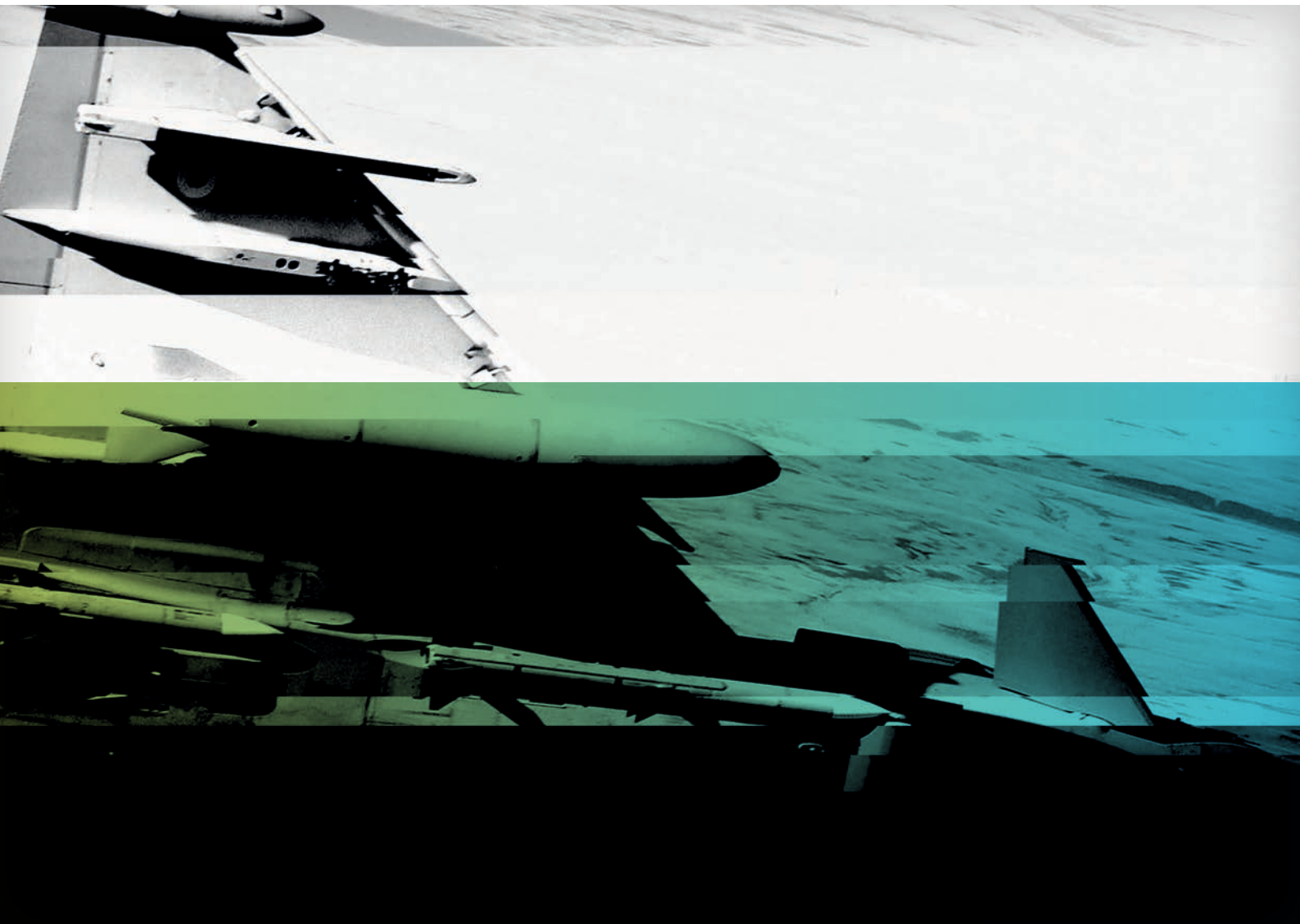




RFeye AirDefense

Passive Long-Range Three-Dimensional
Location of Aircraft, UAS & Missiles



What Is RFeye AirDefense?

RFeye AirDefense is a wide-area 3D geolocation and intelligence system that identifies and tracks aircraft while remaining invisible to electronic detection. Its covert nature makes the system ideal for border monitoring, radar augmentation, target acquisition, spoofing detection and more.

With CRFS's RFeye AirDefense solution, you can achieve highly accurate tracking of RF emissions from friendly and enemy aircraft without emitting any electromagnetic signature that may give away your presence.

The system can operate as a standalone tracking solution, or it can be used to complement existing air monitoring solutions such as radar.

Our state-of-the-art hardware and software can be used to perform 3D geolocations alongside all of your other spectrum monitoring, management and geolocation requirements.

EW support activities

Electronic warfare (EW) is vital for military operations across the globe. Rapid technological advances by state-level actors have created a growing need to improve electronic intelligence (ELINT) collection and analysis and ensure EW systems are resilient to electronic attacks by determined and capable adversaries.

Geolocation intelligence is especially important both in military training exercises and in theater operations. Two important requirements of any system or method for gathering location data are:

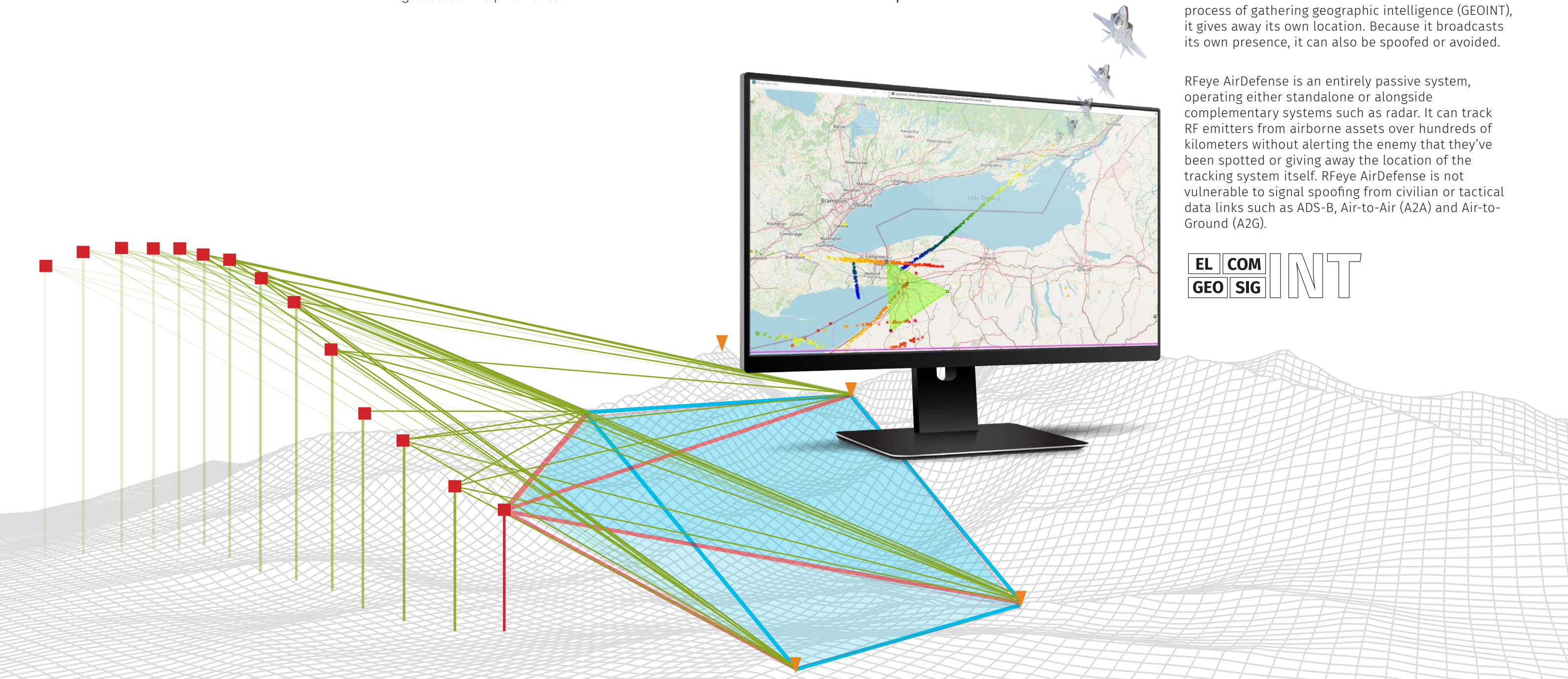
Operational security (OPSEC) – A geolocation/tracking method cannot give away the operator's location.

Resilience/integrity – Systems must be as resilient as possible against attempts to interfere with the system's operation, e.g., stealth technology, jamming or location spoofing.

Active radar suffers drawbacks in these areas. In the process of gathering geographic intelligence (GEOINT), it gives away its own location. Because it broadcasts its own presence, it can also be spoofed or avoided.

RFeye AirDefense is an entirely passive system, operating either standalone or alongside complementary systems such as radar. It can track RF emitters from airborne assets over hundreds of kilometers without alerting the enemy that they've been spotted or giving away the location of the tracking system itself. RFeye AirDefense is not vulnerable to signal spoofing from civilian or tactical data links such as ADS-B, Air-to-Air (A2A) and Air-to-Ground (A2G).

EL COM
GEO SIG INT



Applications

As a complement to radar systems

Radar is an extremely effective solution for pinpointing aircraft locations, but it is not free of limitations. RFeye AirDefense is the perfect complement to create a tracking system that can operate in scenarios where radar would be ineffective or even dangerous to use.

Track aircraft without exposing radar locations

During an incoming attack, commanders must take care with regards to how and when radar is used. Emitting radar pulses while an aircraft is too far away will fail to provide a precise location or enable effective deployment of surface-to-air missiles. Instead, it will simply alert the enemy that they have been detected and make the friendly radar vulnerable to attack.

RFeye AirDefense can be used to monitor airspace continuously over many hundreds of kilometers. Aircraft can then be passively tracked via emitted RF signals (such as Air-to-Air (A2A) and Air-to-Ground (A2G) tactical data links) until they are in range, at which point a radar can be safely activated with a short-range pulse to engage the incoming threat.

Stealth aircraft

Aircraft that avoid radar detection using stealth technology can still be tracked with RFeye AirDefense if they are emitting RF. Often, even stealth aircraft will still emit RF in order to maintain essential communications links.

Locating radar jammers

Radar jamming can be countered using RFeye AirDefense. The very signal which is used to carry out the jamming acts as a powerful RF signature which can be located with our 3D TDOA system.

ADS-B spoofing

There is an ongoing shift away from radar and towards ADS-B when it comes to commercial aircraft tracking.

The FAA (Federal Aviation Administration) has mandated that all aircraft flying in the US be fitted with an ADS-B transponder by 2020. Similar regulations are planned in the European Union and elsewhere.

However, ADS-B is incredibly vulnerable to spoofing. Aircraft can report false locations, or “hackers” can create entirely spurious transmissions, leading to “ghost” aircraft.

This makes it difficult to confidently secure airspace around military test ranges and flight test centers as well as compromising data on a national level for bodies charged with protecting national airspace against possible hostile aircraft.

RFeye AirDefense can be used to cross reference ADS-B data to easily identify spoof transmissions and reveal the true locations or non-existence of aircraft.

Drone tracking

The availability and popularity of commercial drones is a growing nuisance and credible threat to military bases and airfields.

This could be anything, from the low-level threat of a drone enthusiast conducting video surveillance of a local military test range, up to insurgent groups using drone-mounted explosives to carry out attacks on friendly forces during active operations.

Control links for navigation and video links for surveillance streams both emit an RF signature that can be detected and tracked in three-dimensional space.

For more information, see our RFeye Drone brochure.

Third-party integrations: Captured dataset exported from RFeye AirDefense and viewed directly using Google Earth 3D to recreate flight path and pilot perspective.



Real, un-retouched screenshot taken during extensive live trials. The RFeye interface was used to track a drone that used waypoints to plot a flight path spelling "CRFS."

Applications

Missile tracking

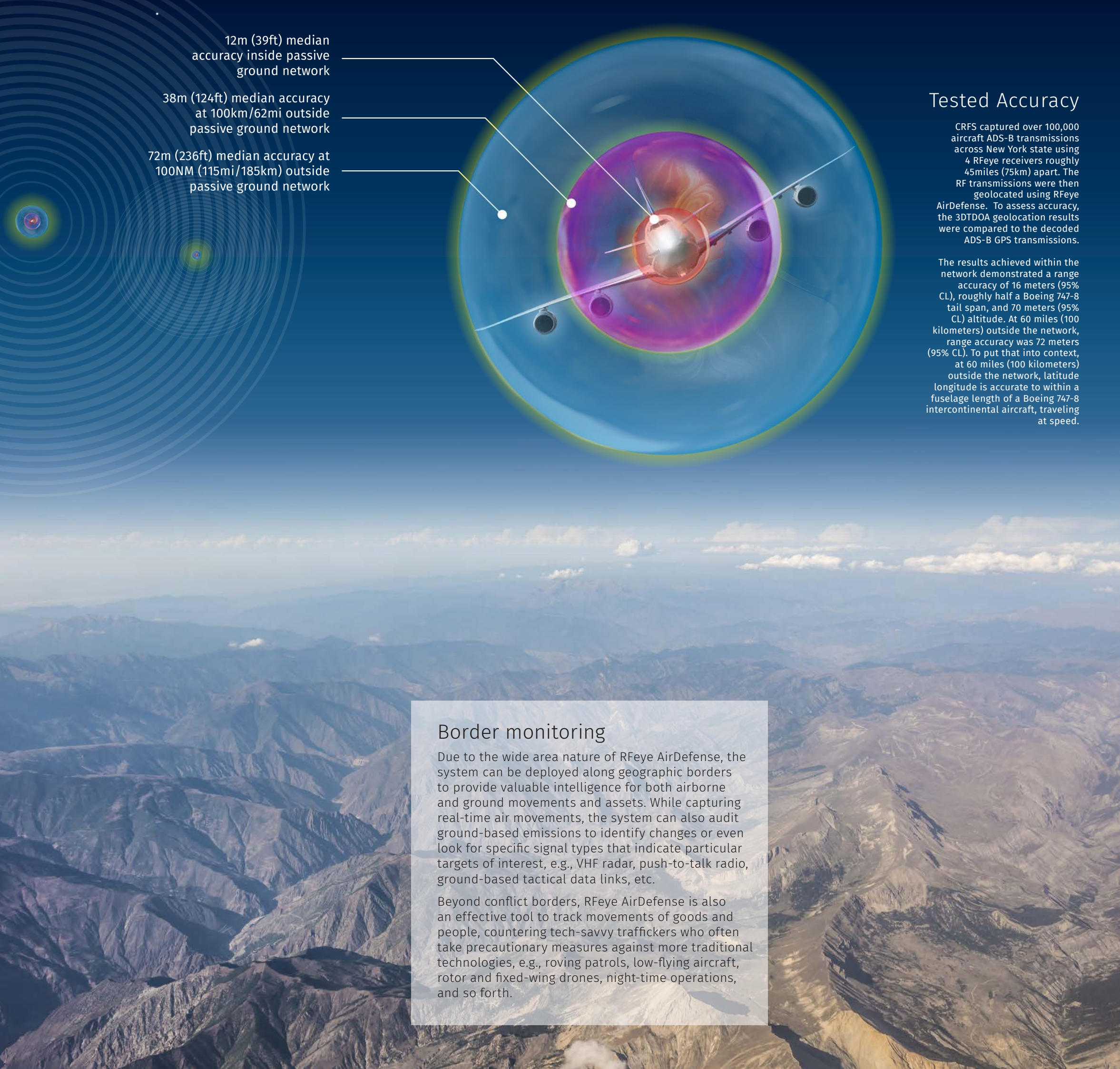
Missiles that use active radar homing can be tracked using RFeye AirDefense as part of a multi-layered Ballistic Missile Early Warning System (BMEWS). Since the system is entirely passive, missile detection and tracking can be carried out without emitting any signals that would create a target for further strikes.

RFeye AirDefense has been exhaustively tested and proven over ranges of hundreds of kilometers and on objects traveling from stationary to supersonic. It is an incredibly scalable solution, where the size of the sensor network can be scaled to suit varying requirements for high-speed and long-range missile detection and tracking.

Low-Earth orbit satellites

Satellites in low-Earth orbit can be detected and tracked as they pass an RFeye AirDefense network. Spy satellites tend to use low-Earth orbits since the low altitude allows a better view of the Earth's surface.

Intelligence on the existence and location of a spy satellite can allow sites such as military test ranges or weapons storage facilities to halt sensitive activities while the satellite is overhead. This might be based on live tracking if a satellite emits continuously or a one-off detected emission from which the orbit can be derived.



12m (39ft) median accuracy inside passive ground network

38m (124ft) median accuracy at 100km/62mi outside passive ground network

72m (236ft) median accuracy at 100NM (115mi/185km) outside passive ground network

Tested Accuracy

CRFS captured over 100,000 aircraft ADS-B transmissions across New York state using 4 RFeye receivers roughly 45miles (75km) apart. The RF transmissions were then geolocated using RFeye AirDefense. To assess accuracy, the 3D TDOA geolocation results were compared to the decoded ADS-B GPS transmissions.

The results achieved within the network demonstrated a range accuracy of 16 meters (95% CL), roughly half a Boeing 747-8 tail span, and 70 meters (95% CL) altitude. At 60 miles (100 kilometers) outside the network, range accuracy was 72 meters (95% CL). To put that into context, at 60 miles (100 kilometers) outside the network, latitude longitude is accurate to within a fuselage length of a Boeing 747-8 intercontinental aircraft, traveling at speed.

Border monitoring

Due to the wide area nature of RFeye AirDefense, the system can be deployed along geographic borders to provide valuable intelligence for both airborne and ground movements and assets. While capturing real-time air movements, the system can also audit ground-based emissions to identify changes or even look for specific signal types that indicate particular targets of interest, e.g., VHF radar, push-to-talk radio, ground-based tactical data links, etc.

Beyond conflict borders, RFeye AirDefense is also an effective tool to track movements of goods and people, countering tech-savvy traffickers who often take precautionary measures against more traditional technologies, e.g., roving patrols, low-flying aircraft, rotor and fixed-wing drones, night-time operations, and so forth.

RFeye AirDefense

TRL9: Mission ready

The RFeye AirDefense pack is deployed today using real-time sensor networks. The RFeye Node receiver platform sits at the heart of the system, delivering high-resolution, low-noise RF collection to deliver precise geolocations as far as hundreds of kilometers away. The data below is real data, and represents a small sample of points captured by the CRFS network in Buffalo, New York over a two-day period.

Get a visual on what's important

Results can be displayed in any number of user-definable ways. Display results using color codes to represent distance, signal strength, signal type, etc. Identify specific transmission types using definable colors, and have geolocations fade over time to build the perfect intelligence picture for your application.

Ballistics tracking

RFeye AirDefense also has a ballistics function which intelligently assesses all targets of interest and builds an automated picture of flight path, aircraft type and heading. Ballistics is an advanced function of RFeye AirDefense and is suited to users who need full situational awareness and a picture of adversary capability. Such users can trace aircraft including fixed wing, helicopter, drone and missile.

Low noise—wide area

The ultra-low noise figures achieved by our RFeye Node platform mean we see further, and with more clarity. In practice, this means RFeye AirDefense can track aircraft many hundreds of kilometers away from the ground sensors. Our own test deployments track aircraft across a 900-km airspace.

Integration & interoperability

RFeye AirDefense can be integrated with other systems and platforms to deliver complete situational awareness. C2 systems can interface directly with RFeye AirDefense using standard protocols and data formats.

ADS-B

Track and identify ADS-B emissions commonly used by commercial and private aircraft

Tactical datalinks

Track and identify tactical air navigation systems such as Air-to-Air (A2A) and Air-to-Ground (A2G) tactical data links

Multi-platform

Identify and track C4 signals between airborne, ground & shipborne platforms

Custom TX

Specify any emission type as your target of interest, or allow RFeye AirDefense to present all transmissions for assessment

Passive RX

RFeye AirDefense uses a network of 4 or more ground receivers to build your detailed air picture without giving away your location

Mapping/Topography

RFeye AirDefense can use any number of mapping solutions or custom overlays to plot targets

The CRFS difference

Leading the way in Spectrum Monitoring & Management

CRFS is at the forefront of new technology for distributed monitoring and geolocation, featuring wideband receivers with lightning-fast sweep speeds and best-in-class noise figures and phase noise. These high-sensitivity receivers are known as RFeye Nodes.

For our military customers, fast sweep speeds and instantaneous bandwidth mean higher probability of intercept (POI). This translates to confidence that potential threats can be detected for real-time tracking, recording and further analysis.

Low noise means that operators can detect and locate lower-power, more distant signals that might otherwise have been missed entirely, providing earlier threat warning indicators (TWIs) and better situational awareness of an area of operations (AO).

RFeye's high-performance hardware and state-of-the-art software enable extremely fast processing to give much faster geolocation updates than other systems. Our TDOA geolocation algorithms typically update 10 times per second compared to similar systems that may only update once every 30 seconds. Fast geolocation updates are crucial in situations where hostile targets may be moving at speeds of over 1,000 mph.

Best in class RFeye wideband receiver technology

- Rugged, SWaP optimized, outstanding RF performance
- Highest probability of intercept
- Deployment options for fixed, mobile & tactical
- TRL9 - Trusted, proven, deployed

Comprehensive RFeye software & visualization tools

- Real-time expert mode
- Automated reports & alerts
- Forensic analytics
- Task automation (e.g. scheduling)

Best price / performance

- Solutions at different price points
- Unmatched system performance

One system, multiple purposes

- Multi-user/multi-mission architecture
- Deploy, redeploy, reconfigure

Best customer experience

- Agile development team
- Customizable solutions
- Outstanding support & training
- On-site trials & demos

Arrange a Demo

Don't take our word for it

Contact us for a live remote or on-site demo.

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1: RFeye Array 100/150
2: RFeye Stormcase
3: RFeye Array 300
4: RFeye Node + ODK
5: RFeye Node 100-18
6: RFeye SenS Portable Recorder

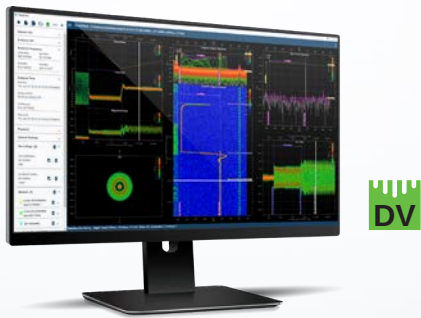
Software Solutions



RFeye Site

RFeye Site is our state-of-the-art desktop application for real-time monitoring and geolocation requirements.

Monitoring, Geolocation, Indoor Geolocation, 3D TDOA MLAT, Signal Classification, Propagation, Map, Signal Verification



RFeye DeepView

RFeye DeepView software is the ultimate forensic tool for searching through multi-terabyte datasets for signals of interest.

Big data view: time/spectrogram & heatmap, Live mode: Real-time Spectrum Analyzer, Fast zoom/scroll through IQ data, Select export: filtered IQ data, Full dataset or selection playback, Marker: Delta function with live recording, Unlimited file duration, Screens: Dataset, Analysis region overview, Analysis region Spectrum, Time cursor Spectrum, Power/Time



RFeye Mission

RFeye Mission is CRFS's flagship solution for automated spectrum operations.

It enables spectrum stakeholders to derive useful and actionable intelligence from their deployed RFeye receivers without the need for teams of RF experts. It has been designed for use with RFeye assets deployed over wide areas such as ranges, test sites, borders and cities, as well as small networks such as indoor technical surveillance countermeasures (TSCM).

About CRFS

CRFS provides best-in-class solutions for radio spectrum monitoring, management and geolocation.

CRFS offers a new generation of technology for the detection, identification and geolocation of signals in complex RF environments.

CRFS is recognized as delivering truly “best in class” technology - our RFeye systems are deployed worldwide by regulatory, military, law enforcement and intelligence agencies.



For further information or to schedule
a demonstration visit:

crfs.com



See through the noise

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