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## From the Shed to the Skies: A Journey of Sensor Development and

 Deployment Involving Bicycles, Drones and EaglesRick M. Thomas ${ }^{1}$, and F. Cropley', A. R. MacKenzie', S. J. Reynolds¹, J. P. Sadler1, L. Chapman¹, A. Quinn¹, J. Zhong', and X. Cai ysica 1620 - 2018 Abstracis, Vol. 20, 2018, ©Author(s) 2018. CC Attribution 4:0 license.

- Meteorological measurements are required above cites to test pollution/heat transport models
- Drones require extensive permissions to legally fly in urban skies
- A bird-carried sensor offers a solution, but requires development and testing

1. Start by 'bread-boarding' the concept
 components supplied on breakout boards.

## 2. Rapid Miniaturisation

Quick shed built miniaturised sensor to test components work together with free microcontroller. Late night soldering and Python programming sessions


## 3. Think of weaknesses <br> and ways to test them

- GPS signal strength and speed
- Pressure allimeter vs laser altimeter accuracy
- Wind sensor response
- Temperature sensor respons
- Sensor robustness


Use a free, lightweight microcontrolle ¿nymin


## 5. Testing the refined

 prototypeFreedom Conservation's trained Eagle Victor carried the sensor to check response to bird body heat and accuracy of meteorological measurements.

6. Make it smaller and better...


Wifi and LoRa Network testing underway for real-time data CO 2 and Fast humidity sensor added
Solar Panels being installed for long term deployment

## See paper for more details and data.

Thomas, R:M., et al., Avian Sensor Packages for Meteorological Measurements in Complex Terrain and Urban Environments. Bulletin of the American. Meteorological Society 2017. (In press. Early release available: http://journals.ametsoc.org/doi/10.1175/BAMS-D-16-0181.1

