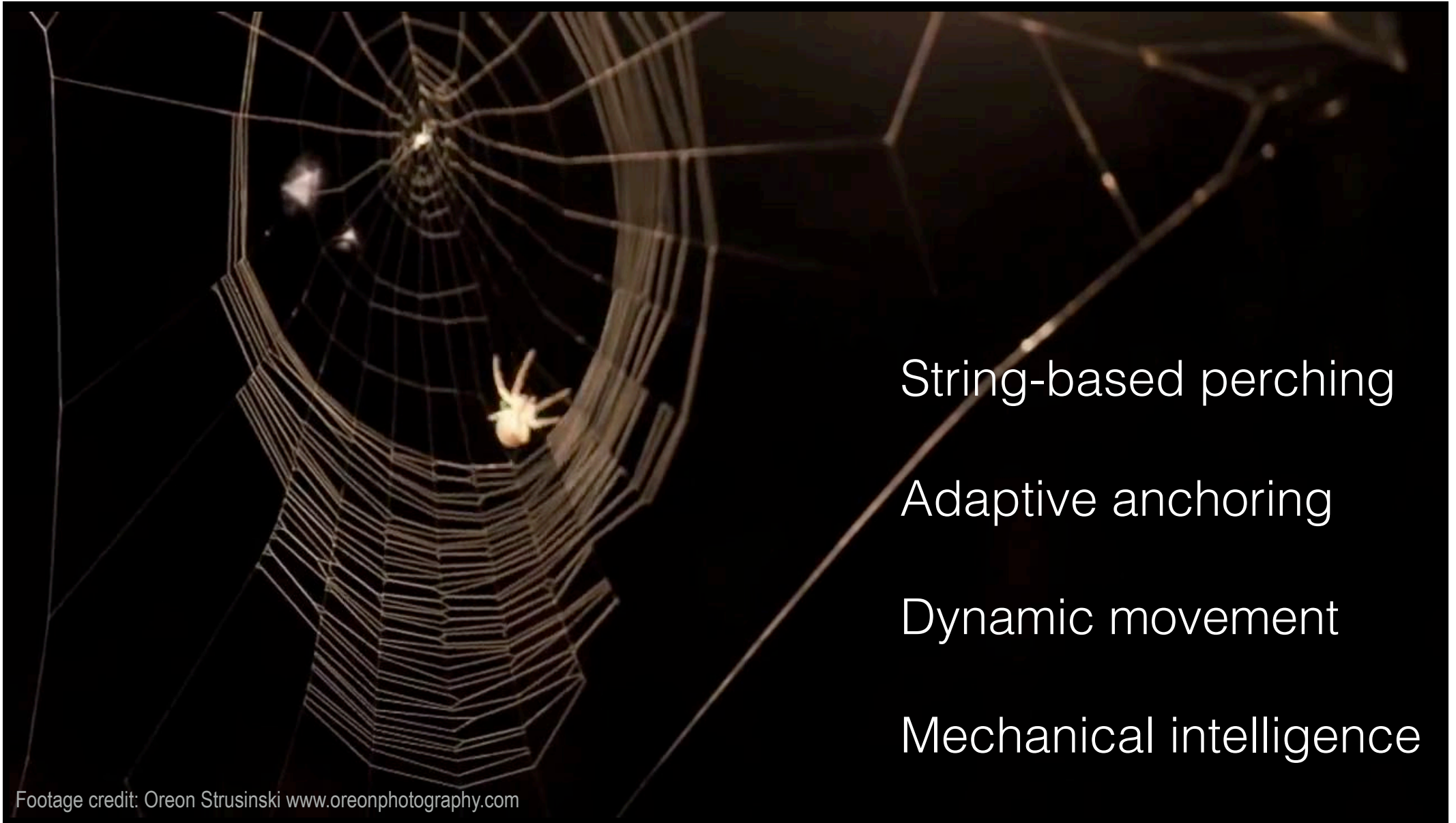
1 kg

High passivity and mechanical intelligence

High control, sensing, and planning



# Solutions in Nature



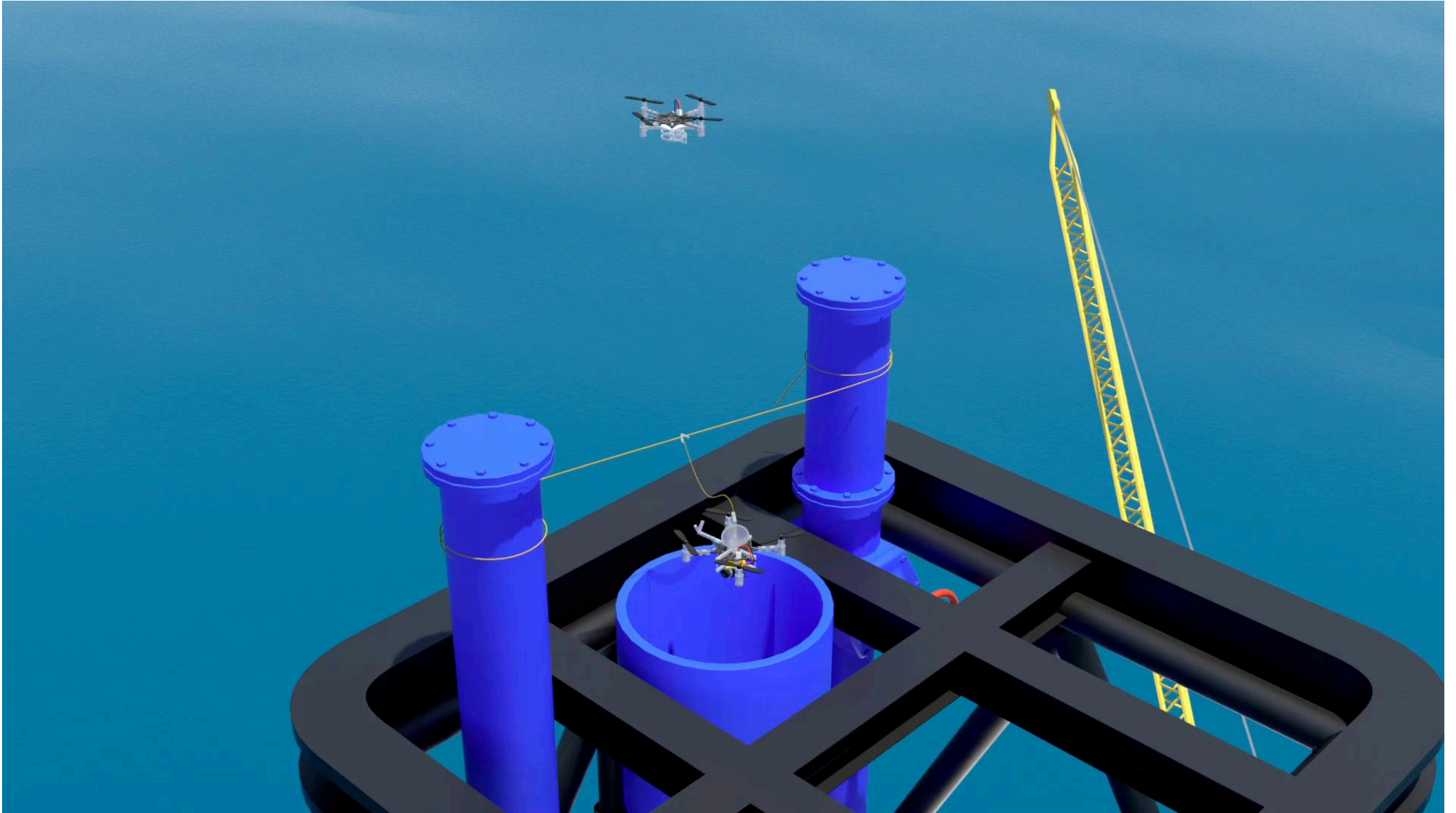
String-based perching

Adaptive anchoring

Dynamic movement

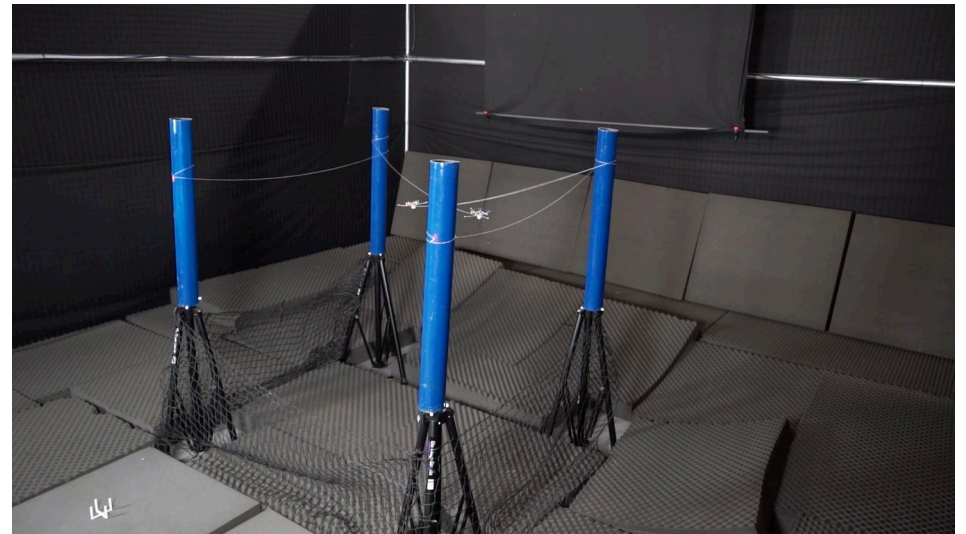
Mechanical intelligence

# Remote sensor placement





# Remote sensor placement



String based  
perching

Adaptive  
anchoring

Embodied  
intelligence

Dynamic  
movement

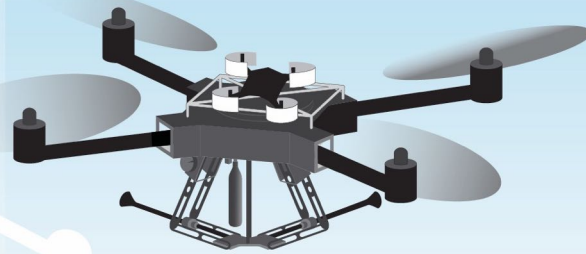




جائزة الإمارات للطائرات  
بدون طيار لخدمة الإنسان  
THE UAE DRONES  
FOR GOOD AWARD  
Finalist



**SPIDER  
DRONE**



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Finalist

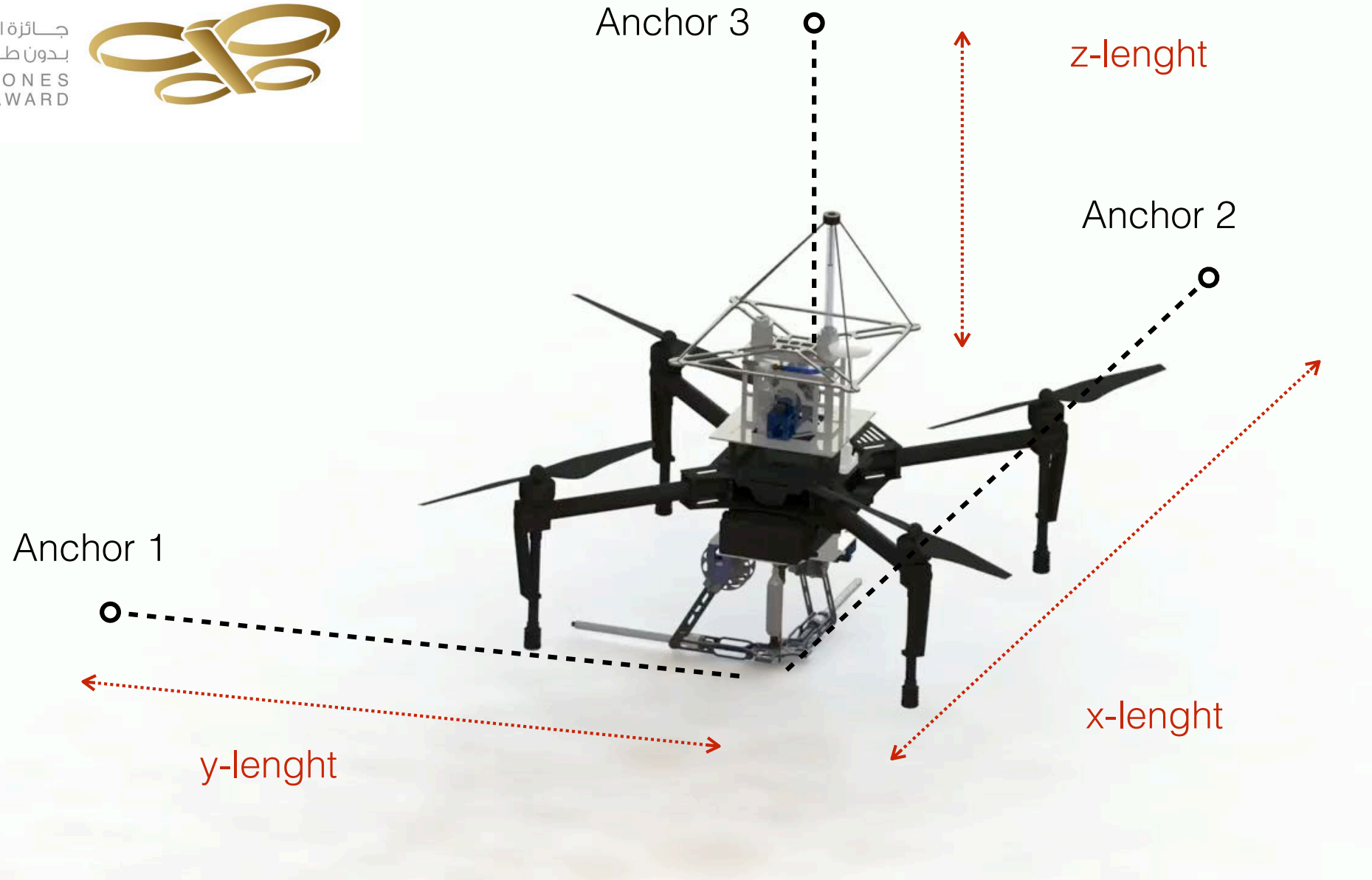


SPIDER  
DRONE

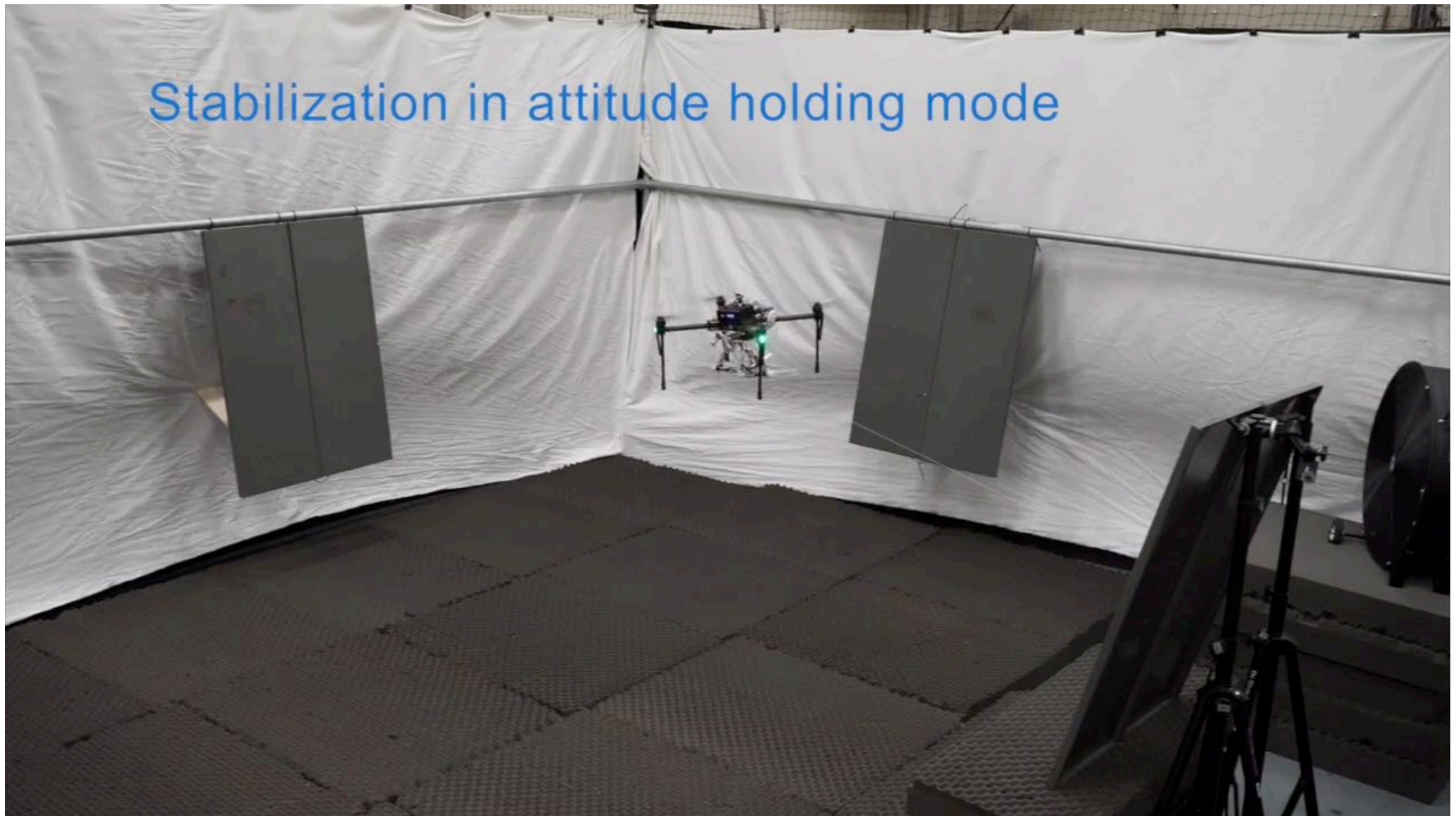


# Remote sensor placement

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بدون طيار لخدمة الإنسان  
THE UAE DRONES  
FOR GOOD AWARD  
Finalist



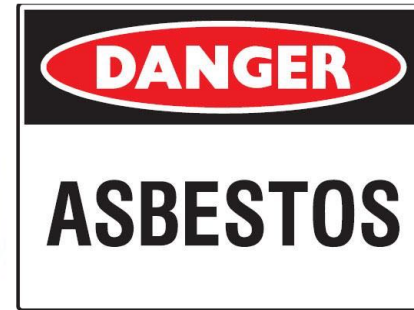
# Stabilisation in dynamic environments



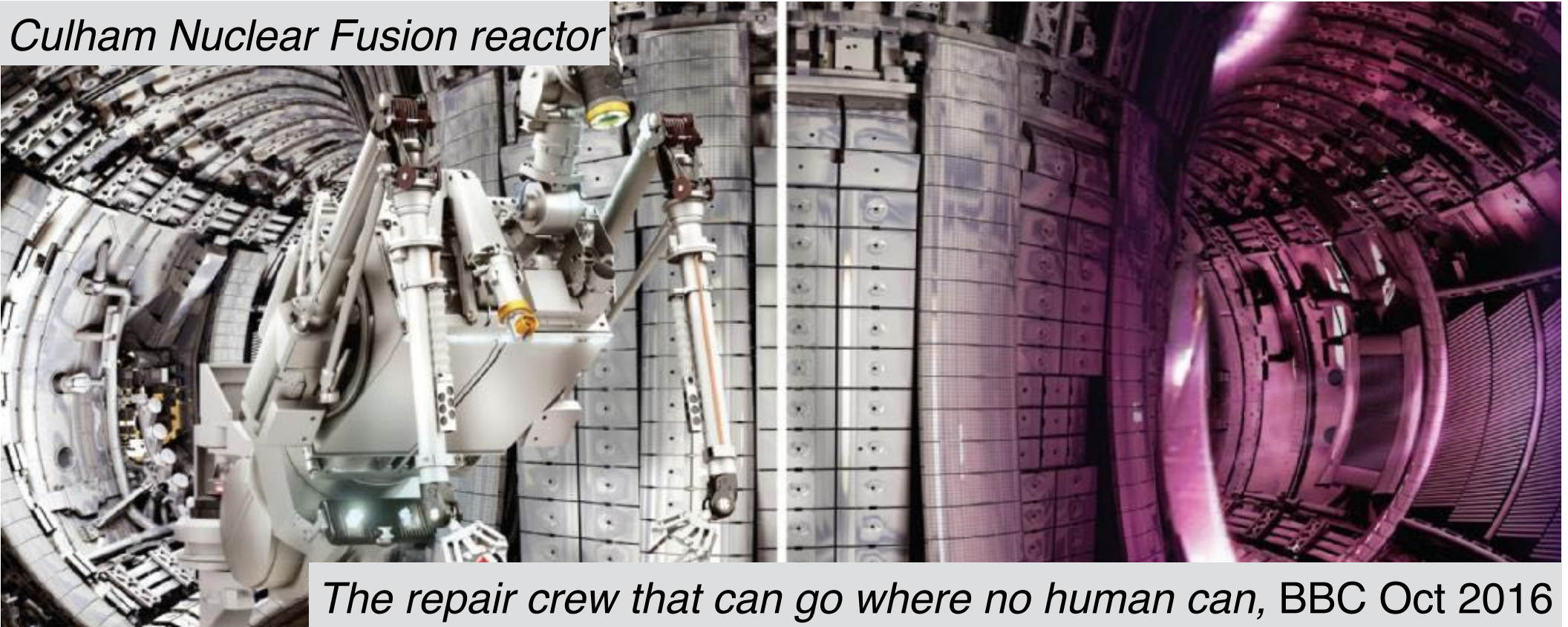


# Industrial Demonstrators

*Battersea Powerstation*



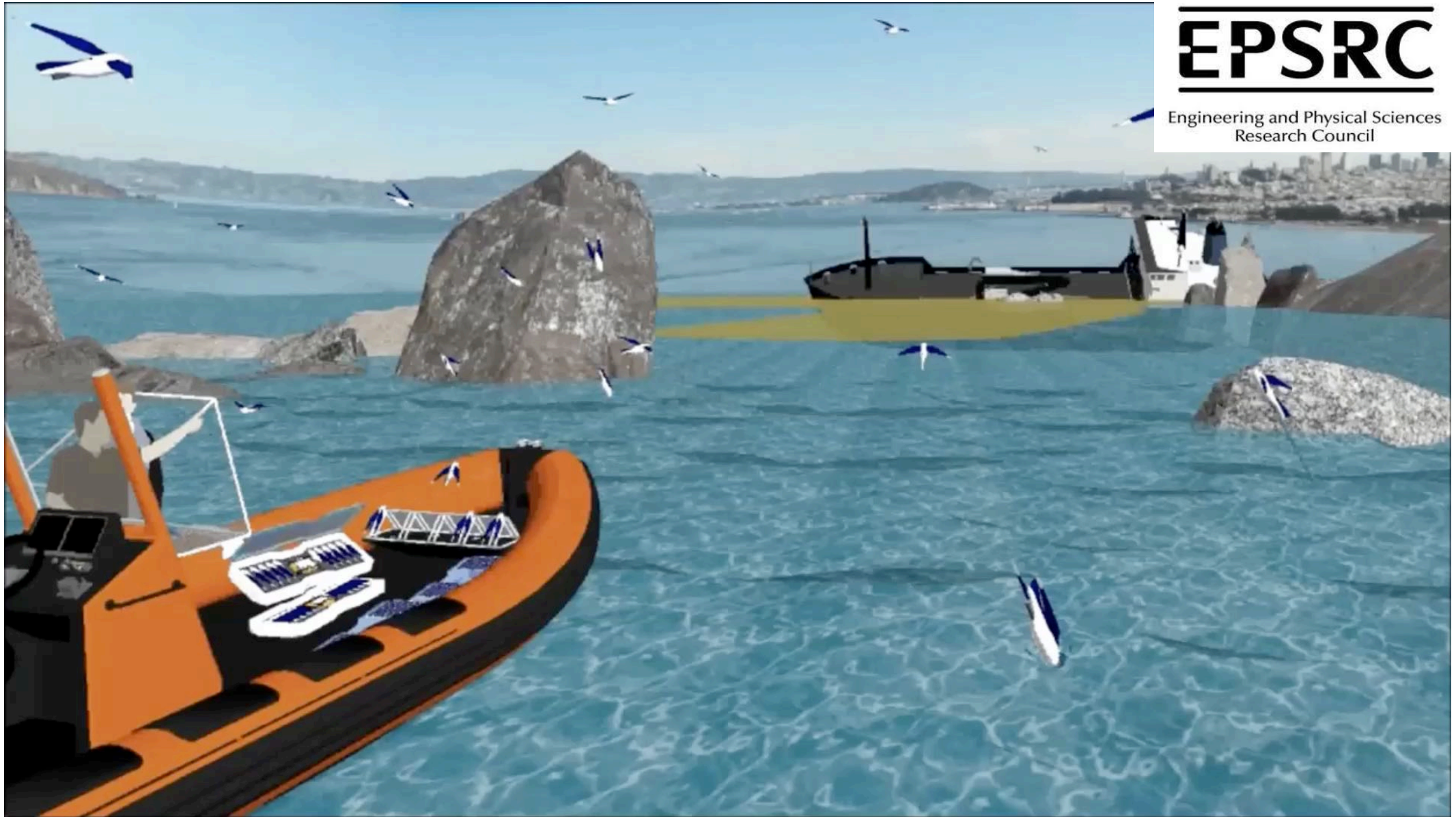
*Culham Nuclear Fusion reactor*



*The repair crew that can go where no human can, BBC Oct 2016*



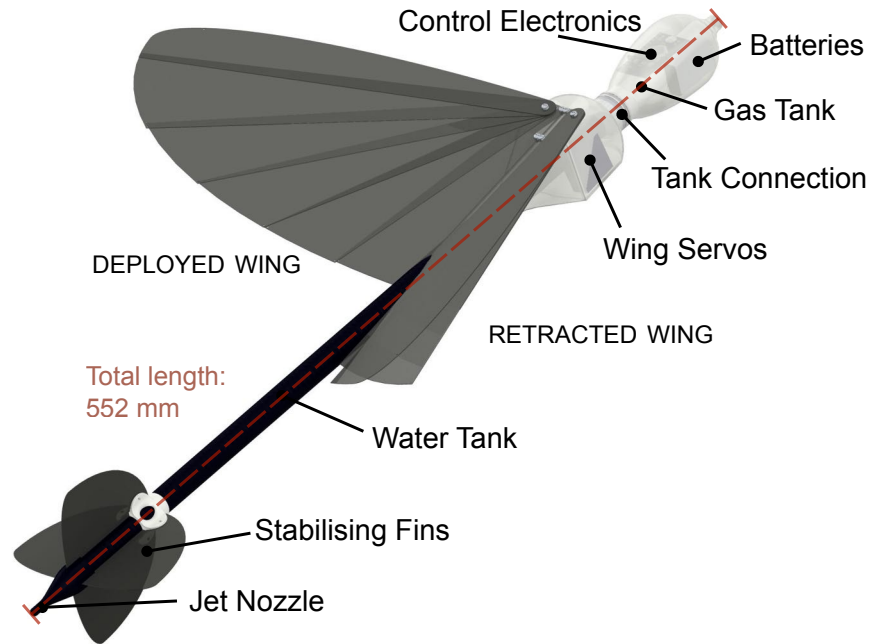
# AquaMAV



**EPSRC**  
Engineering and Physical Sciences  
Research Council

Siddall, Kovac (2014) Launching the AquaMAV: Bioinspired design for aerial-aquatic robotic platforms, *Bioinspiration & Biomimetics*, 2014

# AquaMAV



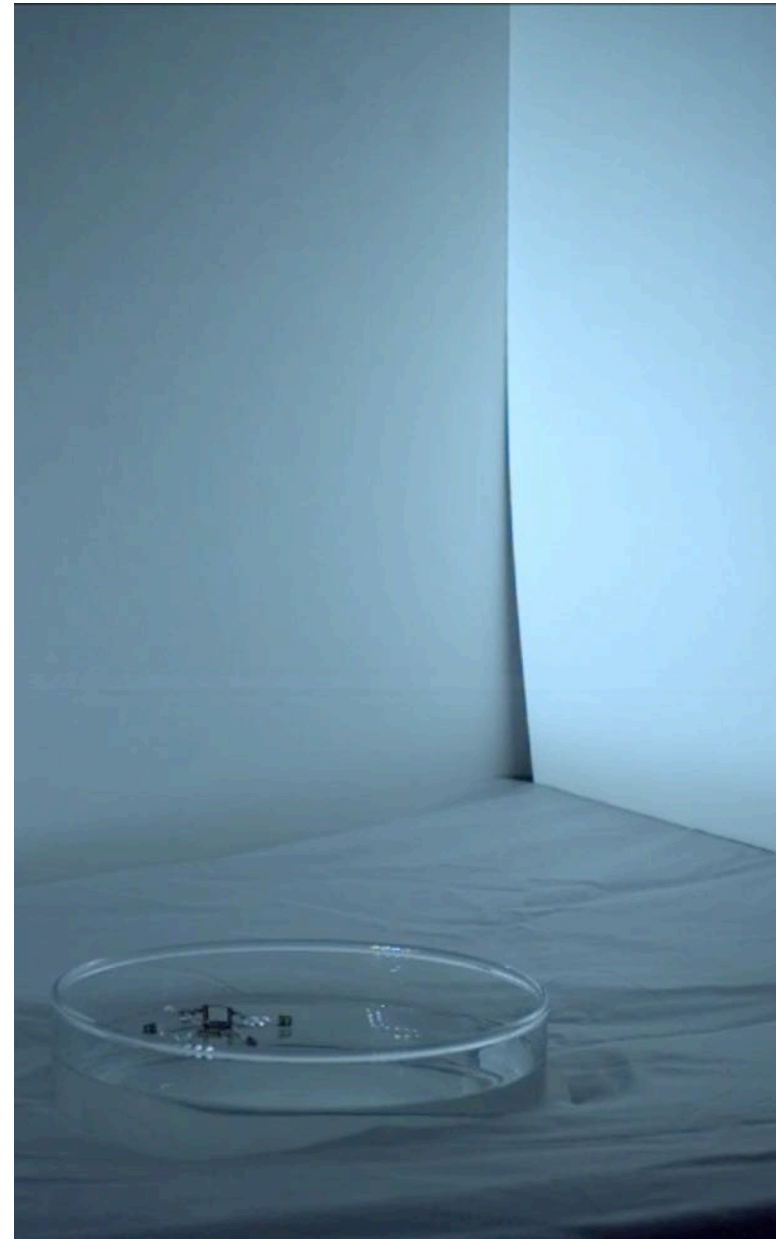
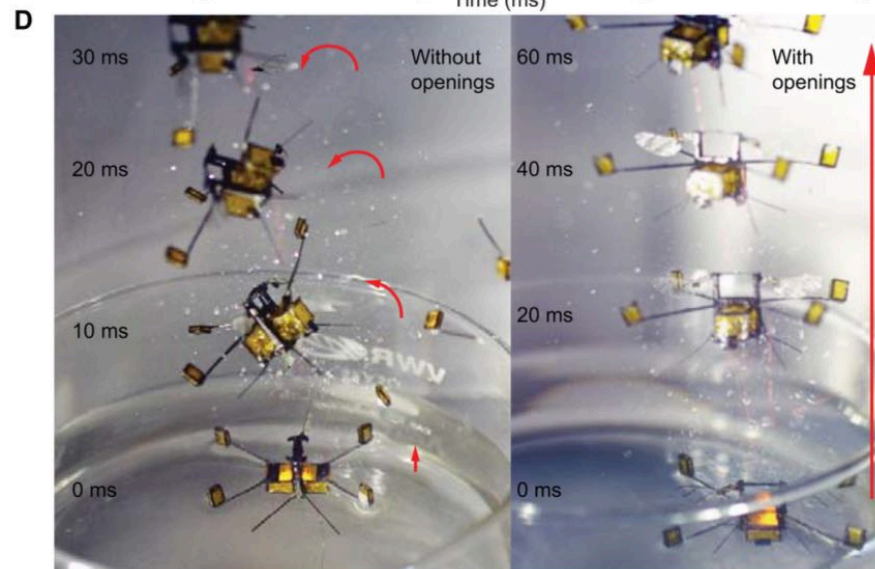
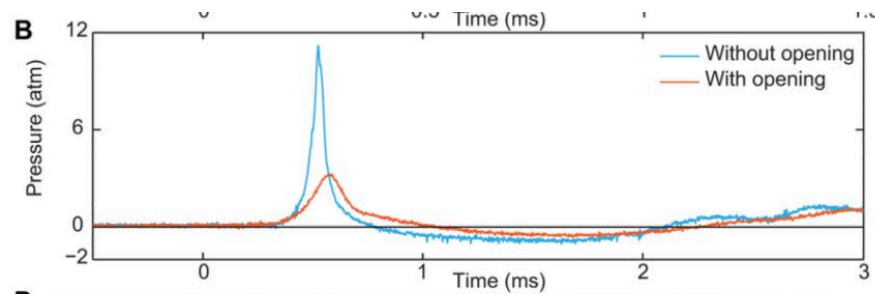
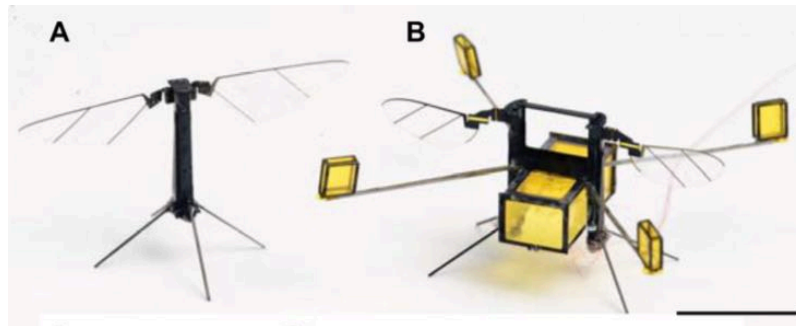
Cao Parametric - Advanced Rendering Extension

- Inspired to aerial-aquatic animals such as flying fish, diving birds and gliding squids
- Aerial-aquatic mobility: multi-modal locomotion and sensing in unstructured environments
- Distributed water quality monitoring, search and rescue, disaster scene assessment, underwater exploration





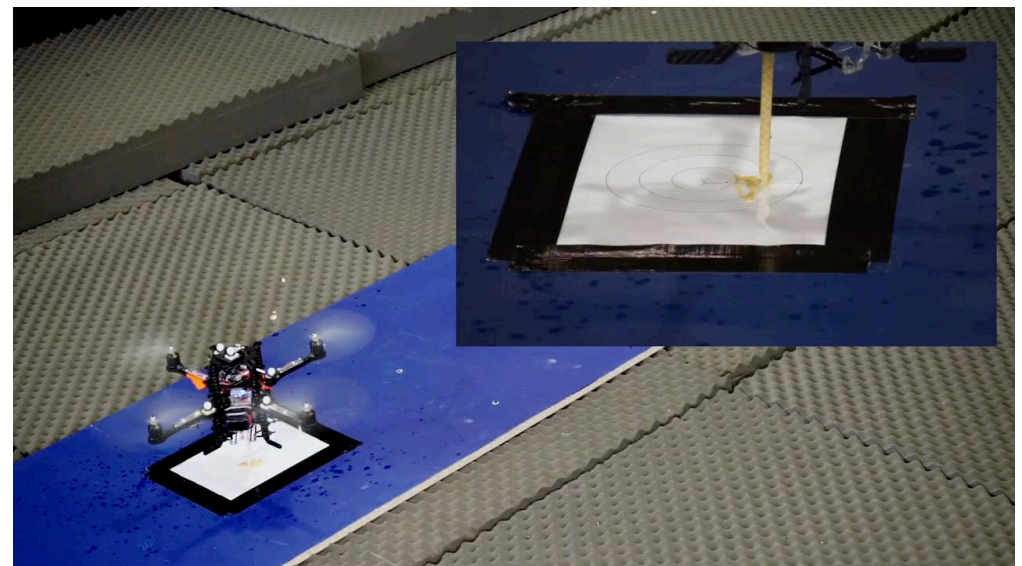
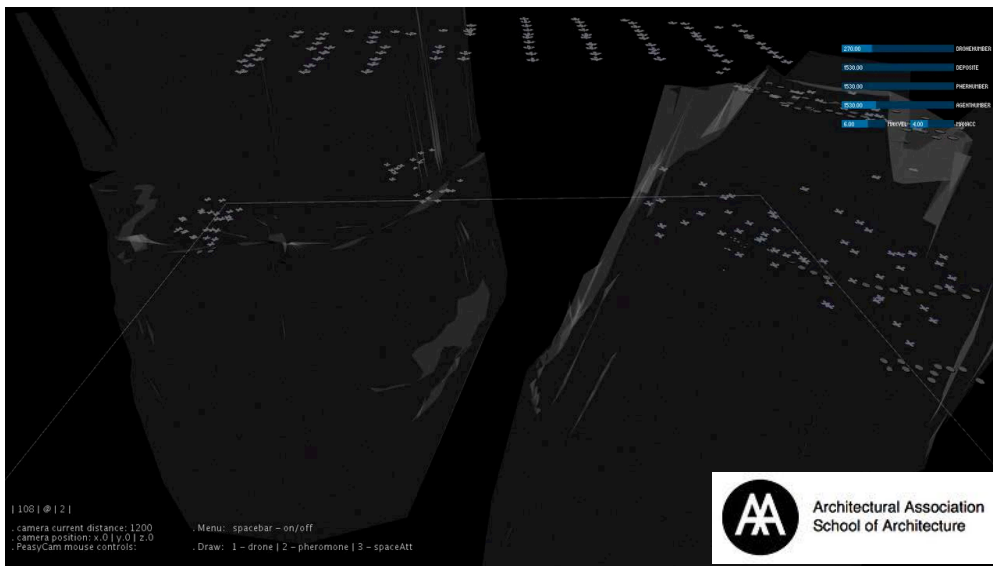
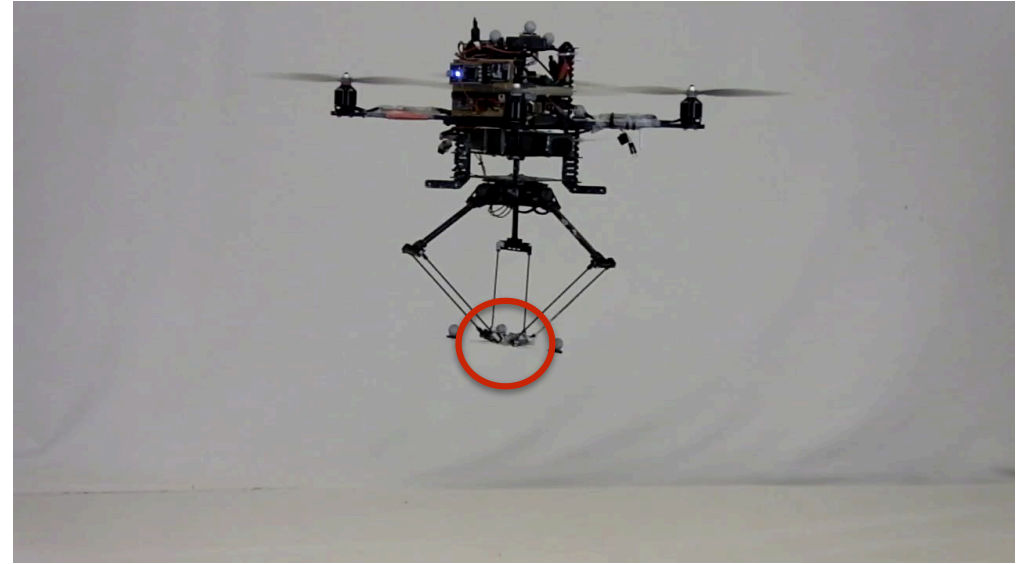
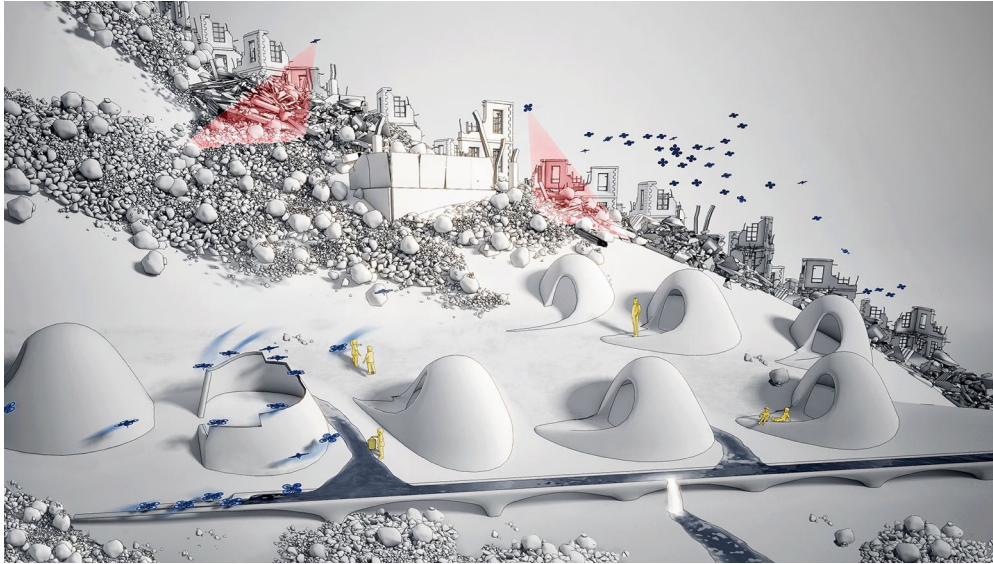
# AquaMAV-RoboBee



Chen, K., Zufferey, R., Kovac, M., Wood, R. et al. A biologically inspired, flapping-wing, hybrid aerial-aquatic microrobot, *Science Robotics* Vol. 2, Issue 11, 2017

# Aerial Additive Building Manufacturing

## 3D Printed Construction with a Swarm of Aerial Robots



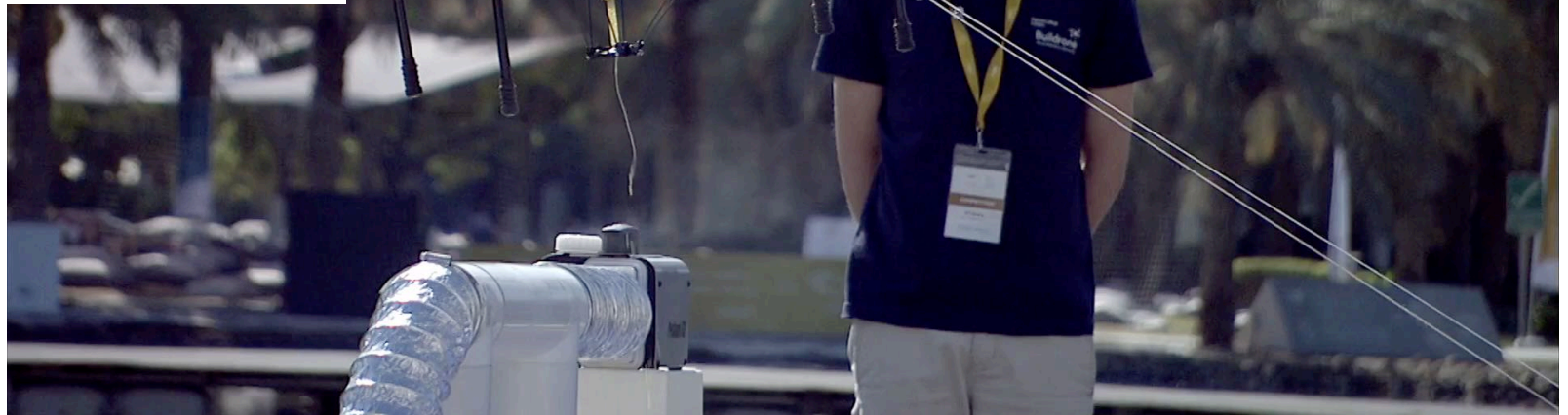


# Aerial Additive Structural Repair

UAE Drones for Good Award Winner  
(1017 submissions in two categories)



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# Facilities at Imperial College

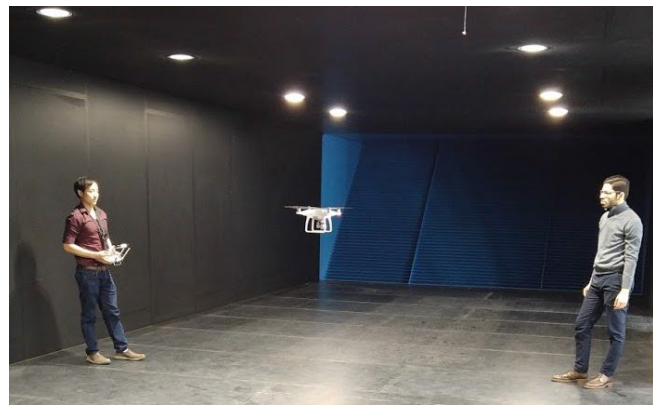
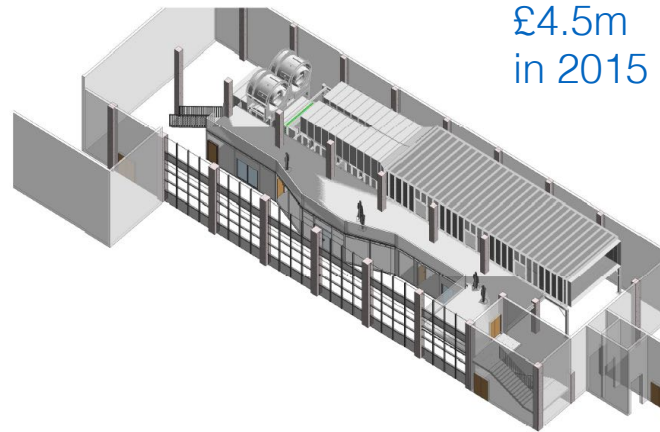
Aerial Robotics Lab



Air/ground/water test areas

- 12m long, 10m wide 5.7m high
- integrated workshops, meeting rooms and student spaces

Extreme weather flight arena



Aerial Robotics Test Section

- 12m long, 5.7m x 3.5m cross section
- Top speed 13m/s
- 17 Wind/water tunnels

Wave generator tank



Wave-generator

- 12m by 20m adjustable bed
- Two separate dive tanks

Rapid prototyping facilities  
(£4m in 2014)

- Multi-material 3D printing
- Laser sintering
- DPSS laser micro-machining
- Etc.

Imperial Robotics Forum

- >35 PIs + >150 researchers
- [www.imperial.ac.uk/robotics](http://www.imperial.ac.uk/robotics)

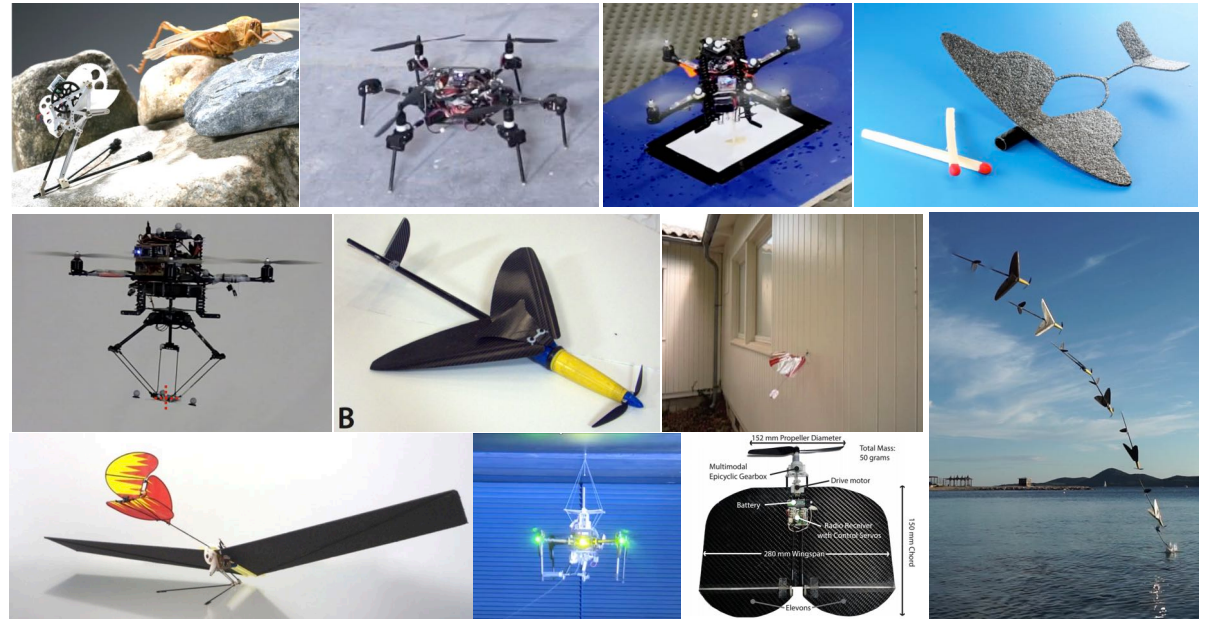


# Working together

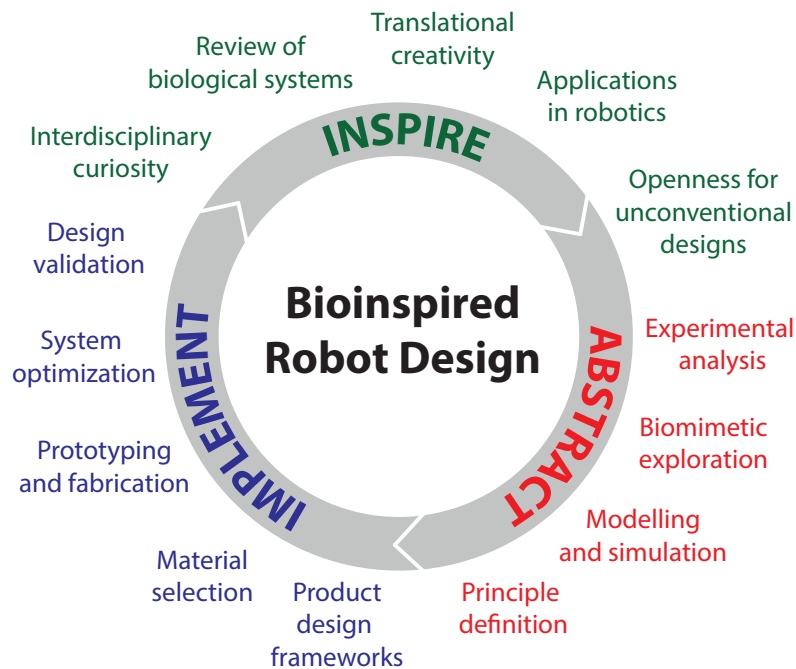
## Scientific Vision



## Developed Prototypes



## Methodology



## Community of communities

