

Improvement of a low-cost CO₂ commercial NDIR sensor for UAV atmospheric profiling applications

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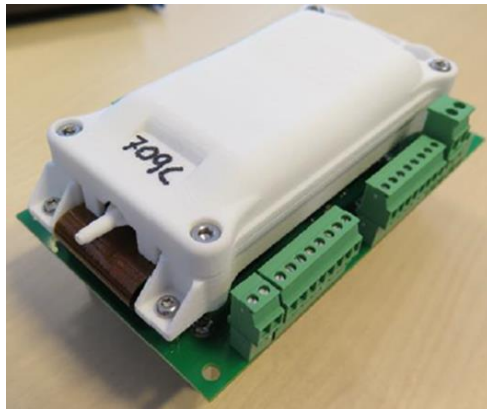
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1 Introduction

This study aims to develop and validate a UAV-CO₂ sensor system to map specific source emissions close to the ground. The CO₂ sensor used here is the High-Performance Platform (HPP 3.2, SenseAir AB) of a total weight 1058g including battery.



CO₂ Sensor
(SenseAir AB HPP_CO₂ 3.2version)



Unmanned System Research Laboratory
(Cyl) - *Cruiser EFI*

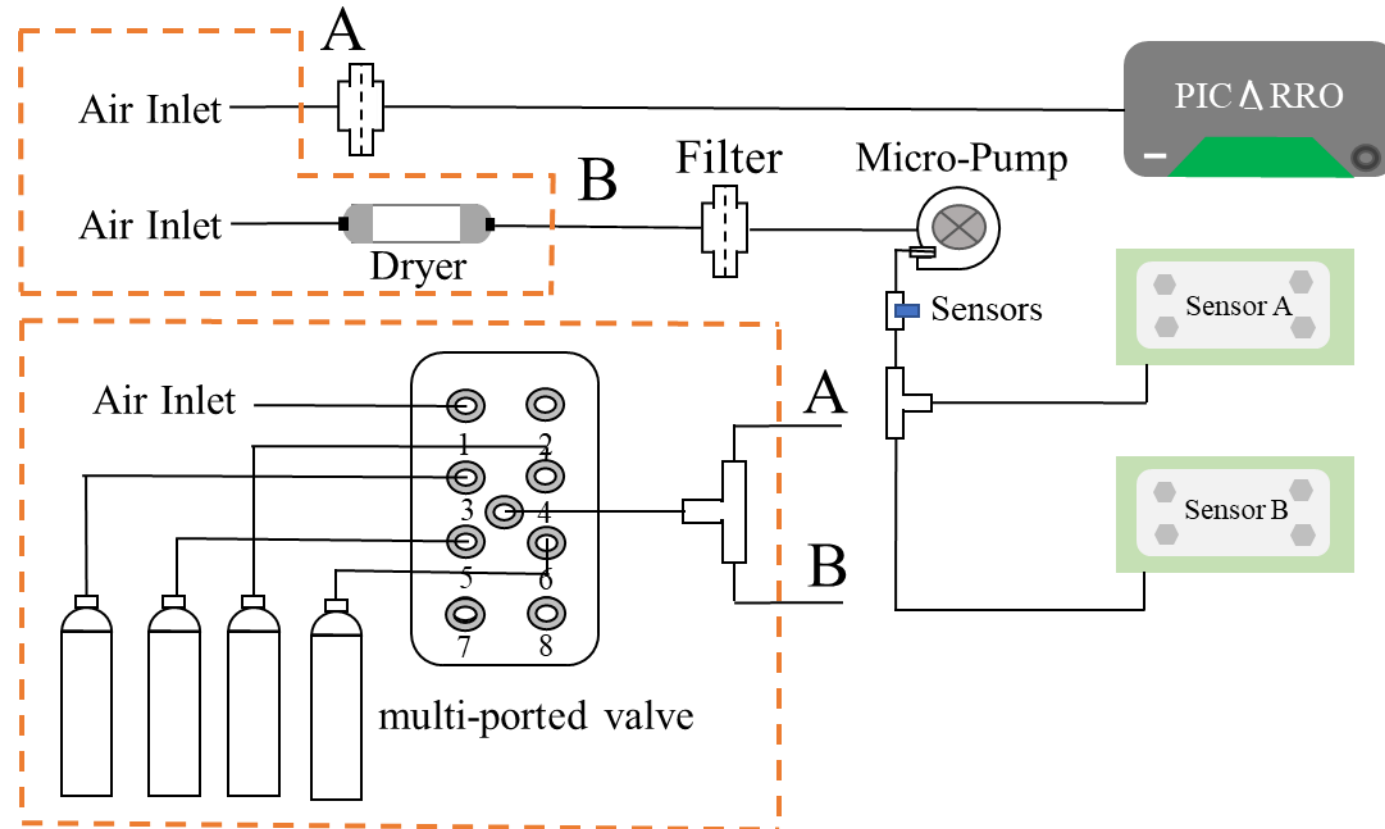
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2 Methodology

	Performance Tests	Purposes
2.1 Laboratory Tests	Calibration	Confirm the precision and stability
	Allan Deviation	Confirm the noise
	Temperature Tests	Correct from T changes
	Pressure Tests	Correct from P changes
	Humidity Tests	Correct from RH changes
	Simulated Flights	Assess the measurement error caused by T and P
2.2 Field Development	Manned Aircraft	Compare the performance with Picarro G2401-m
2.3 Field Development	UAV platforms	A small fixed-wing UAV with a wingspan of 1.83m

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System set up for lab tests and field development

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Highlights (lab tests)

- The precision of Sensor A is ± 0.36 ppm (1σ) at 1 Hz.
- The precision of Sensor B is ± 0.85 ppm (1σ) at 1 Hz.
- Sensor B is more sensitive to pressure changes.
- Simulation tests show above 90% change corrected by pressure.
- Each sensor unit on purchase has their own P/T equations.

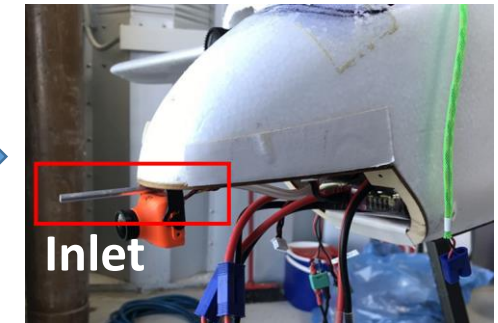
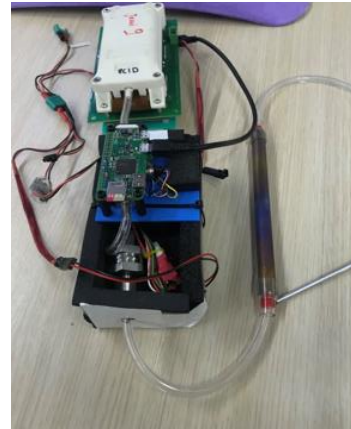
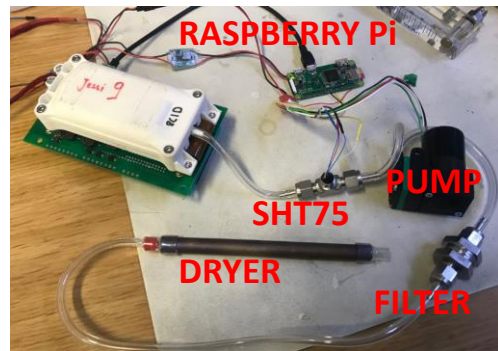


The setup and aircraft platform (Beechcraft Baron 58)

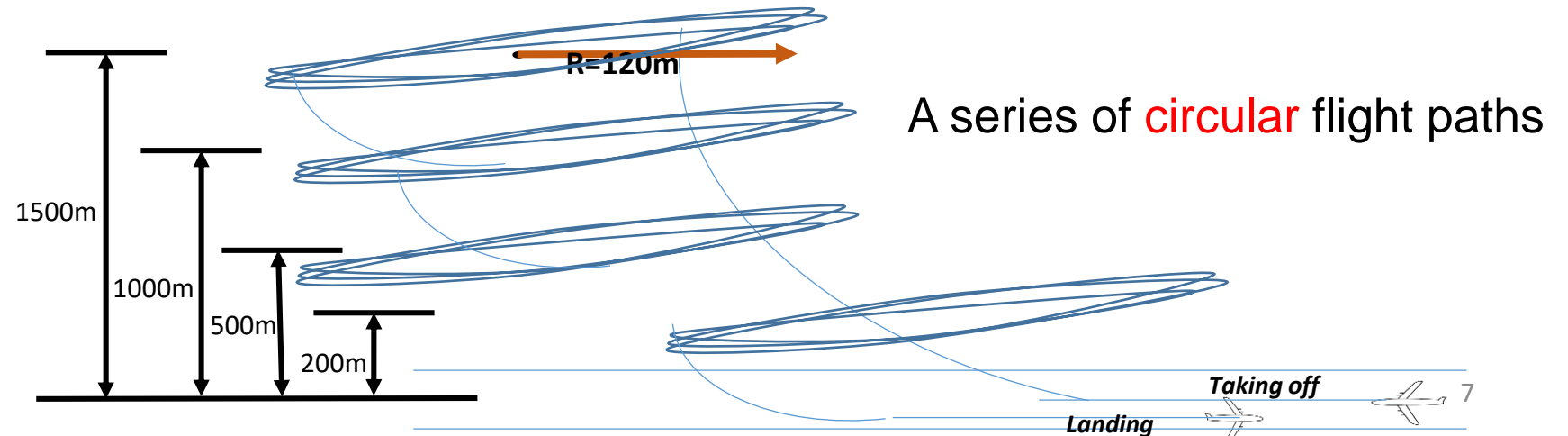
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System set up on the UAV platform



USRL-CYI Runway



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3 Recommendations

- Both sensors performs better below 1.5 km ASL.
- Calibration series are necessary to be corrected by P/T equations.
- The flowrate of sensors should be above 500 ml/min.
- Water vapor experiments are unrepeatable, so a dryer is necessary in the system.
- Each sensor unit on purchase needs to be tested.
- The UAV-CO₂ sensor system is more suitable for horizontal measurements to investigate emissions close to the ground.

References

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Thank you very much for your attention