The Measurement and Monitoring of Fire from Space
A New Detector Processing Technique

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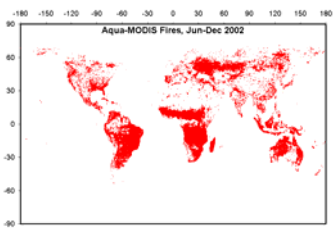
Abstract

This poster summaries a CEOI seedcorn activity to evaluate the use of low-cost bolometer detectors for fire measurement and monitoring from space.

Background to Global Biomass Burning

- Fires are responsible for a large fraction of annual carbon emissions to atmosphere (maybe ~ 30% or more).
- Highly variable in space and time & inter-annually.
- Cost of fire management is very high (billions $ / yr) – much 'spotting' done by air.

- Fires occur on all continents apart from Antarctica.
- Satellite observations are the only method for wide-scale quantification
- Burned area and active fire signatures are used to make detections.



Fire Environments

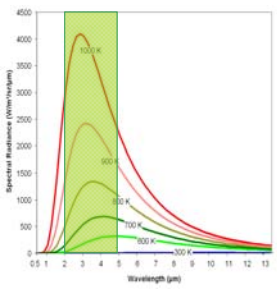



Fire Detection Approach

- Identify fires via their intense thermal emissions
- Utilise MIR window (3–5μm) for fire detection as that is the region of primary signal.
- Smoke is largely transparent in (3–5μm) wavelength region
- Signal so strong that fires can be detected at sub-pixel level.
- LWIR window (8–12μm) allows for discrimination of sun glint and TOA reflections


MWIR

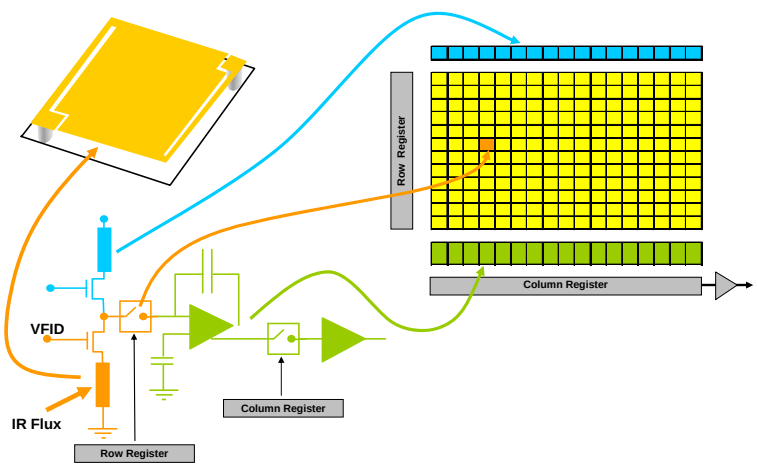

LWIR



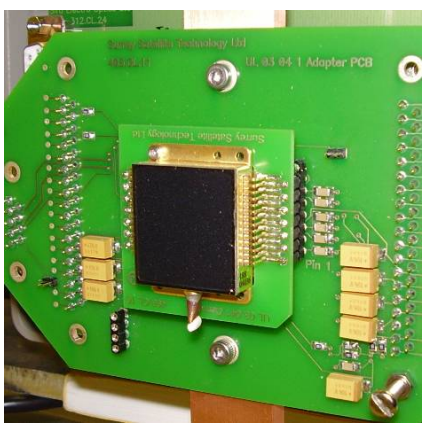
Estimated Radiance Signals

	Temperature (K)	Peak spectral emissions (μm)	3.7 μm			10.0 μm	
			Planck radiance from fire (W/m^2)	Amplification over background		Planck radiance from fire (W/m^2)	Amplification over background
				No solar flux	15 % solar albedo		
Background	300	9.7	0.4	1	1	10	1
Exothermic reaction	550	5.3	146	360	130	94	9
Glowing combustion	825	3.5	1,556	3,900	1,400	252	25
Cool forest fire	1,000	2.9	3,591	8900	3,200	370	37
Estimated Max^m heat fire	1,800	1.6	22,383	55,000	20,000	973	98

Bolometer Schematic



ULIS Bolometer Detector Test Setup



LWIR ULIS bolometer array (UL03041 384 x 288 pixel)

Programme Objectives

- Derive the specification of top level science requirements and mission functional requirements for fire measurement and monitoring from space
- Undertake a MW & LW infrared bolometer detector test programme
- Evaluate the radiometric performance of bolometer detectors for fire measurement and monitoring from space based platforms
- Derive system concepts and identify appropriate design trade-offs