Earth Fire Alliance

CEOS LSI-VC| Dr. Falkowski | Set 16th 2026

Illuminating the World's Fires

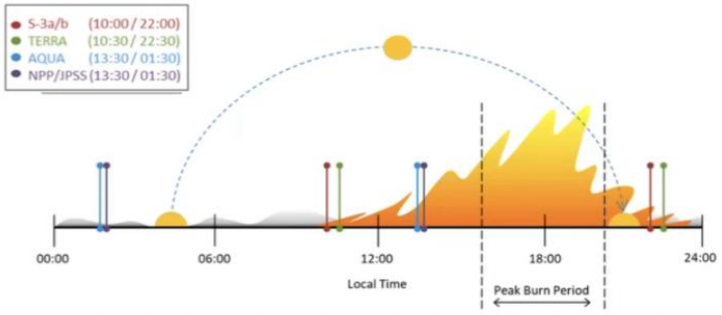
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The Fire Data Gap

Fire is an under-observed and under-understood first-order Earth System process that connects the biosphere, atmosphere, hydrosphere, and lithosphere with profound impacts on humanity

Limitations of current Earth Observation Systems:

- Infrequent revisit times and coarse spatial resolution → Missed ignition and early spread and limited understanding of fire behavior and spread
- Weak integration into operational systems → Limited situational awareness; Decisions are made too late, with too little confidence; Slower response times
- Inequitable access to data and technology → Inequitable impacts to lives and livelihoods



Overpass time of civil Active-fire satellites in relation to the diurnal wildfire activity
Johnston et al., 2020



Himawari image (2km) of fire in NT, AUS

A New Era of Fire Observation

A New Paradigm is emerging: Persistent, High-Fidelity, Global Fire Observation:

- Civil space agencies developing virtual constellations
  - Combining Foundational Low Earth Orbit (LEO) Sats and Geostationary (GEO) Platforms
- Private and non-profit sector stepping up to develop and deliver solutions
  - Sat Constellations, Stratospheric Platforms, Airborne, UAS
  - Next-gen systems (e.g., FireSat) aim for:
    - Better dynamic range, Reduced saturation, Improved small-fire detectability, Persistent observation

These observations have the potential to drastically push forward our global understanding of fire and enhance wildfire resilience, but that potential can only be realized with data that are usable and trusted.

That trust requires rigorous cal/val and collaborative community data standards and review.





Global Wildfire Data for the Public Good

We aim to make transformative wildfire data accessible to every fire agency, scientist, and community that needs it—because better data protects lives, communities, and ecosystems.

FIRE AGENCIES

Seamlessly integrate FireSat data into existing operational workflows, from early detection to safe response and efficient resource allocation.

SCIENTISTS & RESEARCHERS

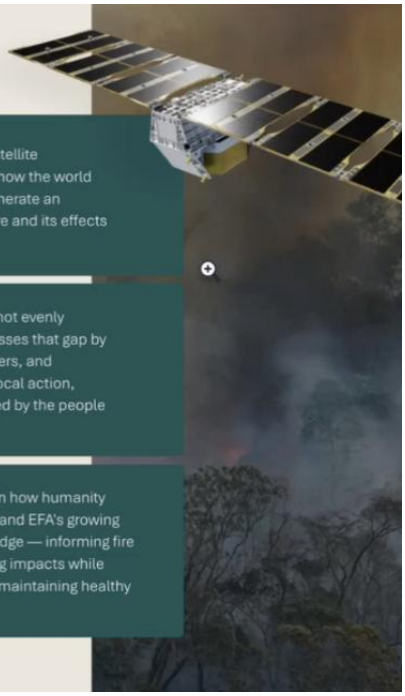
Access a first-of-its-kind global wildfire dataset for modeling, analysis, and discovery. FireSat presents new opportunities to understand fire behavior, ecosystem impacts, and climate change.

NGOS

Partner with us to help FireSat data reach under-resourced fire agencies and communities worldwide.

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Earth Fire Alliance Programs



FireSat AN EARTH FIRE ALLIANCE PROGRAM	**Global Data**	EFA's flagship FireSat program is an advanced satellite constellation designed specifically to transform how the world understands and responds to fire. FireSat will generate an unprecedented, near real-time dataset on wildfire and its effects on the planet and our communities.
FireConnect	**Local Action**	Fire management knowledge and resources are not evenly distributed around the world. FireConnect addresses that gap by activating communities, firefighters, land managers, and researchers globally to connect wildfire data to local action, support beneficial fire, and build solutions shaped by the people and places that need them most.
FireImpact	**Long-term Change**	FireSat's global dataset will open a new chapter in how humanity understands fire. FireImpact translates that data and EFA's growing partner network into actionable scientific knowledge — informing fire management strategies that minimize devastating impacts while recognizing and preserving fire's essential role in maintaining healthy ecosystems.

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A Growing, Global Coalition

Funders

Google.org · Gordon and Betty Moore Foundation · Bezos Earth Fund · Patrick J McGovern Foundation · twilio

Partners

Muon Space · Google Research · Environmental Defense Fund

16 Early Adopters from 5 continents

CFS · CAL FIRE · Tasmania Parks & Wildlife Service · AGIF · Western Fire & Forest Resilience Collaborative · Woodwell Climate Research Center · bombers · IPAM Amazônia · ANEF · WATCH DUTY

FireSat System Overview

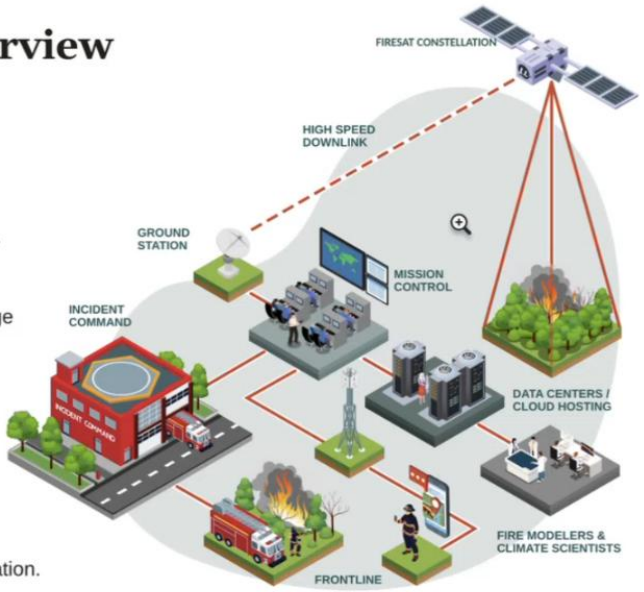
80 Meter Average Resolution
More pixels means more data and clearer images.

5 Meter Hotspot Detection
Subpixel detection helps identify new fire starts sooner.

6 Bands (Red, NIR, SWIR, MIWIR x 2, LWIR)
Detection and tracking of hot and cool fires, land change monitoring, pre-fire conditions, and post-fire recovery.

<5% False Positives
Simultaneous observing across 6 channels in all conditions increases confidence in detections.

Rapid Refresh
12-hour global revisit in 2026 with 3 satellites.
Scales to 1-hour revisit with ~20 satellites
and 20-minute revisit with ~50 satellites in full constellation.



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FireSat Roadmap

Earth Fire Alliance Established
2022 - 2024

Feasibility & Design
Cross-community planning and system requirements definition

Philanthropy supports Initial Operational Capability
2025

1 Satellite FireSat0
Risk reduction and data testing with Early Adopters

2026

3 Satellites Twice Daily Revisit
Coverage and data for key fire geographies

Government funding and commercial data revenue will support Full Operational Capability
2029

1 hr Revisit
Unlocks significant impact targets

2030 +

20 min Revisit
Global coverage and data distribution

Low-latency access to the high-resolution imagery and data products will be made available to operational and science partners.

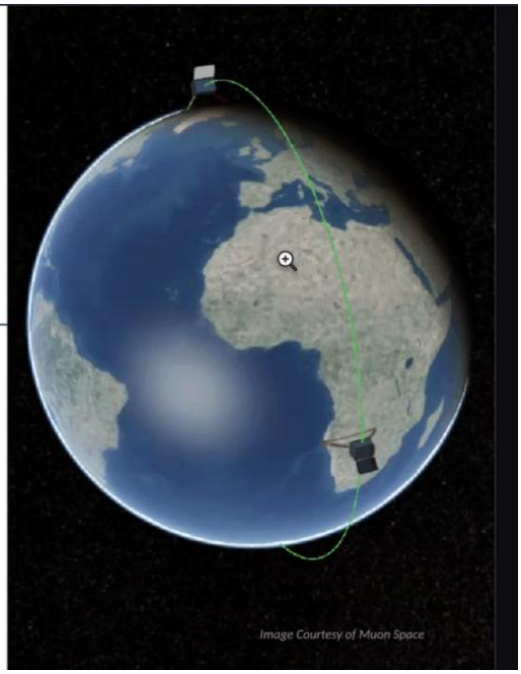
The first 3 satellites will offer early adopters updated full resolution fire maps and access to fresh data dumps every 12 hours.



The satellites will offer an unprecedented view of fire progression by observing key geographies 3 times in rapid succession, spaced 20-30 minutes apart.

Data updates will be processed and transmitted to Early Adopter agencies at low-latency, providing up-to-the minute updates on fire activity when the satellites pass overhead.

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Scaling to Global Operations, 2026-2027

IOC (2026)

- 3 Satellites
- 6 Key Geographies
- Data processed in <20 minutes for Operations
- Daily Collects for Research

FOC Block 1 (late 2027)

- 4 additional satellites
- Begin global coverage via Starlink Plaser integration
- Full constellation impact



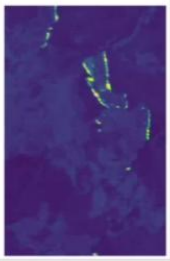
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*switching to low latency in Q2 '27

FireSat Data Pipeline

11:30 — FireSat Data Acquisition & Processing — 11:50 → Access for Operations & Science

FireSat observes a specific geography at 80m average resolution in 5 wavelengths simultaneously.



Ground stations around the globe receive a high-speed downlink within minutes of observation.

Low-latency means nearly up-to-the-minute updates on new fire starts and active fire perimeters.

Raw data is processed into **calibrated radiances** for each spectral channel and 4 Fire Data Products for impact:

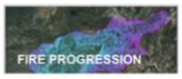
1. **Hotspots**
2. **Fire Perimeters**
3. **Fire Radiative Power**
4. **Fire Progression**

All data is stored and archived in AWS S3 Bucket and accessible via API or WebUI.











Leveraging standard formats, web-based APIs, and existing systems for easy data access and seamless integration.

Meets user needs:

- Lightweight, low bandwidth solutions for **fire operations**
- Robust and comprehensive for **science and research**

Amazon GeoServer

Google Earth Engine

Esri / ArcGIS

Storage & Data Archive

Early Adopter Program Participants

Early Adopters provide a feedback loop for continued development of the data products and integration pathways to ensure FireSat data is useable immediately

Operational use and integration into fire management

California · New South Wales · Portugal · Colorado · Queensland · Tasmania

Oregon · South Australia · Australia Capital Territory · Texas · Spain

Modeling understanding of fire impacts

Western United States · North American Boreal Amazonia

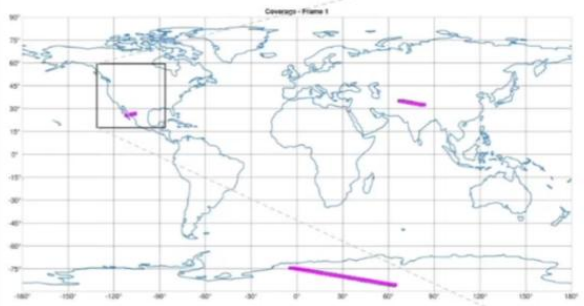
Northern Africa · Amazonia

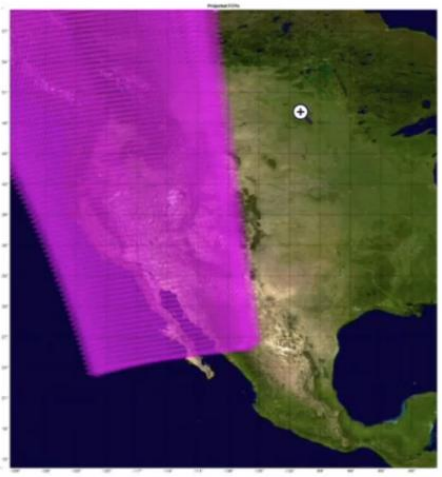
Pathways for integrated intelligence & distribution

United States

Large Observation Area & Always-On Monitoring

1,500km observation swath captures large regions within a single pass





Global coverage per swath projected over land for the 3 IOC satellites

©2026 Muon Space, Inc. Proprietary

Spotting Smaller & Cooler Fires

80-meter average resolution and subpixel 5-meter hotspot detection provides unprecedented accuracy detecting small cool fires.

FireSat

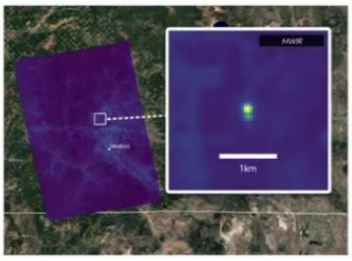


Table Rock, Oregon, United States

ALERT West



Ground-based camera picked up smoke during fire

MEDFORD ALERT NEWS



Local media photo

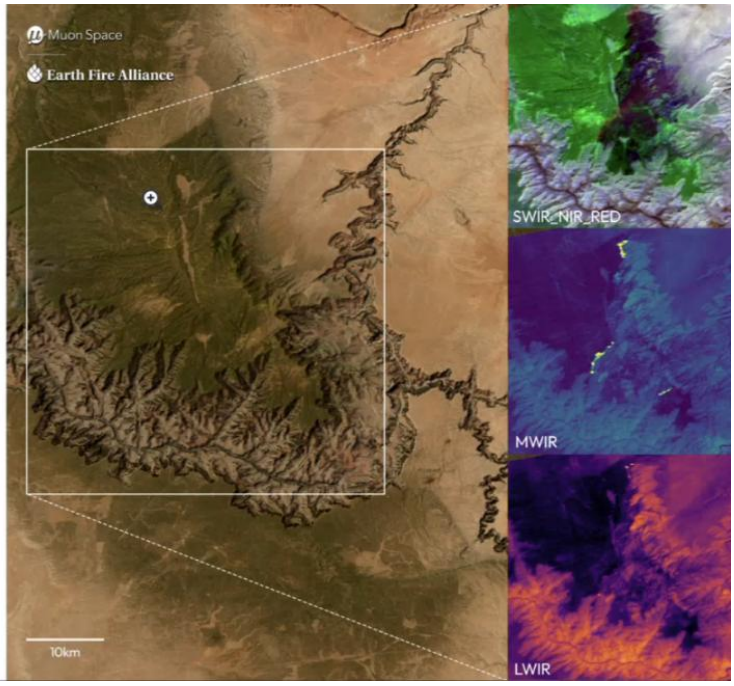
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Images Courtesy of Muon Space, Medford Alert News, Video Courtesy of OHAZ / University of Oregon

Dragon Bravo Fire

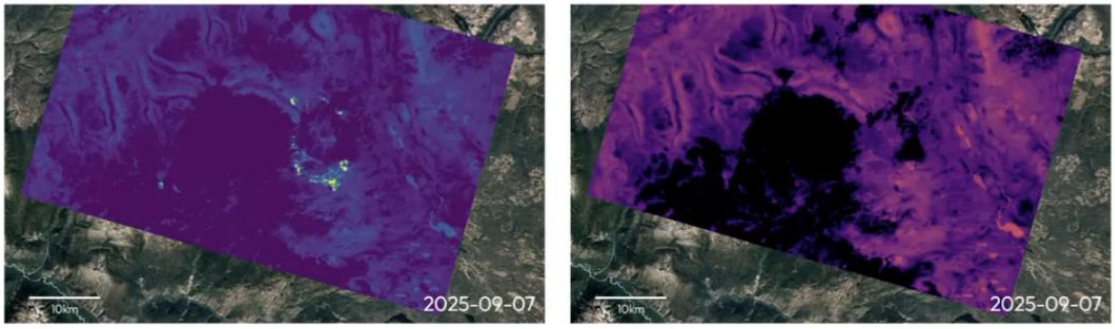
GRAND CANYON, ARIZONA — AUG. 2, 2025:

FireSat delivers complete wildfire intelligence in one integrated view.



FireSat Sees More

Multispectral imaging across 5 bands and 6 channels, simultaneously, captures critical fire characteristics – **size, intensity, and movement** - ensuring detailed analysis even when human and conventional aerial and ground observations face obstructions.



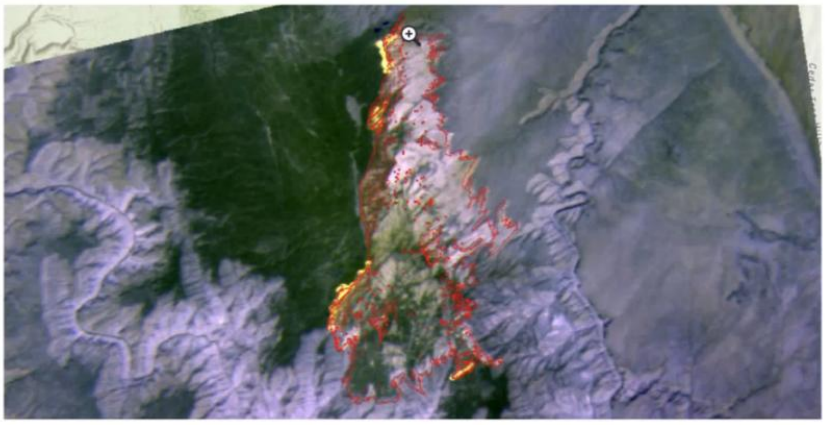
British Columbia, Canada

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Images Courtesy of Muon Space

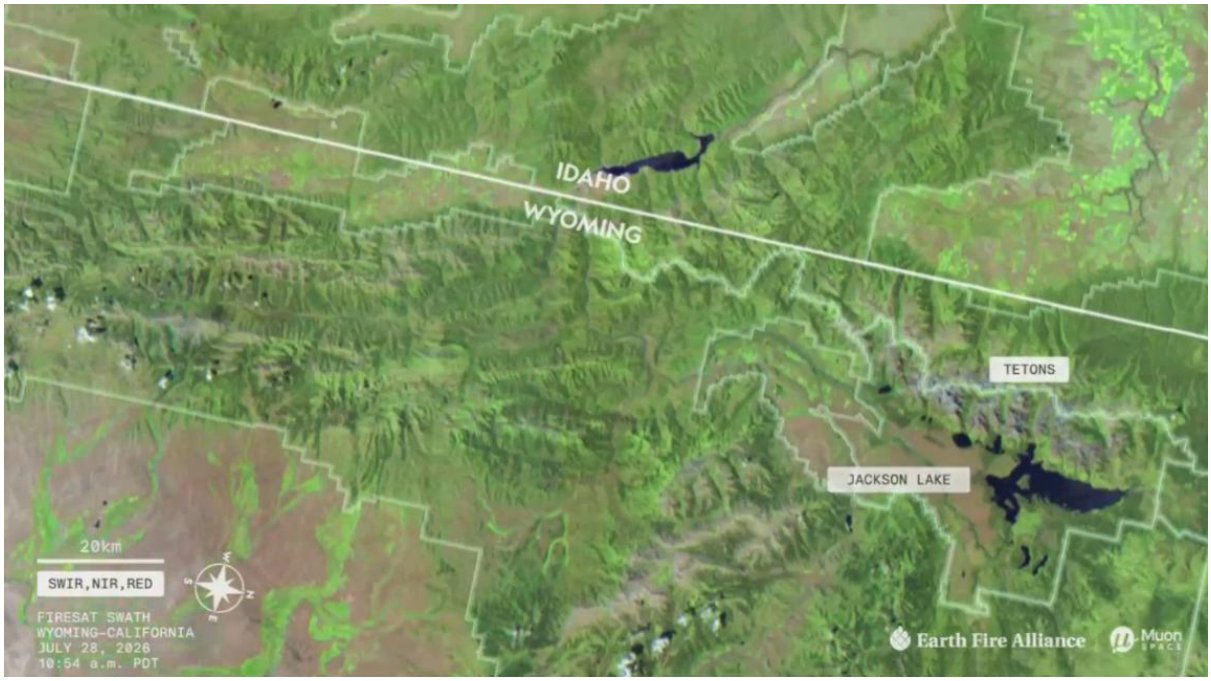


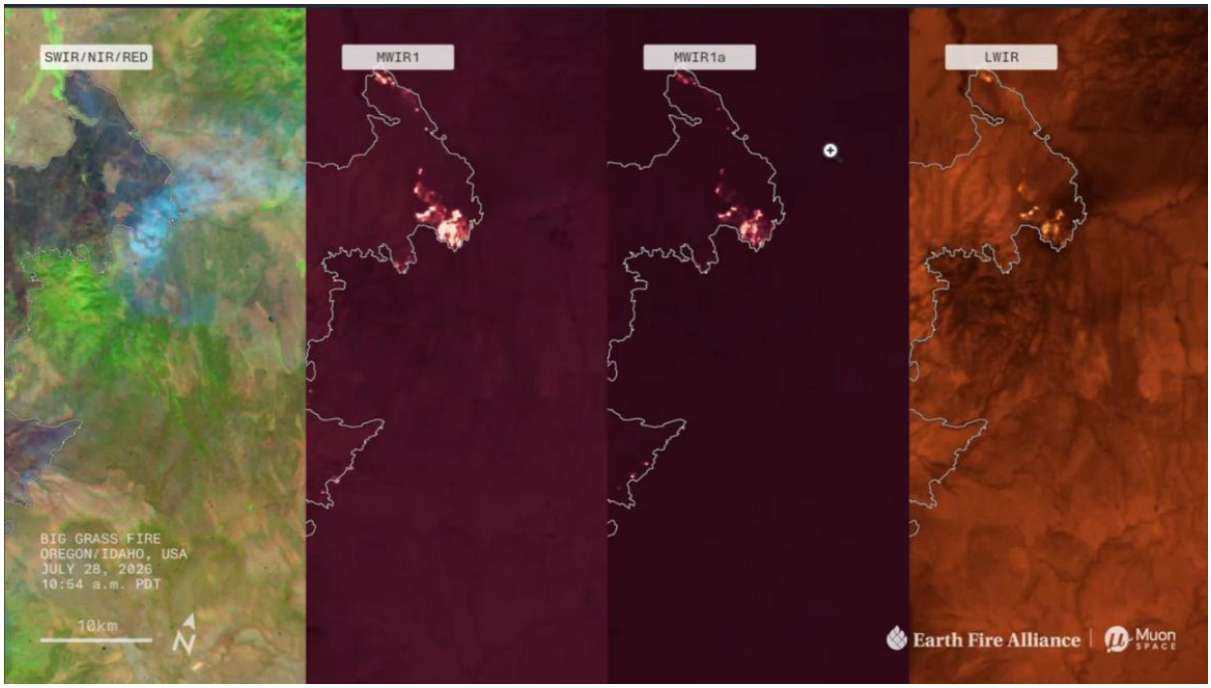
Comparison to Aerial Mapping

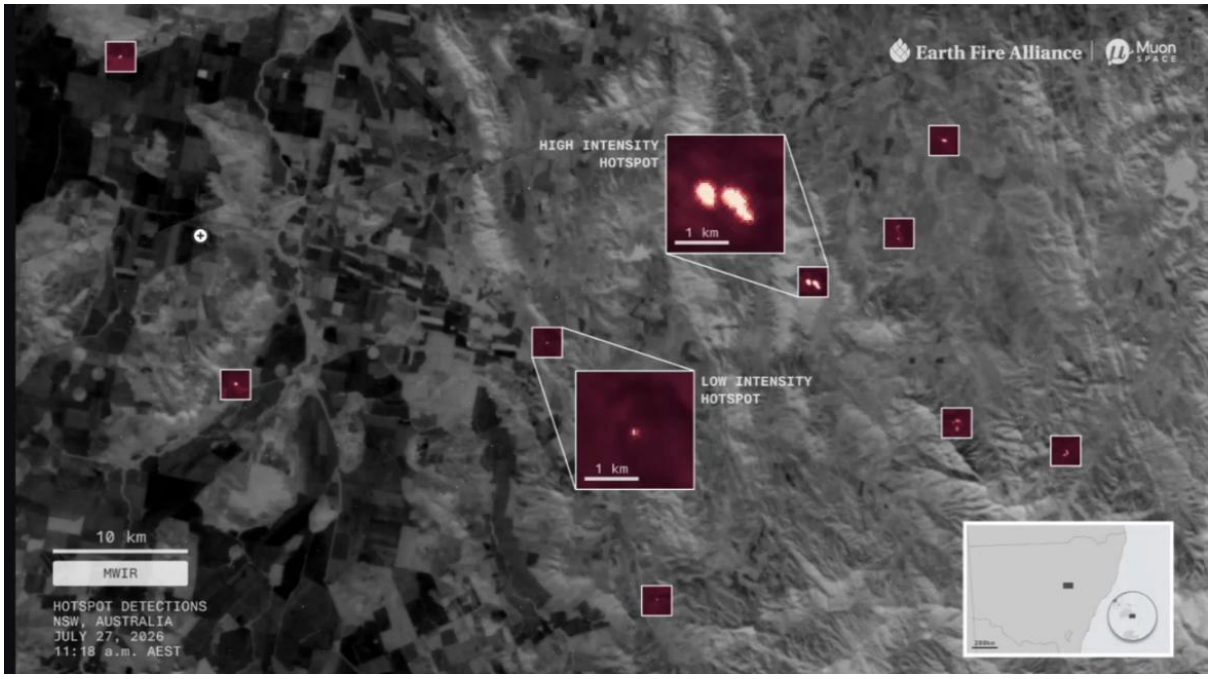


FireSat0 Image from August 2, 2025 overlaid with IR scan from National Infrared Operations (NIROPS) aircraft. Dragon Bravo Fire, Grand Canyon, Arizona, USA.

Images Courtesy of NIFC, Muon Space


IDAHO
WYOMING
TETONS
JACKSON LAKE
20km
SWIR,NIR,RED
FIRESAT SWATH
WYOMING-CALIFORNIA
JULY 28, 2026
10:54 a.m. PDT
Earth Fire Alliance
Muon SPACE


SWIR/NIR/RED
MWIR1
MWIR1a
LWIR
BIG GRASS FIRE
OREGON/IDAHO, USA
JULY 28, 2026
10:54 a.m. PDT
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Earth Fire Alliance
Muon SPACE



FireSat Calibration, Validation, and Uncertainty Assessment Approach

Ensuring Trusted, High-Fidelity Fire Intelligence for Science and Operations

GOAL: *Deliver globally trusted, scientifically validated FireSat data products that enable transformative advances in wildfire science and management.*

1	2	3	4
Calibration	**Validation**	**Uncertainty Quantification**	**Global Cal/Val Network**
Traceable radiometric calibration, pre-launch through on-orbit and cross-satellite	Multi-tier validation — ground, airborne, and satellite intercomparison	Full error budget and uncertainty assessments, sensor to product, complex validation experiments	Global partnerships to sustain long-term validation and data trust

Phase 1 · Year 0-1
Pre-Launch and Comissioning
Lab calibration, algorithm design, on-orbit calibration, initial partnerships

›

Phase 2 · Year 1-2
Initial Cal Val Activities
Early validation, operational end user feedback, algorithm updates partnership building

›

Phase 3 · Year 2-5
Operational Cal Val Program
Continuous monitoring, global cal/val network deployment, science data rollout

›

Phase 4 · Year 3+
Advanced Science and Operations
Integration with diverse user communities, continuous Cal/Val

Expected Outcome: *A gold-standard, uncertainty-quantified fire dataset trusted by the global science and fire-management community.*

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Alaska: A High-Latitude Cal/Val Testbed

A Fairbanks-area cluster of assets enabling early, high-cadence Cal/Val

OPPORTUNITY *Even with only 3 IOC satellites on orbit, high-latitude orbital convergence gives Interior Alaska 15–20 observations per day — turning a single prescribed burn into a densely sampled Cal/Val event years ahead of full constellation buildout.*

1	2	3	4
Scheduled Prescribed Burns	**High-Latitude Cadence**	**Operational Partners**	**Field and Airborne Science Partners**
Known ignition time, location, and perimeter at Fort Wainwright (or other locations)— ground truth wildfires can't provide	15–20 FireSat passes/day as of 2026 — capturing a prescribed burn's full life cycle	Alaska Fire Service and GINA Ground Infrastructure support real-time downlink, satellite inter-comparison, and operational evaluation	USFS Fire Scientists / academic partners supply in-situ fuels and fire-behavior ground truth. Airborne measurements?

Multi-org collaboration potential: *EFA, DoW, USFS, NOAA, DOI, Universities, NGOs, etc*

Bottom Line: *A near-term, high-cadence Cal/Val cluster— scheduled ignitions, ground infrastructure, high cadence, sat measurements, science expertise, local operational capacity and need*

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Southeastern US Cal/Val Testbed

Cluster of assets in Southeastern US enable long-term Cal/Val, operational use, and science inquiry

OPPORTUNITY *Persistent prescribed fire, engaged operational users, and proximity to science expertise offer advantage for long-term cal/val experiments, detailed uncertainty assessments and end user driven data product optimization.*

1	2	3	4
Scheduled Prescribed Burns	**High-Fire Cadence**	**Operational Partners**	**Field and Airborne Science Partners**
Known ignition time, location, and perimeter at Fort Fort Stewart (or other locations)— ground truth wildfires can't provide	**In an average year in Georgia there are about 5,000 acres of wildfire and 900,000 acres of prescribed fire. This is a place where communities co-exist with fire**	Georgia Forestry Commission, Fort Stewart Forestry Program, Oconee National Forest, St. Marks Wildlife Refuge, etc.	USFS Fire Scientists / academic partners supply in-situ fuels and fire-behavior ground truth. Airborne measurements?

Multi-org collaboration potential: *EFA, DoW, GFC, USFS, NOAA, DOI, Universities, NGOs, etc*

Bottom Line: *A longer-term Cal/Val cluster— scheduled ignitions, ground infrastructure, science expertise, local operational capacity and need*

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Observe. Serve. Conserve.
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www.earthfirealliance.org