DETECT • LOCATE • PROTECT

SPECTRUM MANAGEMENT

Real-time Spectrum Monitoring is Mission Critical

Pyramid Level	KEY ELEMENTS	CRFS APPROACH
LEARN	Databases, machine learning, training tools	Efficient data structures and protocols, training data, full IBW I/Q record & playback
REACT	Automated alerts & C2 feeds	Open API, real-time and near real-time intelligence
LOCATE	Lines of bearing, geolocations & heatmaps	Accurate time synchronization, hybrid techniques for different signal types, 3D geolocation
ANALYZE	Signal classification & identification	Edge processing, machine learning, automation and expert modes
VISUALIZE	Maps, spectrograms, waterfalls, heatmaps	Advanced maps, Pub7/Spectrum21 overlays, Lidar data, simulation tools
DETECT / CAPTURE	Probability of intercept	Wideband receiver, outstanding RF sensitivity/SFDR, ultra-fast sweep & tune speeds, 100MHz instantaneous bandwidth (IBW)

Why monitoring matters

- A spectrum management strategy is essential to get the most out of precious finite radio spectrum. You can't manage spectrum without monitoring it.

- Spectrum dominance is a critical goal of modern warfare. You can't dominate what you can't control and you can't control what you don't monitor.

- Most modern threats rely on radio comms or data links (missiles, UAV's, electronic jammers, bugging devices, cellphones etc). You can't protect against threats you can't see.

WHY CRFS?
Leading the way in Spectrum Monitoring & Management

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
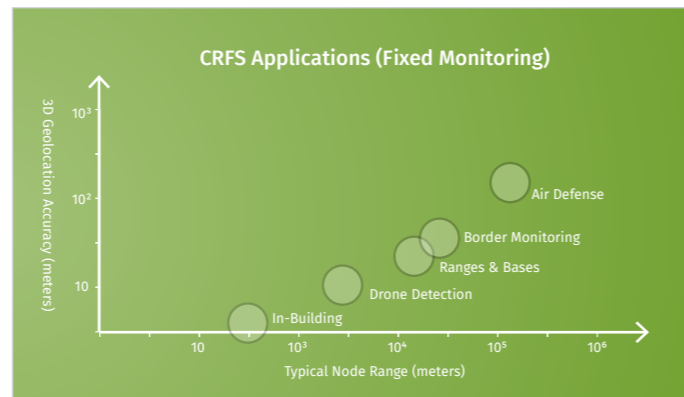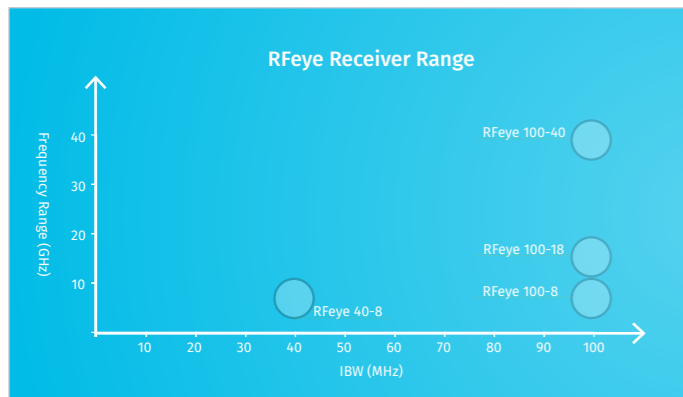- Forensic analytics
- Task automation (e.g. scheduling)

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
- "Try before you buy" on-site trials & demos

RFeye Receiver Range

(chart: Frequency Range (GHz) vs IBW (MHz))
- RFeye 100-40
- RFeye 100-18
- RFeye 100-8
- RFeye 40-8

CRFS Applications (Fixed Monitoring)

(chart: 3D Geolocation Accuracy (meters) vs Typical Node Range (meters))
- Air Defense
- Border Monitoring
- Ranges & Bases
- Drone Detection
- In-Building

MANY APPLICATIONS
Concept of Operation / OV-1

Real-Time & Near Real-Time
Wide area - hundreds of km
- Spectrum management
- Interference geolocation
- Border monitoring/security
- Marine surveillance
- Air defense
- Civil aviation

Macro area - tens of km
- Interference geolocation & hunting
- UAS detection & tracking
- Illegal broadcast detection and geo-location

Micro area - < 1 km
- Rapid deployment for tactical applications.
- Compound & perimeter protection.
- sUAS detection & tracking
- Enforcement in zero transmission environments
- Interference/jamming detection & geolocation
- Technical surveillance countermeasures (TSCM)

Post-Event Analysis
Forensic investigation
- 1Hz resolution spectral analysis. High fidelity signal capture during operations or on test range
- Search, classify and export I/Q to demodulate/decode
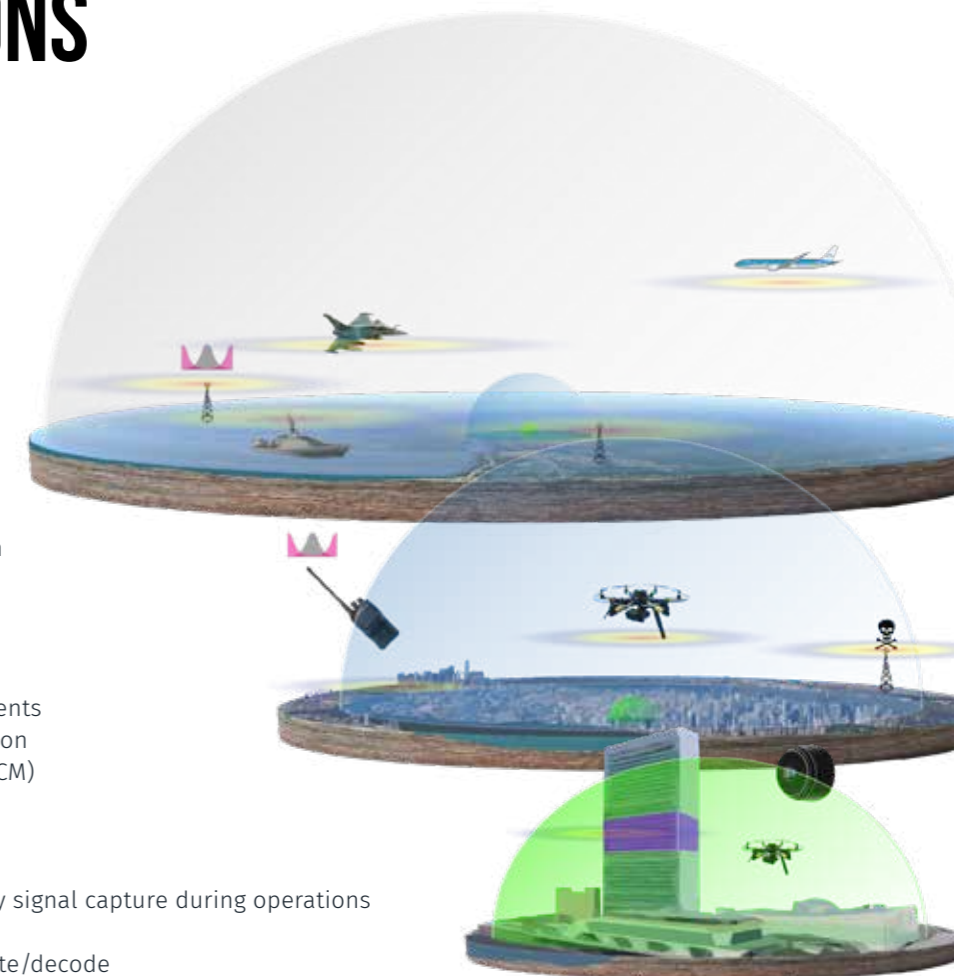
RANGES & BASES
Real-time Spectrum Monitoring & Management

Military ranges and bases are critical users of the RF spectrum for a variety of routine tasks, as well as for test, tactical and training applications. Control of Electro-Magnetic Spectrum Operations (EMSO) is essential for safe and effective daily operations.

Routine monitoring of spectrum bands is required to ensure that allocated frequencies are used correctly and that any interference can be resolved quickly. During complex test or training events, spectrum conflicts can lead to costly delays, lost data or potentially even catastrophic failures. Such problems can be prevented or mitigated, cost effectively, using a real-time monitoring system. In addition, real-time monitoring of EMSO permits fine tuning of operations. Recording/playback of signals for subsequent forensic analysis enables ongoing improvement of CONOPS.

CRFS's rugged RFeye systems are multi-user, multi-mission allowing the same equipment to be deployed additionally for air defence (aircraft, missiles) or to protect against inbound UAV aggressors, as well as for its primary spectrum management function.

RFeye systems are widely deployed across many ranges, bases and proving grounds in the United States, Europe and other friendly nations.

BORDERS & COASTLINE
## Digital Borders Using an RF Fence

Securing national borders against external threats is a major challenge. Physical barriers are generally impractical and uneconomic. Border patrols can be effective but cannot be in all places at once and need real-time intelligence. The best solution is to construct a "smart" border for detecting incursions and alerting the border forces or military.

Smart borders may comprise several sensor technologies including ground pressure sensors, cameras, radars and RF detectors. RF detection has many advantages and can be deployed practically and cost effectively over very large borders.

Most operations close to borders emit radio transmissions (e.g. military comms, cell phones, walkie talkies, radio-controlled drones) that can be detected and geolocated.

CRFS's rugged unmanned RFeye sensors create an "RF fence" along a border or coastline. The system intelligently identifies potential threats, allowing an appropriate response in near real time. High fidelity signal capture enables forensic analysis and signal decode for intelligence gathering. The RF fence does not rely on line of sight or visible light. It can equally detect threats on the ground, out to sea and in the skies.

The RFeye has been deployed in many countries across thousands of miles of national borders for defence, drug enforcement and border control.
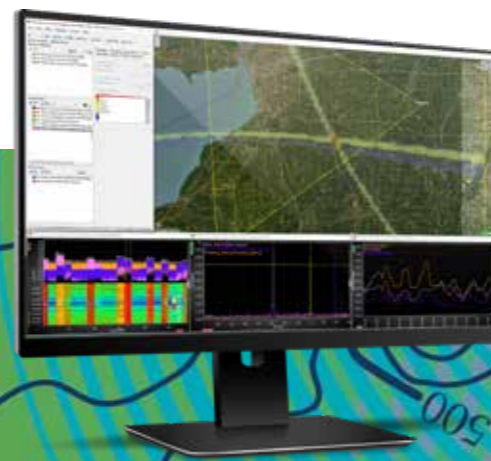
AIR DEFENSE
Passive Monitoring of the Air Domain

Passive RF monitoring of the skies complements and augments traditional radar and provides an additional source of intelligence in critical C2 situations. This is well understood and employed by certain NATO adversaries as part of their EMCON arsenal. Blue forces should adopt equivalent systems, if only for training to develop strategies and tactics to deal with such potential enemy capability.

Where active radar performs well mainly against traditional aircraft with large RCS and travelling at reasonable speeds, RF monitoring can detect and geolocate the emissions of both traditional and non-traditional targets. Where radar is vulnerable to counter-measures and is of limited utility during hostile engagements, RF monitoring is passive and can "see without being seen". Where radar has limits on positional accuracy over greater distances, RF monitoring can provide excellent resolution and geolocation at long distance*. In addition, RF monitoring can geolocate targets where the adversary has deployed GNS jamming or spoofing measures.

The RFeye Air Defense system is proven and deployed. In addition to its training utility, it can also be deployed along hostile borders or at forward bases, as part of a wide area threat detection and intelligence gathering system.

* For example, the RFeye Air Defense system detects and geolocating aircraft 165km (100nM) away with a bearing accuracy of 0.02° (including altitude) using ADS-B and aircraft data-link transmissions. (>95%)

DRONE DEFENSE
Detection and Geolocation of UAV Threats

RF sensors are a critical element of any drone detection system. They can be used to help protect military bases, air fields, compounds, perimeters and critical infrastructure, either standalone or as part of a wider cUAV solution.

CRFS has developed its RFeye DroneDefense system to be capable of detecting and geolocating the widest range of targets from COTS to MALE drone, irrespective of drone size or signal type. It is different and more capable than other systems in a number of important ways. Rather than relying on a pre-existing library of drone RF signatures, the RFeye sweeps a wide frequency range to learn its environment and can differentiate RF emissions coming from a likely drone from other signals that can be safely ignored.

It also supports signal identification and newly detected threats can be added to a database. Known non-threat signals can be whitelisted to reduce false positives. The open API allows easy integration with other sensors and RF geolocation data can be sent to radar or EO systems to aid targeting.

RFeye Drone Defense has been subject to extensive blind testing and trials against other systems before being deployed on US and NATO bases.
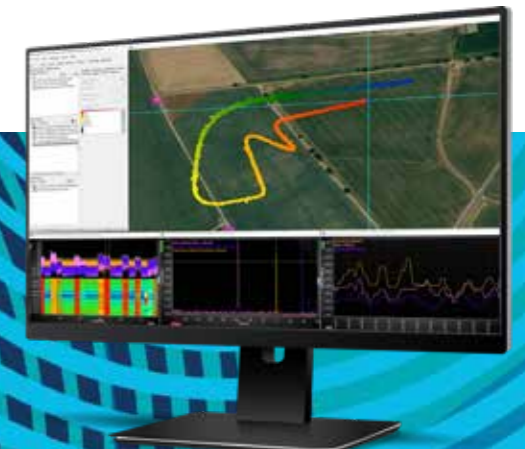
ELECTRONIC WARFARE
EW support systems & SIGINT

Electronic Warfare is an increasingly important element of modern warfare. US and NATO forces are playing catch-up in EW against their main adversaries. Traditional SIGINT systems were designed for a world of analog and basic digital signals. They are not fit for purpose for capturing or analyzing the latest complex digital waveforms and modulations. These demand wider frequencies, faster sweep and capture and more advanced analytical tools.

CRFS's family of rugged RFeye receivers are best in class in frequency range, probability of intercept and signal resolution. Exceptional spurious-free dynamic range, sweep speeds of up to 390GHz/s and sampling speeds of 250 megasamples/s in IQ, provide outstanding capture fidelity for signals of interest (SOIs).

RFeye receivers are available in a variety of tactical form factors including Stormcase systems, RF recorders and VPX cards.

RFeye DeepView software allows massive data sets to be visualized and analyzed in near real time. It includes advanced Machine Learning tools for signal identification and classification. IQ data can also be exported in various standard formats, such as Matlab, HDF5 and WAV-E for demodulation, decryption and decode using commercial third-party software.

ARRANGE A DEMO
Don't take our word for it

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

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DETECT
LOCATE
PROTECT

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