

## KOLIBRI SYSTEM ENABLES MOBILE MEASUREMENT OF AIR EMISSIONS AT THE SOURCE

### Kolibri

Researchers at the U.S. Environmental Protection Agency (EPA) are developing and demonstrating the Kolibri, an air emission sensor/sampler instrument, for use on small unmanned aerial systems (sUAS) and ground-mobile applications. The instrument can remotely and safely sample emissions from a variety of open area sources such as wildland fires and industrial plumes.

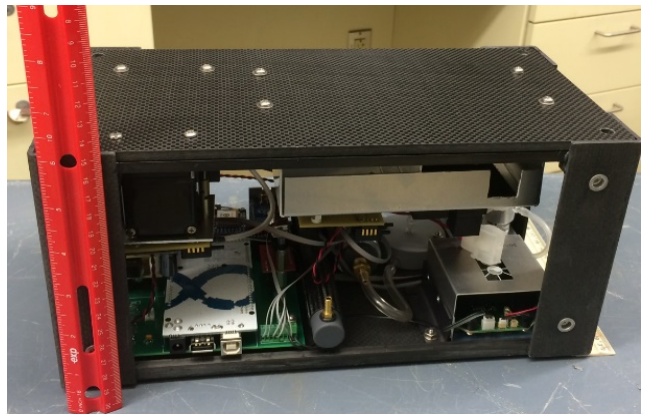
### Instrument Measurement Capabilities

The Kolibri sensor/sampler instrument is a shoebox-sized, lightweight system that weighs up to eight pounds. It can be used to sample a comprehensive suite of gas and particle emissions, including:

- Carbon dioxide (CO<sub>2</sub>),
- Carbon monoxide (CO),
- Nitrogen and sulfur oxides (NO<sub>x</sub>/SO<sub>x</sub>),
- Volatile and semi-volatile organic compounds (SVOCs, VOCs),
- Polycyclic aromatic hydrocarbons (PAHs),
- Particulate matter (PM),
- Bioaerosols,
- PM metals, and more.

### Features

- The Kolibri includes an array of air sensors and other miniature measurement instruments that provide real-time and cumulative data. The types of samplers used on the platform can be customized for specific measurement needs.
- The Kolibri is self-powered and has a microcontroller that operates the sampling pumps, records data, and



*Top: Kolibri sampling system attached to sUAS  
Bottom: Kolibri sampling system*

transmits data to the ground operator through a telemetry system.

- Data can be viewed by the operator in real time and batch samples can be sent to the laboratory for further analysis.
- The Kolibri can be placed on an sUAS owned and operated by other parties or on vehicles, enabling sampling at the emission source and in the immediate area surrounding the source.

## Applications in the Field

The Kolibri is being used in multiple applications in the field to characterize the chemical and biological composition of emissions. The Kolibri can be applied to various challenging open area scenarios such as fires, lagoons, flares, and landfills as well as forest and agricultural burns and industrial plumes.

The novel air sampling instrument offers the capability to obtain a comprehensive suite of emissions data from sources where data do not previously exist because of accessibility limitations and/or safety issues for personnel. The system further provides a significant tool to characterize emergency situations for air emissions.

In 2020, researchers plan to use Kolibri to study emissions during wildfire-like prescribed burns with the U.S. Forest Service; emissions of oil burns on water with the U.S. Department of Interior; and emissions with open detonation demilitarization operations with the U.S. Department of Defense.

The system is operated by EPA's Office of Research and Development (ORD) and has been deployed on 11 campaigns since 2016.

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### HIGHLIGHTED REFERENCES:

Aurell, J., Mitchell, W., Chirayath, V., Jonsson, J., Tabor, D., & Gullett, B. (2017). Field determination of multipollutant, open area combustion source emission factors with a hexacopter unmanned aerial vehicle. *Atmospheric Environment*, 166, 433-440.

Zhou, X., Aurell, J., Mitchell, W., Tabor, D., & Gullett, B. (2017). A small, lightweight multipollutant sensor system for ground-mobile and aerial emission sampling from open area sources. *Atmospheric Environment*, 154, 31-41.

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*sUAS-based emission sampling during the Fire and Smoke Modeling Evaluation Experiment in Fishlake National Forest, Utah, June 2019. Jess Juchter, Desert Research Institute, used by permission.*



*Researchers outfitting sUAS with Kolibri for emission sampling.*