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# sUAS for Deployment and Recovery of an Environmental Sensor Probe

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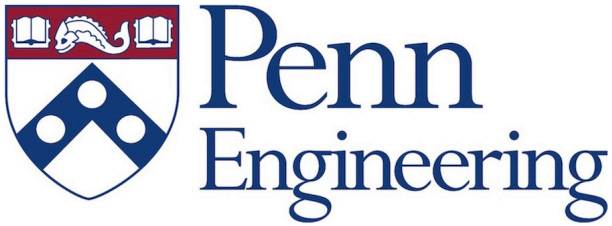
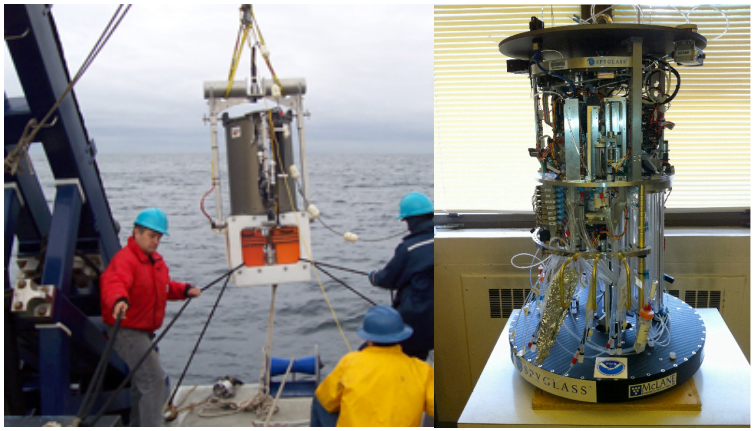
University of Pennsylvania




# Environmental Probe - Motivation

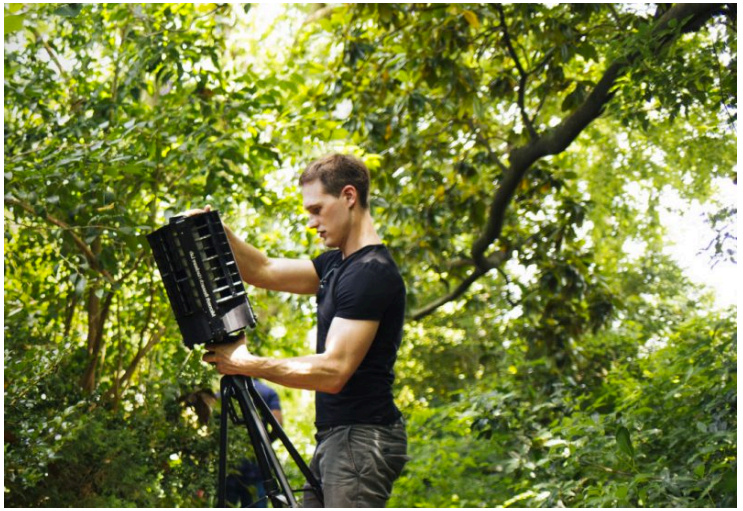
In-situ sensing inadequate

- pest samples for pest-density monitoring
- air quality monitoring
- boundary detection of hazardous plumes
- water quality monitoring



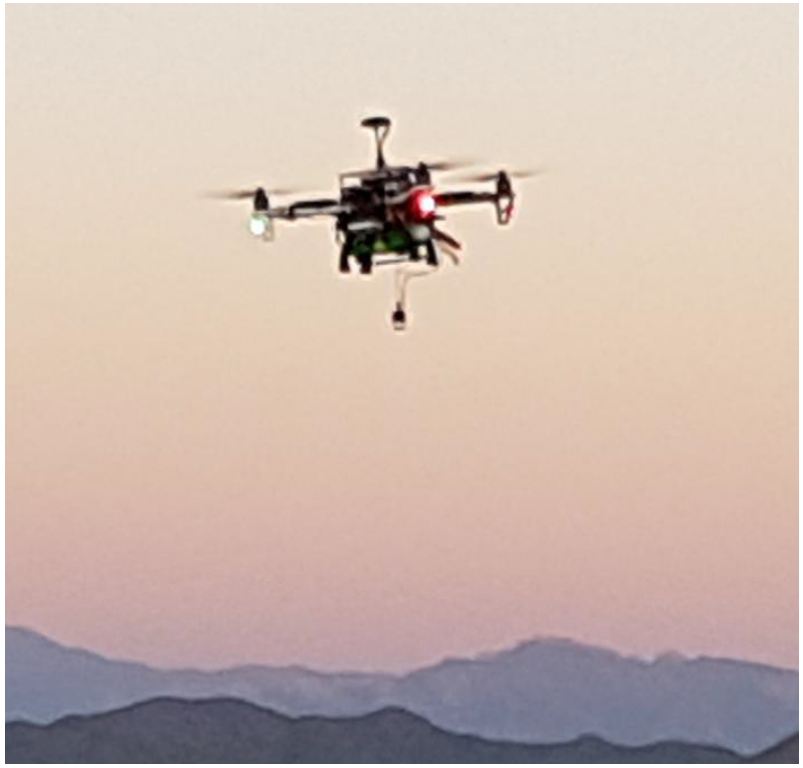
Genomic Environmental Sample Processor (ESP)

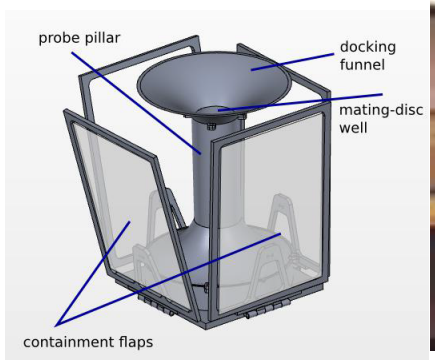
- Persistent presence
- Ex-situ analysis of collected samples
- Deployment guided by in-situ sensing and predictive models
- Close-the-loop



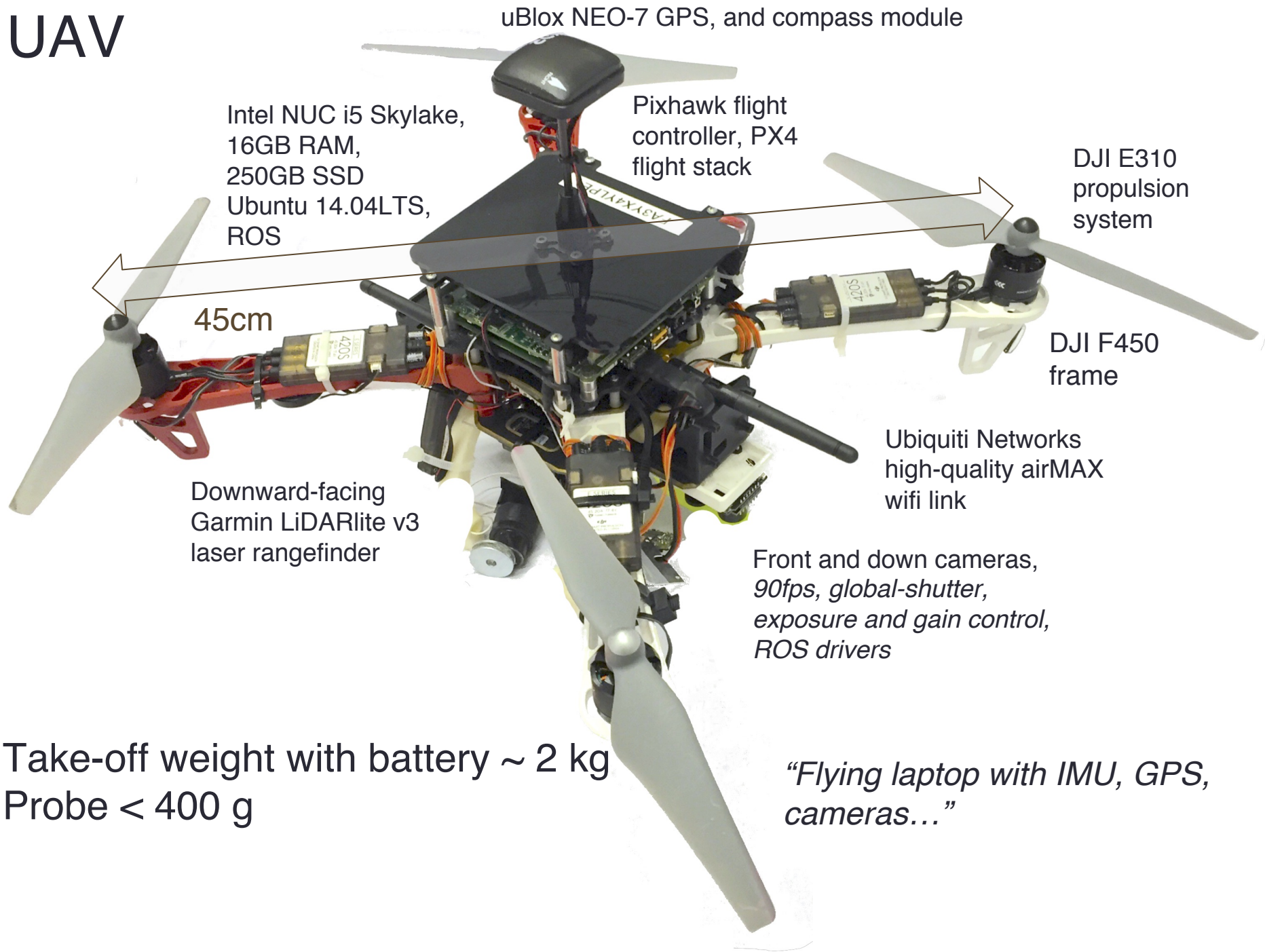
Microsoft Research's Project Premonition robotic mosquito traps

# Environmental Sample Collection






# UAV

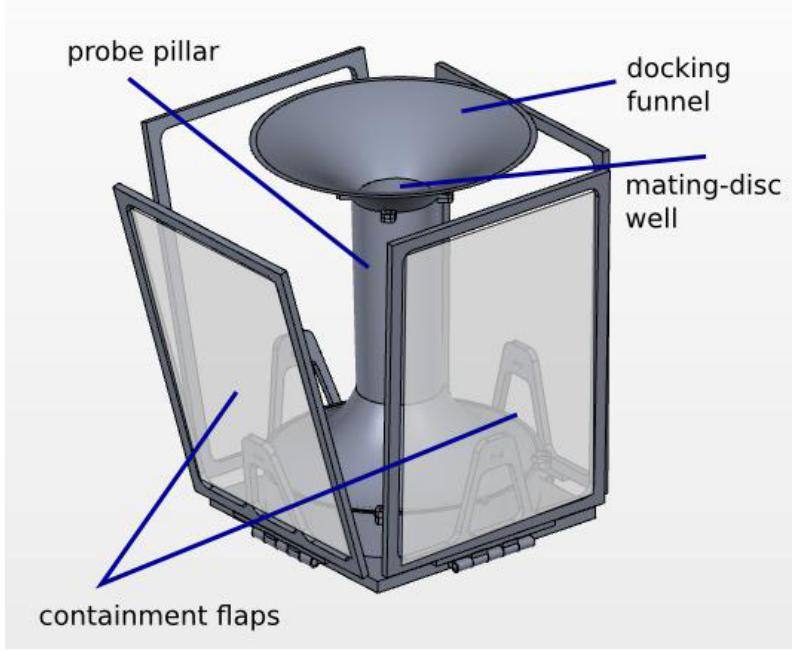



Take-off weight with battery ~ 2 kg
Probe < 400 g

*"Flying laptop with IMU, GPS, cameras…"*

# Design Goals for Probe Prototype

- Few moving parts on probe
- Versatile probe template
- Enclosed during flight to deter
- Upright after deployment



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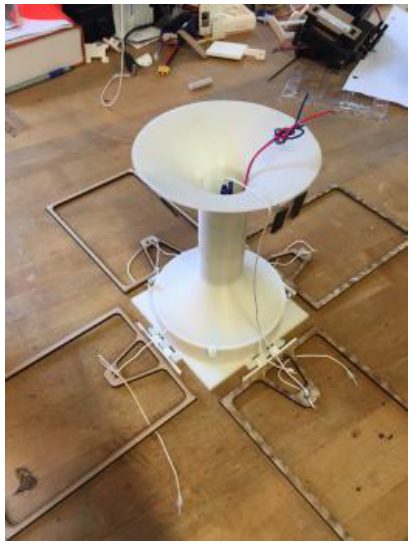

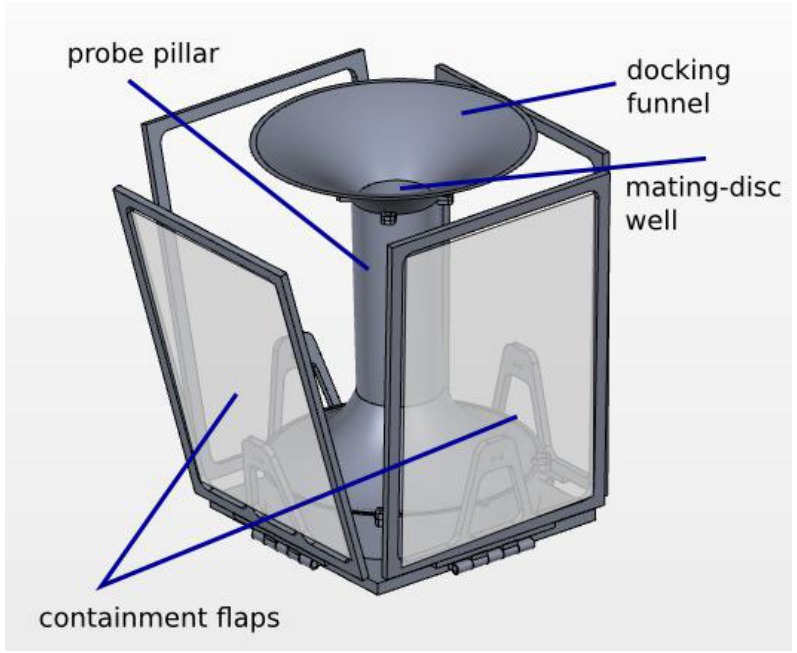

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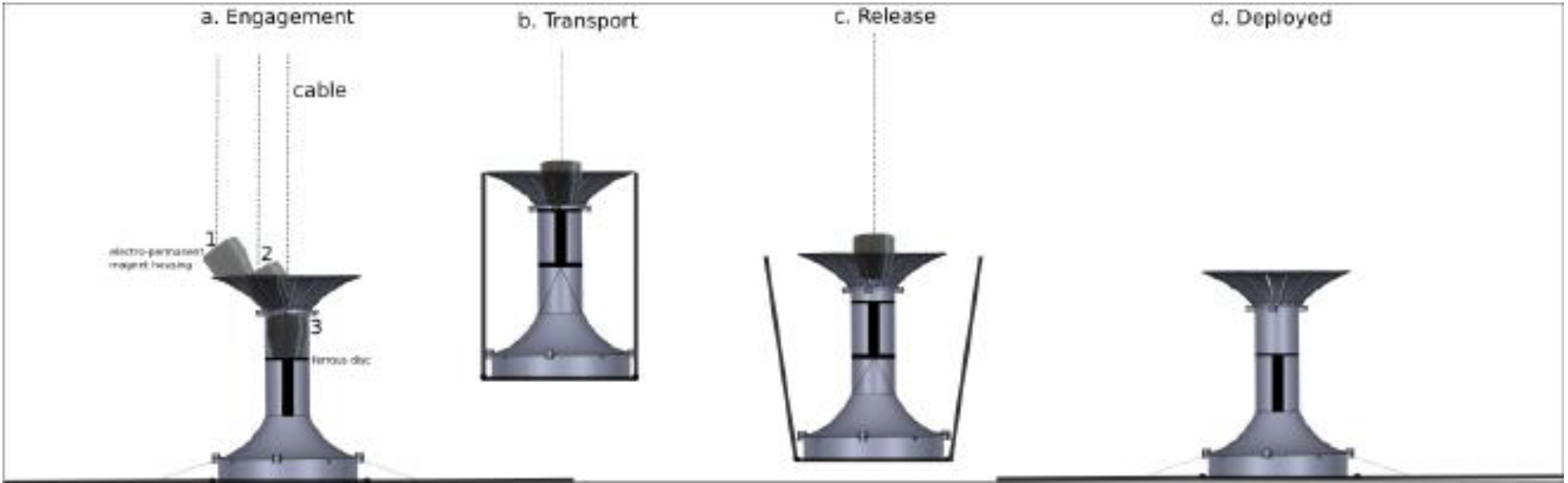
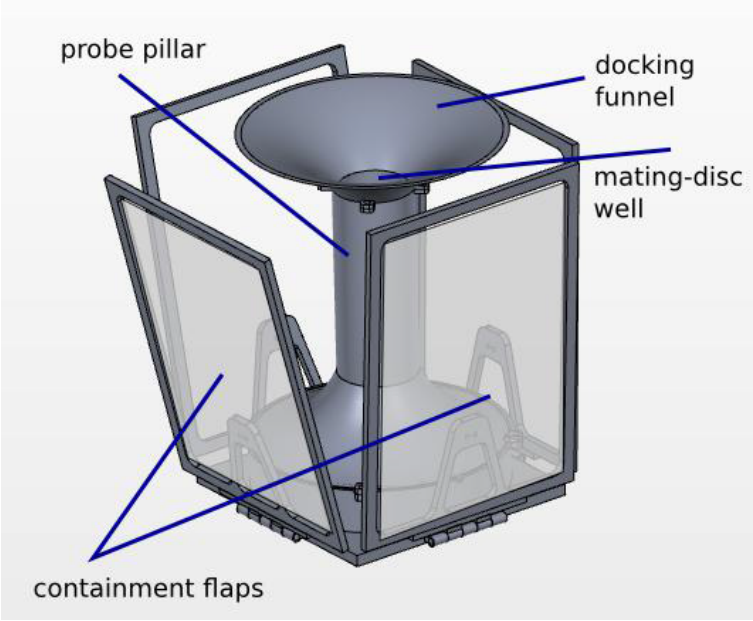
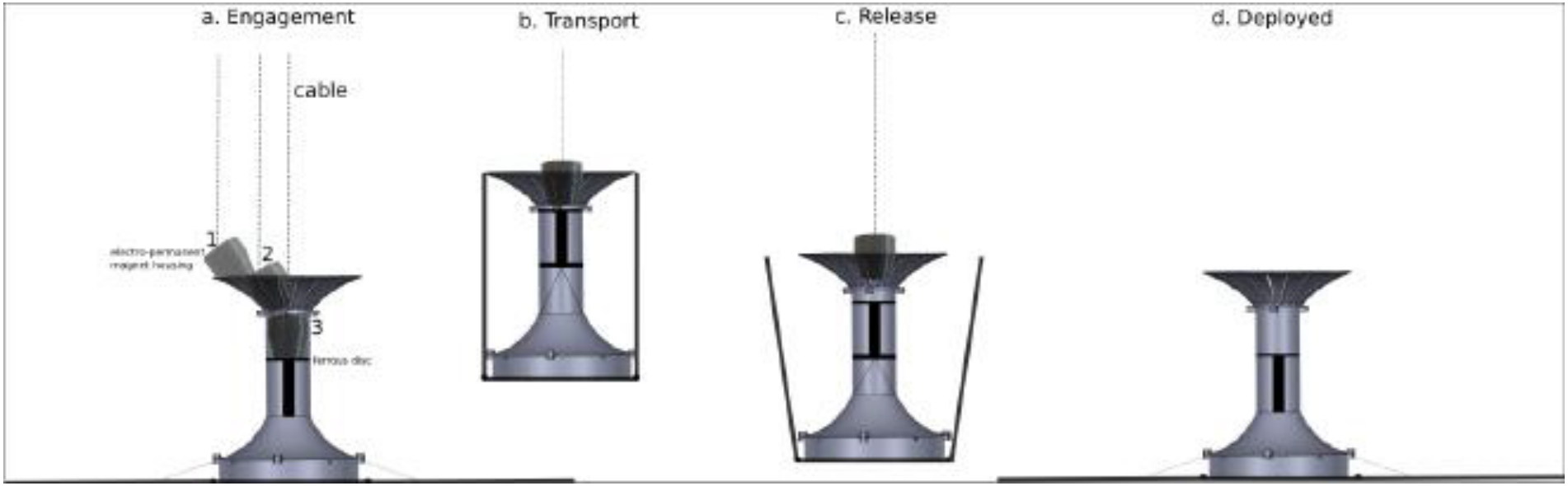
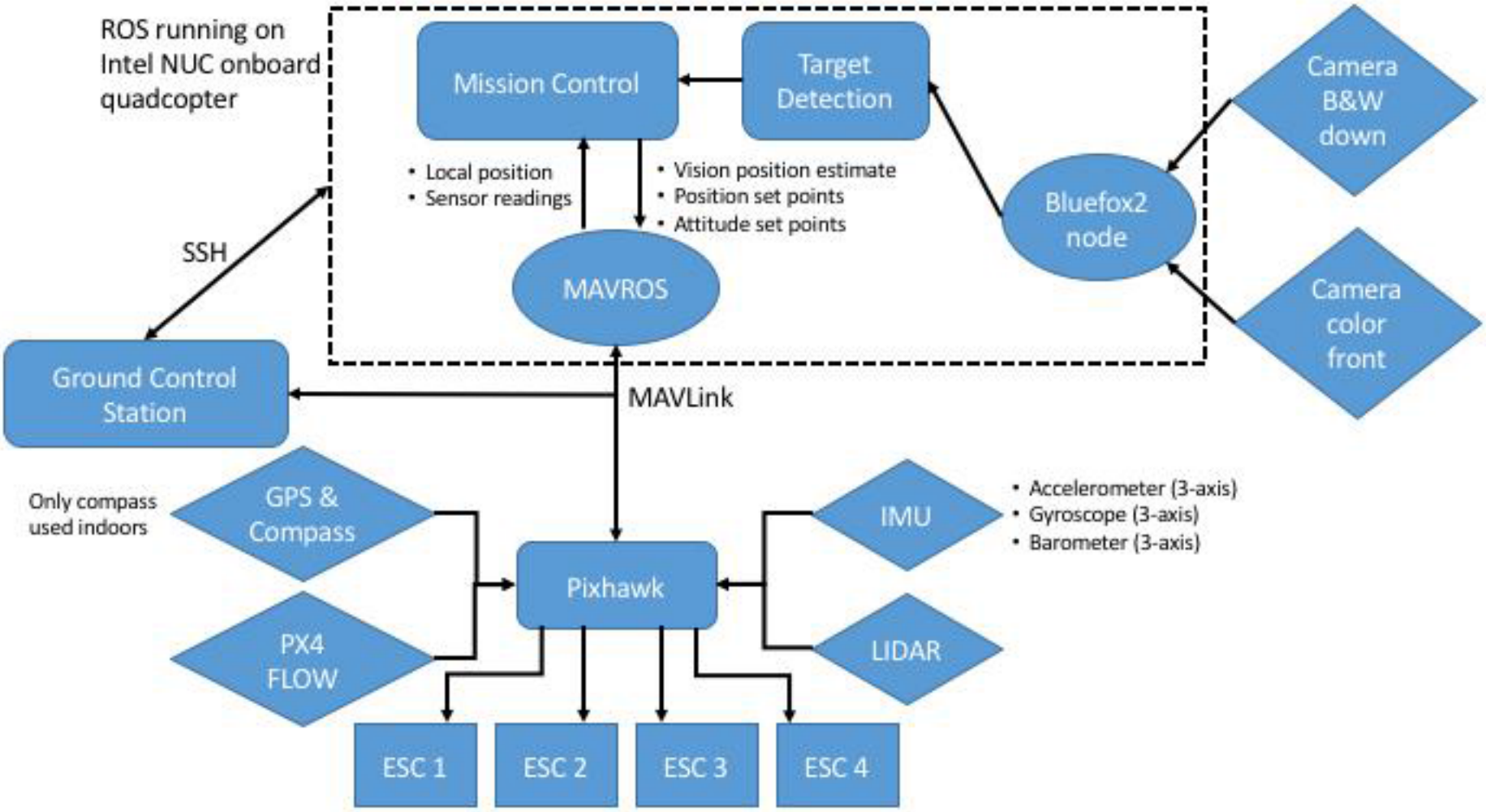


# Probe Design

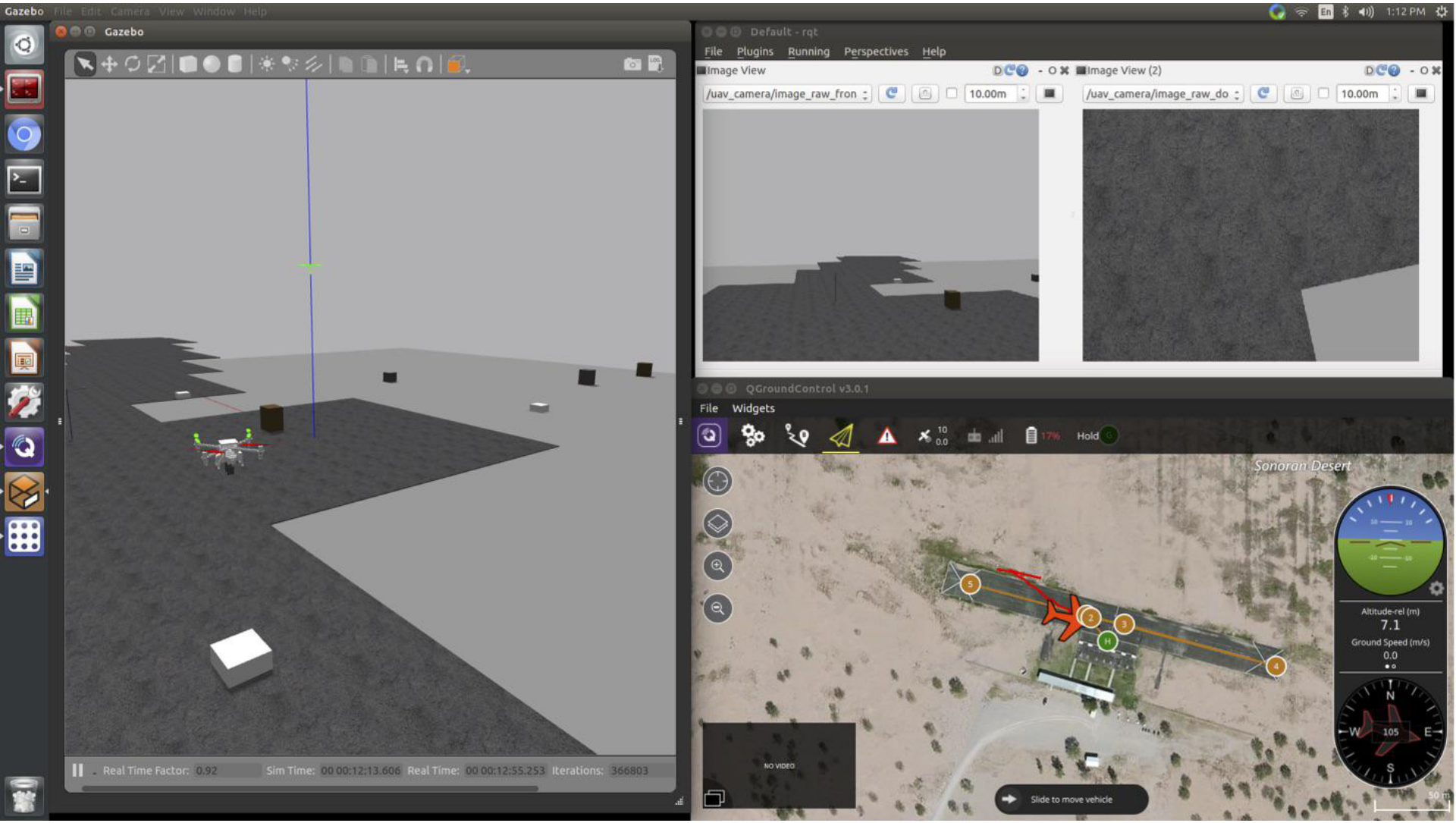


# System Description



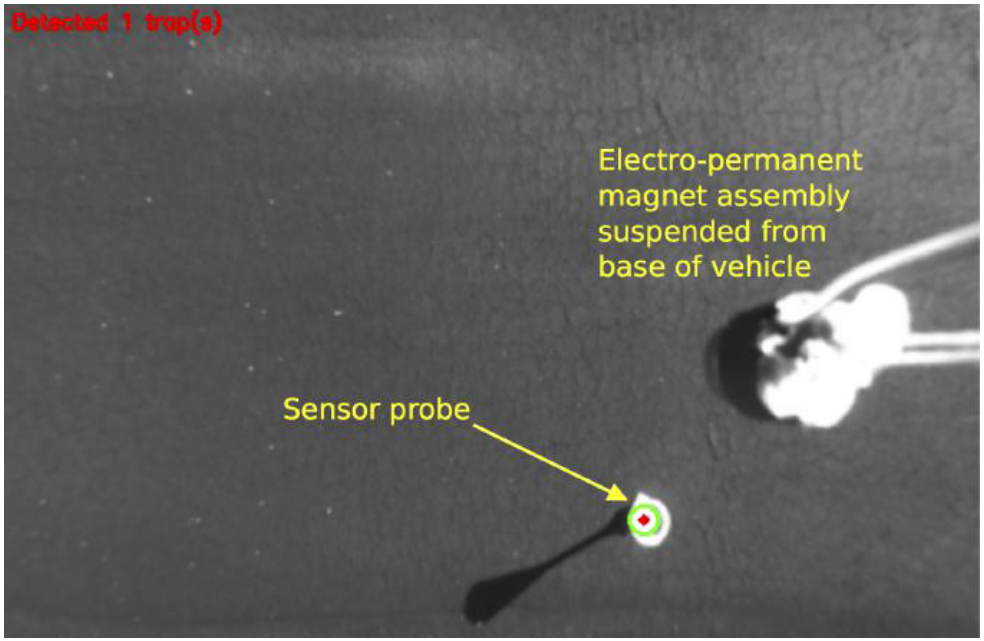
# Simulation Tools

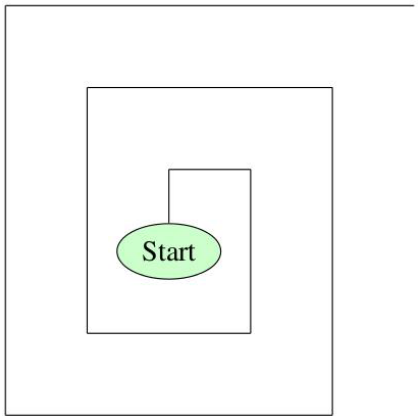


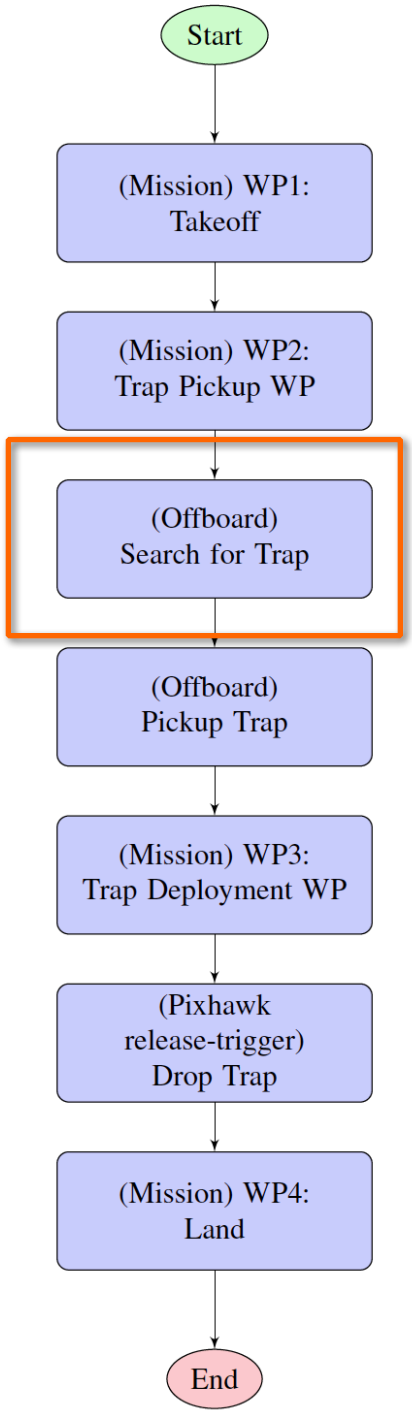
# Outdoor Mission

TIMPA airfield, southern Arizona

# Anatomy of a Mission



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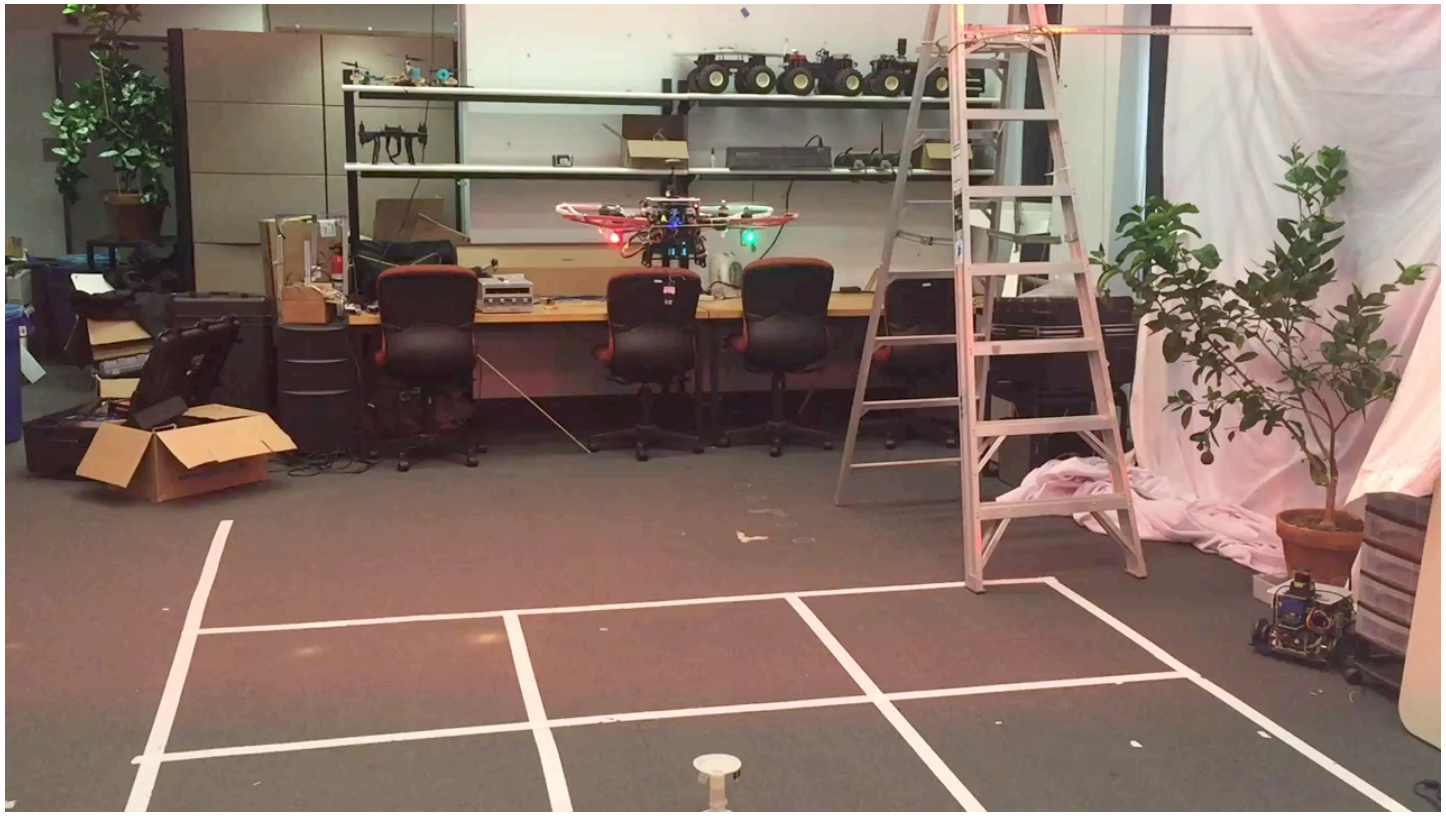

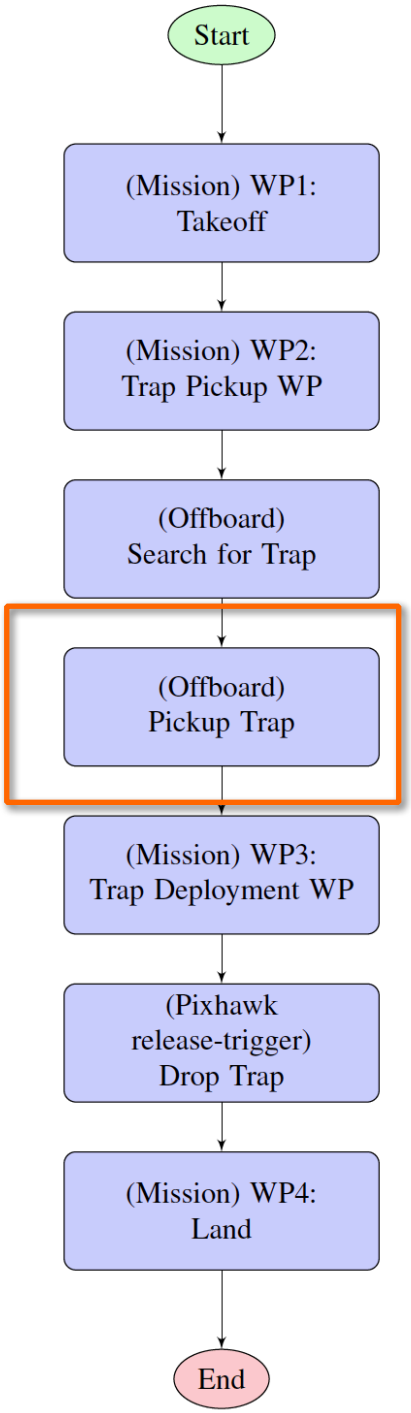

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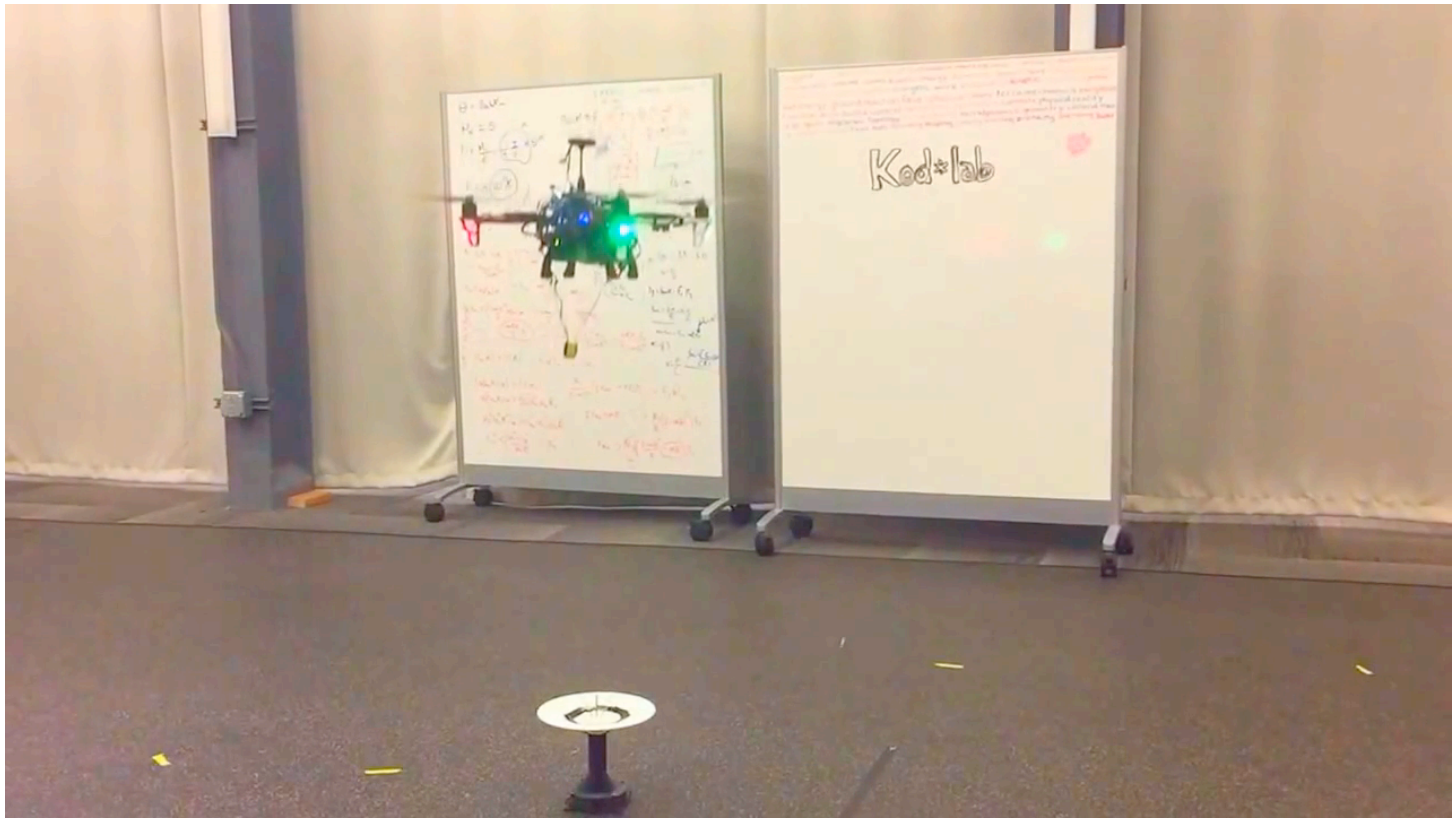


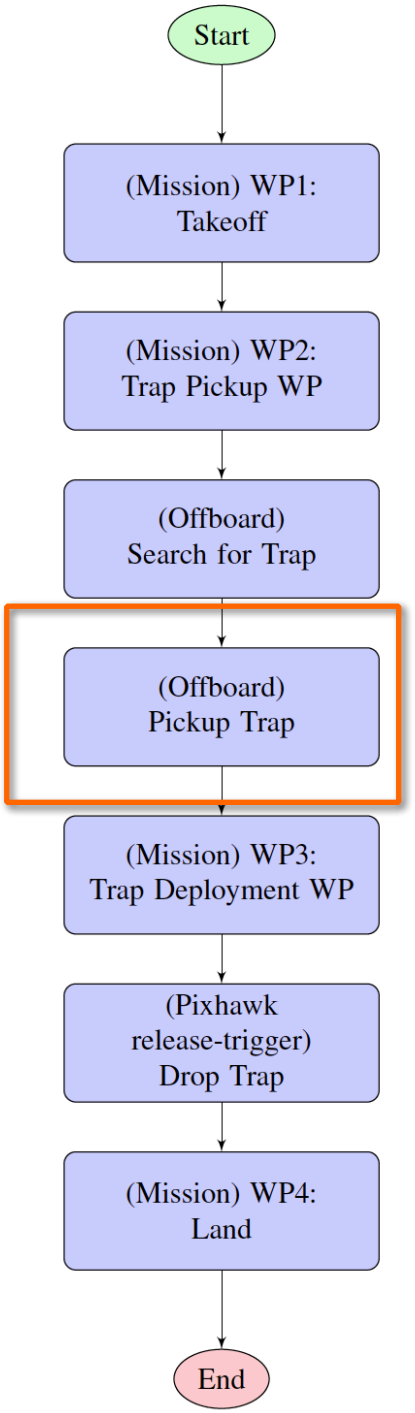

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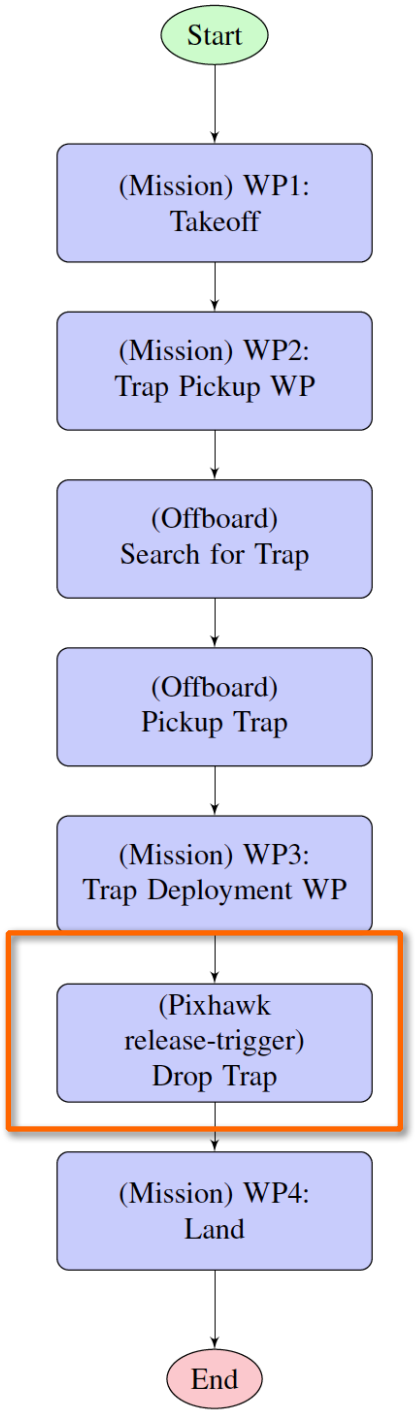

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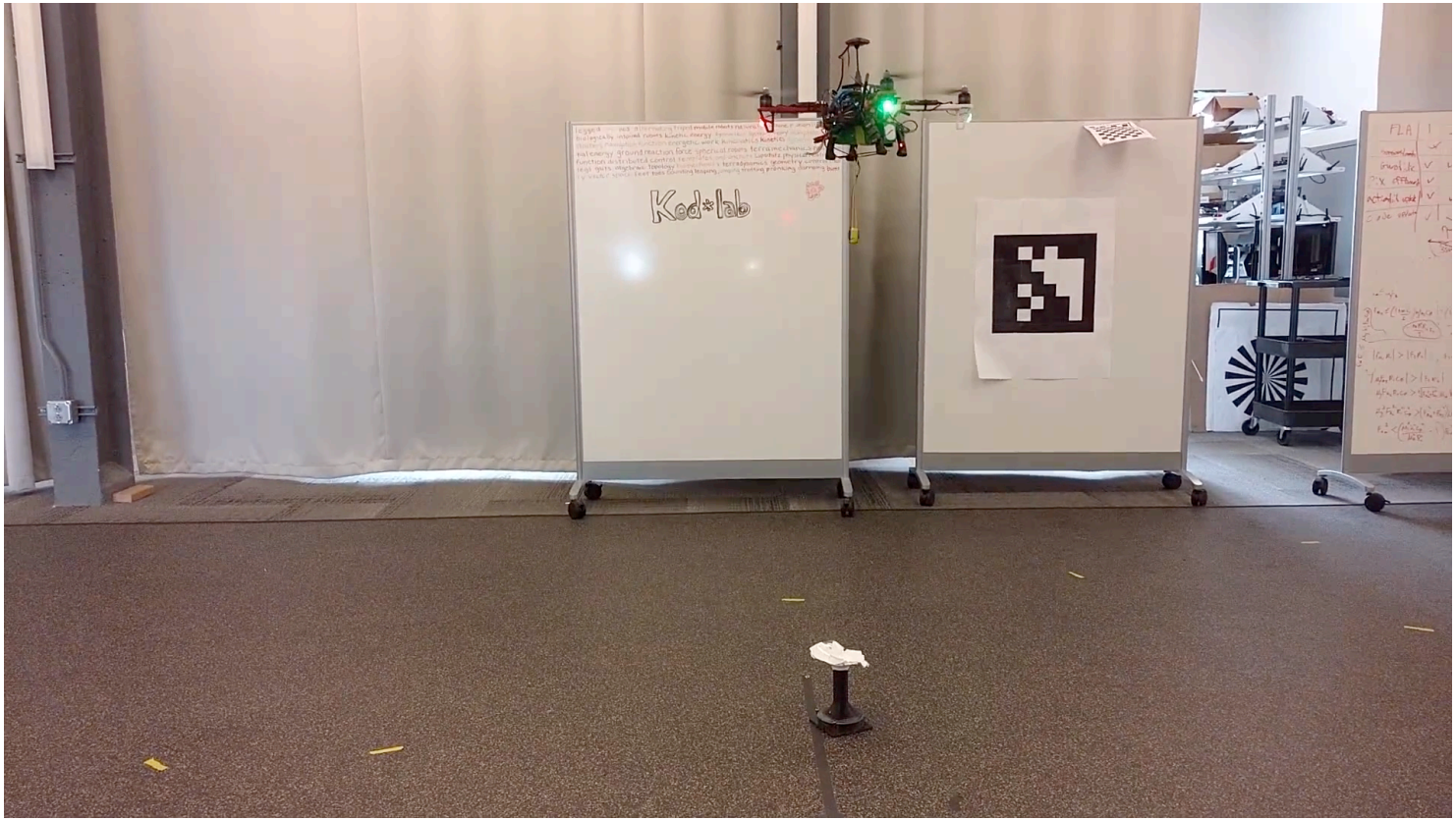
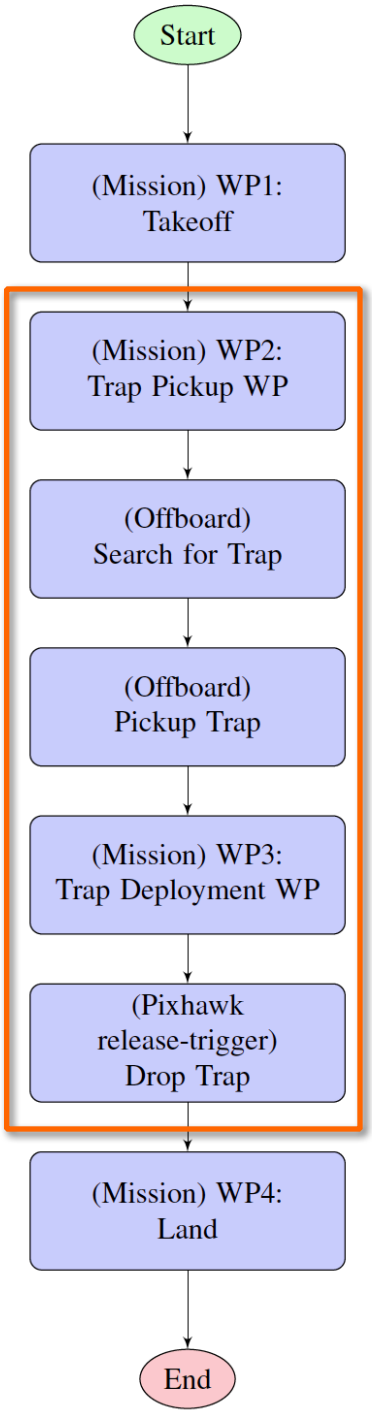


# Conclusions

- Data-driven robotic sampling for crop health monitoring
- Probe for automated collection of physical agricultural samples for ex-situ analysis

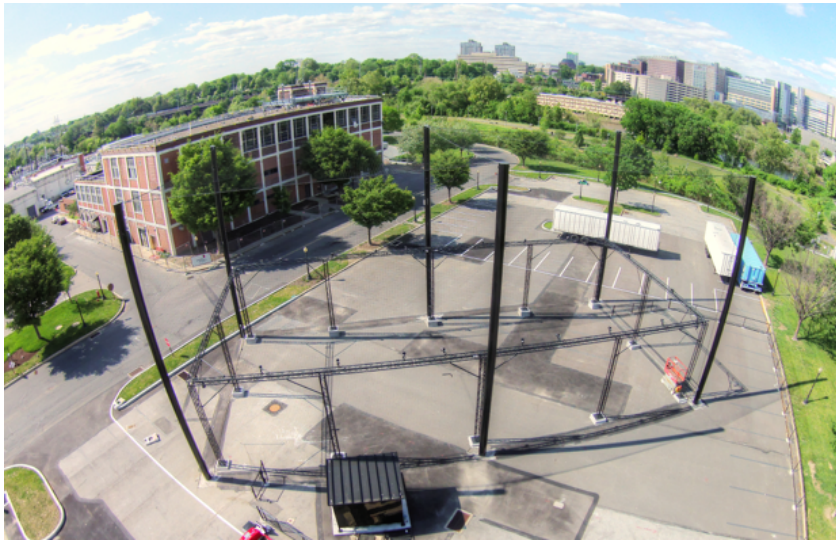
Future directions

- Robust Enclosing system
- Pest-trapping field deployments
- Winch system
- Computation onboard probe

# Facilities at University of Pennsylvania


Penn Engineering | PERCH
Penn Engineering Research & Collaboration Hub

**Pennovation Center** -- incubator for fundamental research and technology commercialization



Outdoor drone testing facility
With motion capture system

# Acknowledgements

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