

A Small UAS Payload for Infrared Remote Measurement of Wildfire Intensity – NightFOX

MOTIVATION

As large fires get more complex, wildland firefighters and wildfire modelers want accurate measurements of fire intensity and spread. However:

- Satellite observations are coarse and infrequent
- Aircraft observations are complex and expensive
- Fire forecasts lack detailed input data

CIRES

What do we do? Let's use **small Uncrewed Aerial Systems** (sUAS) to link the measurement chain from satellites suites to the ground. Hence, the Nighttime Fire Observations eXperiment – **NightFOX**.



Fire practitioners increasingly use UAS technology for situational awareness. Credit: USDA Forest Service

	BANDPASS	OPTICAL INSTRUMENT DETAILS
	Visible	FLIR Duo R, 90° x 51° FOV, 1920 x 1080 pixels
	SWIR	Custom camera, 23° x 23° FOV, 1.0-1.7 µm, 64 x 64 pixels
	Near IR	Custom scanning scope, 1° FOV, 1.610 µm, ±30° scan across the flight track
	Mid IR (4 µm)	Custom scanning scope, 1° FOV, 3.960 µm, ±30° scan across the flight track
	Thermal IR	FLIR Duo R, 57° x 44° FOV, 7.5-13.5 μm, 160 x 120 pixels

SOURCES

https://modis.gsfc.nasa.gov/about/specifications.php https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/viirs/

Thornberry, T. D., Gao, R. S., Ciciora, S. J., Watts, L. A., McLaughlin, R. J., Leonardi, A., Rosenlof, K. H., Argrow, B. M., Elston, J. S., Stachura, M., Fromm, J., Brewer, W. A., Schroeder, P., & Zucker, M. (2023). A Lightweight Remote Sensing Payload for Wildfire Detection and Fire Radiative Power Measurements. Sensors, 23(7), 3514. https://doi.org/10.3390/s23073514

INSTRUMENT PAYLOAD



Our payload remotely observes fire radiative power with narrow-band IR single-element scanners and fire extent with wide-band IR imagers.



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BLACK SWIFT TECHNOLOGIES S2 sUAS

DATA PRODUCTS



PAYLOAD FACT SHEET			
Payload Weight:	< 2 kg		
Sensor Resolution,	Scanners: ~ 18 m		
1 km Flight Alt:	MWIR Imager: ~ 7 m		
mparable Satellite	VIIRS: 375 m		
ensor Resolution:	MODIS: 1 km		
ST S2 Endurance:	Up to 2 hours		
F S2 Cruise Speed:	18 m s⁻¹		
omparable VIIRS	I3 (1.61 μm), M10 (1.61 μm)		
channels (CWL)	I4 (3.74 μm), M13 (4.05 μm)		
mparable MODIS	6 (1.628 - 1.652 μm)		
annels (bandpass)	21, 22 (3.929 - 3.989 μm)		

NEXT STEPS

We seek to further demonstrate the capabilities of this payload by measuring the radiative power of active wildfire via UAS from the 1 km design altitude. Any and all suggestions for collaboration or connection with fire practitioners are appreciated.

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