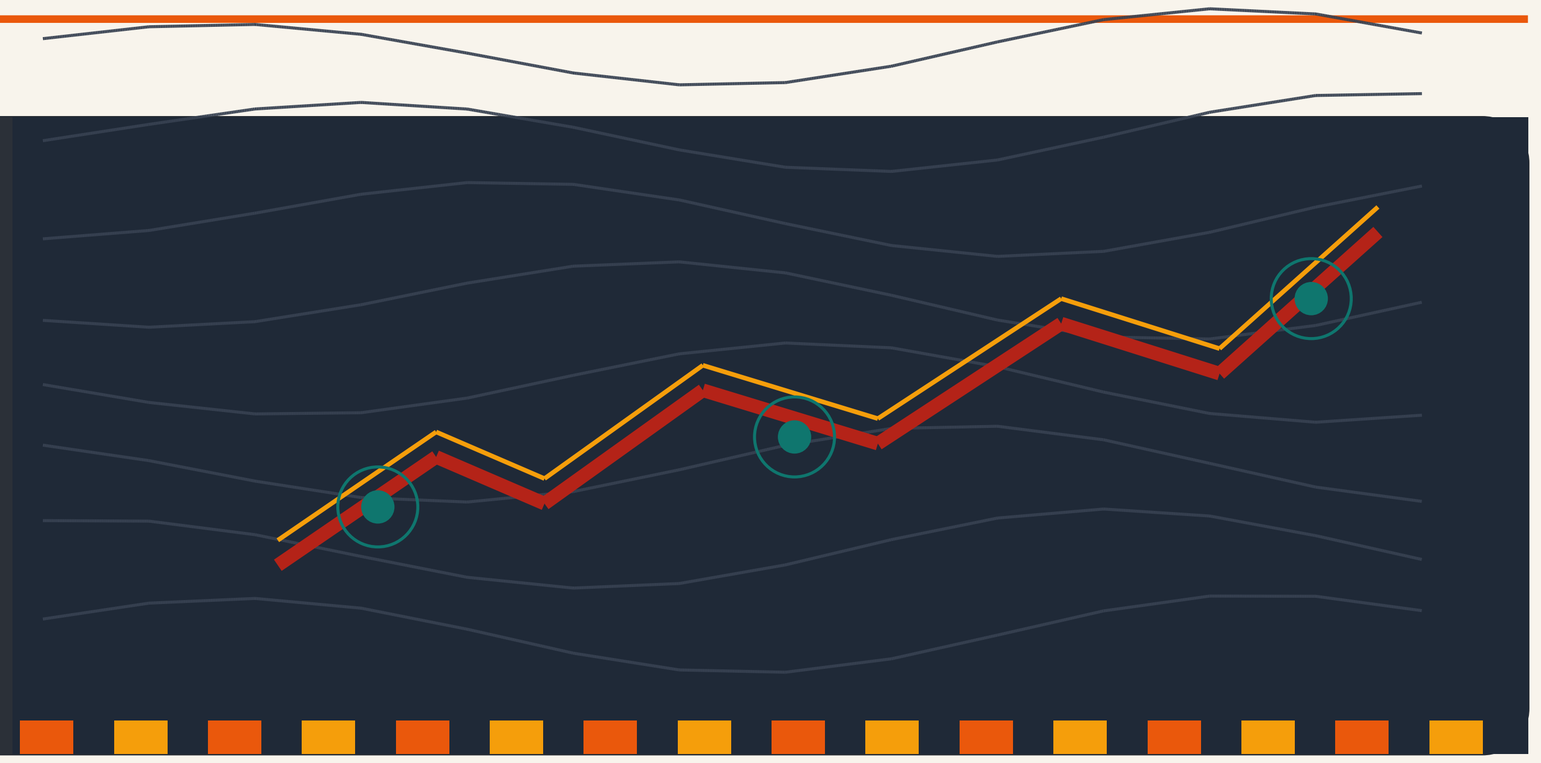
CASE STUDY

NASA WILDFIRE REAL-TIME PROCESSING

Airborne sensing - UAS algorithms
Real-time detection - tactical decisions



Sub-sec
target image processing latency

JETSON
AGX Xavier edge deployment

ArcGIS
and TAK interoperability

1 mo.
ahead of original schedule

OVERVIEW

NASA partnered with CrowdPlat to develop a scalable wildland fire perimeter detection and spread prediction algorithm deployable on embedded UAS systems. The goal was to transform tactical situational awareness by reducing imagery analysis time from hours to seconds.

THE CHALLENGE

Traditional imagery processing pipelines required hours of analysis, creating decision gaps for ground crews and tactical commanders. NASA needed a resource-efficient algorithm that could run in near real time aboard small UAS and integrate with existing firefighting tools.

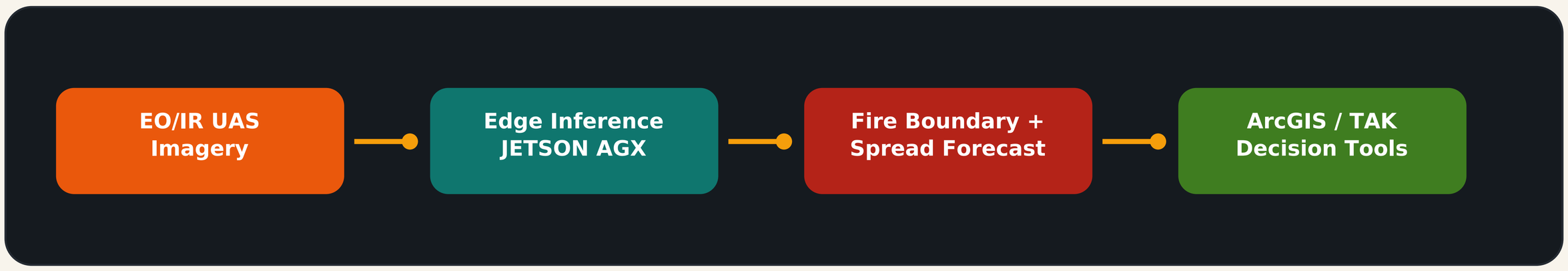
KEY OBJECTIVES

- Reduce fire imagery analysis from hours to sub-seconds while maintaining high accuracy.
- Deploy on JETSON AGX Xavier UAS embedded systems with strict power and memory limits.
- Detect fire boundaries and predict spread direction using electro-optical and infrared imagery.
- Ensure interoperability with ArcGIS and Tactical Assault Kit (TAK) systems.
- Design a modular architecture adaptable to diverse UAS platforms and sensor configurations.

THE SOLUTION

Agile crowd-based algorithm development with performance tracking

CrowdPlat rapidly assembled a specialized team of machine-learning engineers, image-processing specialists, embedded systems experts, and remote-sensing advisors. Using Agile/Scrum delivery, CI/CD pipelines, and continuous NASA feedback, the team improved the algorithm across detection, prediction, integration, and deployment.



1. Algorithm Design & Optimization

Designed a dual-language architecture: Python for rapid ML prototyping and C++ for performance-critical preprocessing on JETSON AGX Xavier. TensorRT GPU acceleration and multithreading supported sub-second latency for EO/IR imagery streams.

2. Fire Detection & Predictive Analytics

Developed CNN models for fire boundary segmentation, classification, and object detection in high-resolution UAS imagery. RNN/LSTM models supported temporal fire spread forecasting under varying wind and terrain conditions.

3. Modular Architecture & Integration

Built a microservices-based architecture using Flask RESTful APIs. The solution supported flexible sensor and UAS configurations, Dockerized deployment, and interoperability with ArcGIS and TAK.

4. CI/CD Pipeline & Quality Assurance

Implemented Jenkins and Docker pipelines for automated testing and rapid updates. Multi-platform UAS testing validated reliability across sensor configurations, and all milestones were completed one month early.

EXPERT AND GOVERNANCE HIGHLIGHTS

A remote-sensing and imaging-systems SME contributed technical guidance on the algorithm approach and validation methodology. CrowdPlat provided structured milestone governance, transparent NASA communication, and coordination across concurrent NOIS2 technical workstreams.

OUTCOME

Validated real-time wildfire intelligence delivered ahead of schedule

- Sub-second fire boundary detection and spread prediction algorithm running on JETSON AGX Xavier.
- ArcGIS and TAK-integrated modular system deployable across diverse UAS platforms.
- Scalable microservices architecture capable of processing simultaneous multi-sensor data streams.
- CI/CD-enabled software pipeline supporting continuous post-deployment improvements.
- Complete documentation, training materials, and Apache 2.0 open-source code repository.

CROWDPLAT ADVANTAGE

1

Scalable Technical Talent Assembly

CrowdPlat rapidly assembled specialized expertise in embedded ML, image processing, remote sensing, and UAS systems for a technically complex NASA software challenge.

2

Agile Delivery With NASA Visibility

Scrum-based sprints, weekly NASA syncs, and CI/CD-enabled updates gave NASA continuous progress visibility and supported rapid issue resolution.

3

Operational Integration Focus

The solution was designed for tactical use, with edge deployment, modular architecture, and compatibility with ArcGIS and TAK decision-support workflows.

Why it mattered

The algorithm equips NASA and partner firefighting agencies with real-time aerial intelligence that can improve tactical decision-making, resource deployment, and firefighter safety during wildland fire operations.