AVIATION RISK INTELLIGENCE

Leveraging Open Source Intelligence for Airline Risk Mitigation

How airlines can use satellite intelligence, ADS-B data, and open-source tools to make safer routing decisions in contested or volatile regions

What Is OSINT & Why Does It Matter for Aviation?

OSINT Defined

Collection and analysis of information gathered from publicly available sources to produce actionable intelligence.

Delivers early warning that often precedes official NOTAMs or regulatory guidance.

- Commercial satellite imagery
- Aircraft tracking data (ADS-B)
- Radio-frequency & signal monitoring
- Thermal & hyperspectral imaging
- Social media and news signals
- ATC audio and open communications
- Geospatial & infrastructure data

The Democratization of Intelligence

Data once exclusive to governments and military agencies is now commercially available. Planet Labs alone operates 200+ satellites capturing daily full-Earth imagery open to commercial customers.

200+

Planet Labs satellites imaging Earth daily

<1 sec

Time to search entire Earth for a target image

Key OSINT Sources for Aviation Flight Planning

Satellite Imagery

NASA Worldview, Sentinel Hub, Google Earth Pro — allowing analysts to detect activity changes at military installations or identify damage to aviation infrastructure via free or low-cost services.

Real-Time Flight Tracking

ADS-B Exchange, Flightradar24, FlightAware, OpenSky Network — providing unfiltered visibility into aircraft movements, including military and government flights that might indicate shifting frontline dynamics.

Social Media & News

X (Twitter), X Pro (TweetDeck), Hozint — providing immediate eyewitness accounts of security incidents, often faster than official government announcements, with platform monitoring for crisis hashtags.

Aviation Communications

LiveATC.net — unencrypted ATC audio revealing operational anomalies or emergencies in real-time, providing an additional layer of situational awareness alongside satellite and tracking data.


Source: Planet Labs PBC

Real-Time Flight Tracking Platforms

ADS-B Exchange

An open, uncensored flight tracking platform that includes military and private aircraft often filtered by commercial services. Critical for identifying transponder deactivations that signal sensitive operations.

Flightradar24

The world's most widely used flight tracking platform. Provides global aircraft positions, historical data, and visibility over no-fly zones in conflict areas. Valuable for cross-referencing route risk in near-real-time.

FlightAware

Live and predictive flight data combined with airport analytics and historical records. Used to monitor traffic pattern anomalies and airport operational status during crises.

OpenSky Network

A research-oriented platform offering extensive historical ADS-B datasets and an API for deep-dive analysis. Ideal for academic, forensic, or retrospective route-risk analysis and pattern detection.

Geospatial Imagery & Situational Awareness Platforms

GEOSPATIAL & INFRASTRUCTURE

Sentinel Hub

High-quality multi-spectral Earth observation data used to detect changes at airports or military installations, damaged infrastructure, etc

NASA Worldview

Near real-time global imagery for tracking large-scale security incidents, natural disasters, or fires that could affect flight operations.

Google Earth Pro

Essential for comparing historical satellite imagery to assess infrastructure changes, new construction of military assets, etc.

SITUATIONAL AWARENESS & THREAT

Hozint

Specialised situational awareness platform that monitors real-time threats near airports, conflict zones, and crew hotels—providing rapid alerts.

LiveATC.net

Provides live and archived air traffic control audio, allowing analysts to monitor operational emergencies, unusual ATC instructions, etc.

Shodan.io

A search engine for internet-connected devices used to identify exposed airport systems, IoT vulnerabilities, etc.


Source: Satellite Image (c) 2023 Maxar Technologies

USE CASE 1

Monitoring Military Airfield Activity

OSINT TYPE *Satellite Imagery · Light-Pollution Data*

How It Works

A shift from daytime-only to night-time military airfield operations—detectable through space-based light-pollution data—can indicate escalation and increased military readiness.

Analysts monitor changes in runway lighting patterns, hangar usage, fuel depot activity, and the arrival or dispersal of aircraft. Sustained night operations indicate a high operational tempo preceding potential conflict.

Risk Indicators

- Sudden increase in night-time runway lighting
- New aircraft appearing on aprons or taxiways
- Fuel bowsers active around the clock
- Hardened shelters opening; dispersal patterns shifting

USE CASE 2

Tracking Military Aircraft Movements

OSINT TYPE	*Aircraft Tracking Data (ADS-B) · Radio-Frequency Signals*

How It Works

Changes in military aircraft activity—either dramatic increases or sudden cessation—can signal mobilisation or pre-operation transponder deactivation.

ADS-B data allows real-time monitoring of military aircraft call-signs, flight paths, and altitudes. When ADS-B transmissions stop unexpectedly, this itself is a strong indicator of sensitive or hostile operations beginning.

Risk Indicators

- Surge in military sorties near a border region
- ADS-B transponders suddenly go dark
- Unknown aircraft outside normal patterns
- Military aircraft loitering near civil routes

USE CASE 3

Verifying Alleged Attacks & Military Activity

OSINT TYPE *Thermal Imagery · Heat-Map Data*

How It Works

When official information is limited or delayed, thermal and heat-map data from commercial satellites can confirm reported attacks by identifying unusual heat signatures from space.

This allows analysts to independently verify or contradict social media claims and government statements—providing airlines with a ground truth source when deciding whether a region is safe to overfly.

Risk Indicators

- Unexpected heat plumes at military sites
- Fire signatures from artillery or missile strikes
- Explosion aftermath in thermal bands
- Industrial heat indicating emergency operations

FAA Releases Updated GPS Interference Guide

USE CASE 4

Detecting GPS Jamming & GNSS Spoofing

OSINT TYPE *ADS-B Data · GNSS Signal-Integrity Monitoring*

How It Works

Persistent or widespread GPS signal disruption—often linked to military jamming or spoofing—can indicate interference with aircraft navigation and signal escalating military activity in a region.

ADS-B aggregators can flag aircraft reporting unusual position jumps or navigation errors. Patterns of GPS jamming near conflict zones are often the first detectable sign of new military operations on the ground.

Risk Indicators

- Multiple aircraft reporting position errors
- ADS-B tracks showing impossible jumps
- Military jamming zones expanding in radius
- Navigation warnings correlating with conflict

USE CASE 5

Weaponry Data & Altitude Engagement Limits

OSINT TYPE *Commercial Satellite Imagery · Open-Source Weapons Analysis*

How It Works

OSINT analysis of publicly available and commercial imagery allows detailed assessment of weapons system capabilities, including altitude engagement limits—critical for understanding what threats exist to civil aviation at specific flight levels.

Identifying new or repositioned SAM systems, radar installations, or ballistic assets can directly inform whether a flight route should be avoided, re-altituded, or suspended.

Risk Indicators

- New SAM batteries visible in satellite imagery
- Radar systems repositioned or activated
- Ballistic launchers deployed near flight routes
- Range analysis vs. civil cruise flight levels

The Satellite Revolution Powering Modern OSINT

AI-Powered Image Analysis

Modern AI can be shown a single target image and instantly locate every matching object in Planet Labs' entire historical archive in under one second. Search by image or text prompt.

Hyperspectral Imaging

420+ spectral bands (vs 8 on standard satellites) enables detection of camouflaged vehicles, fake vs. real aircraft heat signatures, methane leaks, and much more invisible to standard cameras.

Launch Cost Revolution

Launch costs have dropped 5× in 10 years. SpaceX Starship targets $100/kg to orbit. Performance/cost of satellites up 1000× in a decade—like mainframes becoming PCs.

AI + Space Convergence

Will Marshall (Planet Labs): "AI and Space are getting married. This creates planetary intelligence." AI systems can now autonomously predict crises—including airspace closures—before they happen.

CONCLUSION

From Reactive to Proactive Airspace Safety

- OSINT provides airlines with independent, near-real-time situational awareness far beyond official NOTAMs and government channels.
- Five complementary data streams—satellite imagery, ADS-B, thermal, signal data, and open tools—cover the full spectrum of modern airspace threats.
- AI and commercial satellite technology have made planetary-scale intelligence accessible to operators of all sizes, including through free and low-cost platforms.
- A structured OSINT risk cycle—Monitor, Detect, Verify, Assess, Decide—enables proactive route risk management across all phases of a crisis.