CRFS

RFeye Array

Ultra wide frequency, high performance
radio direction finding up to 40 GHz

What is an RFeye Array?

Ultra wide frequency, fully integrated, multi-mission systems for fixed, vehicle or transportable applications with simultaneous DF, monitoring and geolocation capability

RFeye Arrays contain one or two RFeye Nodes together with two or more arrays of 6-element directional antennas covering 360^{O} deployment plus omnidirectional antennas.

The architecture is based on a multi-layer, multi-banded approach that is more versatile than other systems. The use of a series of high performance spiral directional antennas makes the Array sensitive to the majority of incoming signal polarizations, including all linear polarizations. This allows reliable detection of signals, including those invisible to the majority of DF systems that use only vertically polarized directional antennas. Measurements are overlaid onto a wide variety of maps, satellite images and 2D/3D GIS datasets to give a powerful positional display showing source geolocation probabilities. RF signal types can be mapped, irrespective of signal power, bandwidth or frequency.

RFeye Arrays are supplied in a range of sizes and antenna configurations for fixed, vehicle-based or transportable deployment and in versions up to 3, 8, 18 or 40GHz. The Arrays are fully self-contained within a robust radome designed for hostile conditions. Close coupling of the RFeye Nodes and antennas reduces cable runs and cable losses and significantly improves performance at higher frequencies. Arrays can be networked over large distances as part of a wide area monitoring and TDOA network with other RFeye receiver nodes.

Designed for your mission

The RFeye Array is the benchmark for high performance, real-time 24/7 radio direction finding.

RFeye Array 300

The RFeye Array family is available in many sizes and configurations, from small through to intermediate-sized system. It can be deployed as vehicle-mounted or as part of a fixed installation. The RFeye Array is available in different receiver configurations either based on the class-leading RFeye Node 100 series with 8/18/40GHz with 100 MHz IBW. Alternately the RFeye Node 40-8 with 40MHz IBW and 3/8GHz upper frequency is also available. See datasheets for more information.

All RFeye Arrays are designed to provide hybrid capability, allowing the system to adapt to changing mission parameters. Combinations of AOA and TDOA techniques can be used against signals on a best fit basis.

Flexibility by design

Broad bandwidth and Ultra-wide frequency range

We have a range of different Arrays to suit every application with a DF frequency range of 20 MHz right through to 3, 8, 18 or 40 GHz. This ensures that a signal of interest is never missed. Arrays are available with either a 40 MHz or 100 MHz instantaneous bandwidth (IBW). The IBW is the frequency range a receiver can acquire without having to retune. A wide IBW allows RFeye Arrays to quickly sweep through the frequency range with less time to retune. This translates to faster sweep speeds and a higher probability of intercept.

Spiral Antenna

The key to our ability to deliver such wide frequency ranges is in the spiral antenna implementation. We focus on power, not just phase differentials. We select the best methodology for each frequency range, delivering the most agile DF array on the market.

Inbuilt processing for low backhaul

All RFeye Arrays have their own inbuilt processor. This enables the system to process the RF data in situ to perform geolocation and monitoring tasks. The results of these tasks can then be sent securely over your choice of network in realtime anywhere in the world without the need for high data-rate backhaul. Data can also be stored locally to USB drive / optional internal SSD or transmitted via an external wireless network.

Multi-user, multi-mission capability

The RFeye Arrays unique architecture is capable of supporting multiple, simultaneous tasks and missions, as well as queries from multiple users.

So, if you needed to perform multiple AOA or TDOA geolocations at the same time as a colleague makes spectrum occupancy measurements, you can. Remote programming allows tasks to be assigned relative priorities and the system is able to seamlessly execute the required tasks in the most efficient manner.

Example tasks include:

- **Spectrum sweeps**
- **IQ captures**
- **Spectrum occupancy measurements**
- **Signal classification**
- **Alerting on mask breaks and triggering alarms**
- **Geolocating signal sources**

Get focused on the real-world

The RFeye Array is the benchmark for high performance, real-time 24/7 radio direction finding.

The RFeye Array uses a unique multi-layer approach that is more sophisticated and versatile than traditional direction finding techniques. High-performance spiral directional antenna modules are optimized for different frequency bands and arranged in multiple orientations. The Array is sensitive to the majority of incoming signal polarizations including all linear polarizations, allowing reliable detection of signals including those invisible to other DF systems.

Timing and synchronization features enable combined AOA, TDOA and POA techniques, allowing signal types in the range to be mapped, irrespective of signal power, bandwidth or frequency.

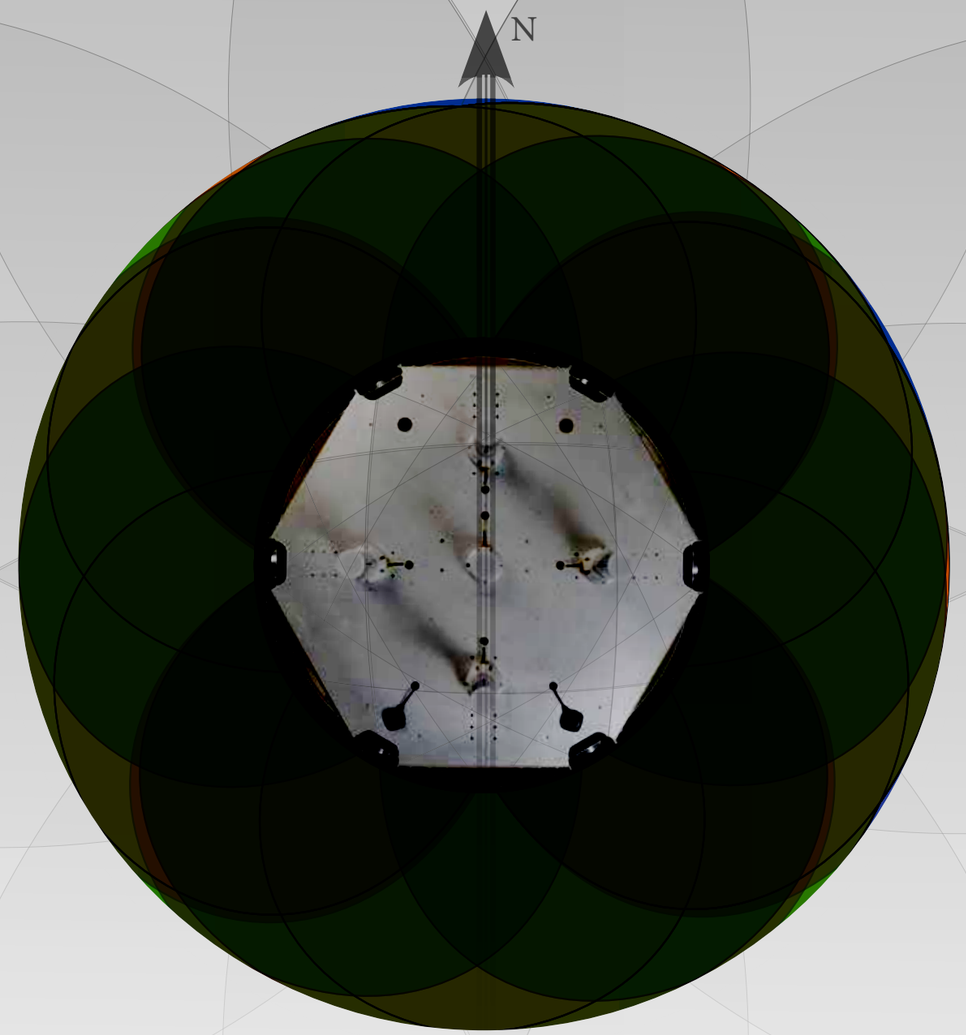
Each RFeye Array is individually calibrated in a real-world environment to test not just its potential accuracy, but also accuracy in the presence of other signals, as found in any deployed environment. Each array then carries a unique calibration file which unlike other array systems on the market, is constant over time. The end result is that RFeye Arrays do not require repeated, scheduled recalibration. Once deployed, our systems are designed to maintain exceptional accuracy, even in extreme environmental conditions.

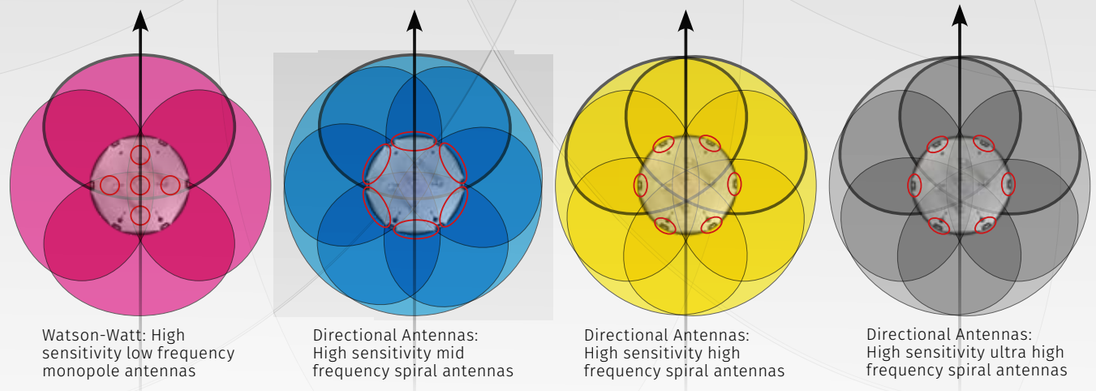
Critical Design Choices

The Array 300 series uses a unique multi-layer approach to DF that is more sophisticated and versatile than traditional single technology methods. Key design objectives:

- Maximum accuracy
- Maximum sensitivity
- Immunity to distorted wavefronts
- Minimal sensitivity to depolarization
- Maximum resistance to receiver desensitization
- Minimum signal duration capability below 0.5ms through hardware and software to manage pulsed signal identification

RFeye Arrays co-locate the receiver with the antenna to maximize sensitivity by minimizing cable loss.



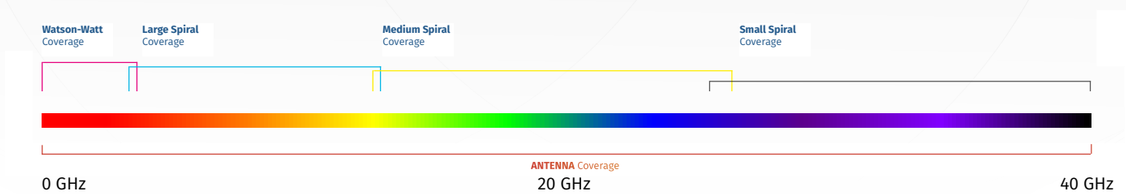


Watson-Watt: High sensitivity low frequency monopole antennas

Directional Antennas: High sensitivity mid frequency spiral antennas

Directional Antennas: High sensitivity high frequency spiral antennas

Directional Antennas: High sensitivity ultra high frequency spiral antennas



Array 105
Single 8 GHz Rx
500 MHz to 8 GHz DF with
40 MHz IBW

Array 125
Single 8 GHz Rx
500 MHz to 8 GHz DF with
100 MHz IBW

Array 150
Single 18 GHz Rx
500 MHz to 18 GHz DF with
100 MHz IBW

Array 205
Single 8GHz Rx
20 MHz to 3 GHz DF with
40 MHz IBW

Array 300-8
Twin 8GHz Rx
20 MHz to 8 GHz DF with
100 MHz IBW

Array 300-18
Twin 18GHz Rx
20 MHz to 18 GHz DF with
100 MHz IBW

Array 300-40
Twin 40 GHz Rx
20 MHz to 40 GHz DF with
100 MHz IBW

RFeye Array 300

The Ultimate DF

RUGGEDIZED

IP55 protection enables Arrays to be deployed outdoors in the harshest weather conditions.

AERODYNAMICS

Both upper and lower sections are designed to create compression at their joint ensuring high integrity and maximum adverse weather performance

LOW BACKHAUL

Data is processed on the Node reducing backhaul requirements and enabling control from anywhere in the world

RUGGED DEPLOYMENT

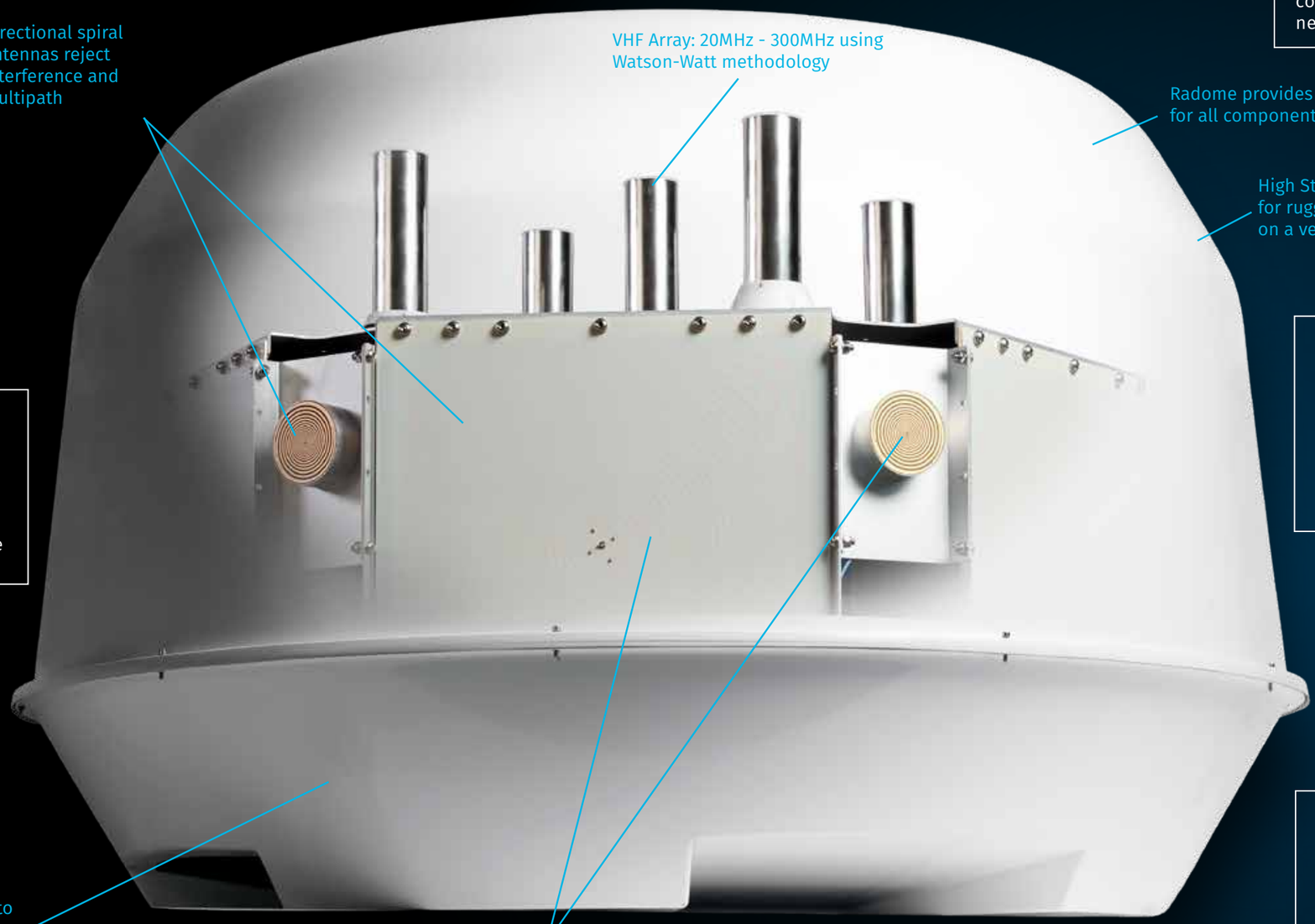
Designed to withstand everyday vibration without affecting calibration or performance

DUAL RECEIVER DESIGN

Increased probability of intercept using dedicated continuous scanning receiver alongside a dedicated precision DF receiver

PROPRIETARY ANTENNA DESIGN

Only CRFS can produce this Array, because CRFS designed the unique antenna layout to deliver years of consistent accuracy without the need for regular, costly calibration.



THERMAL DESIGN

Carefully designed for optimal thermal management allowing operational deployment from -30°C to +55°C (-22°F to +131°F)

HYBRID DF

Stand-alone AOA DF or simultaneous hybrid AOA/ TDOA operation

FLEXIBLE MOUNT

Can be easily vehicle, tower or pole mounted allowing for flexible redeployment in the future

Compact all-in-one unit delivering Spectrum Monitoring, AOA DF and TDOA up to 40GHz

RFeye Array 100

The Compact DF

RUGGEDIZED

IP55 protection enables Arrays to be deployed outdoors in the harshest weather conditions.

Low SWaP

RFeye Array 100 is designed to be small, lightweight and agile, while drawing just 25W DC on average.

LOW BACKHAUL

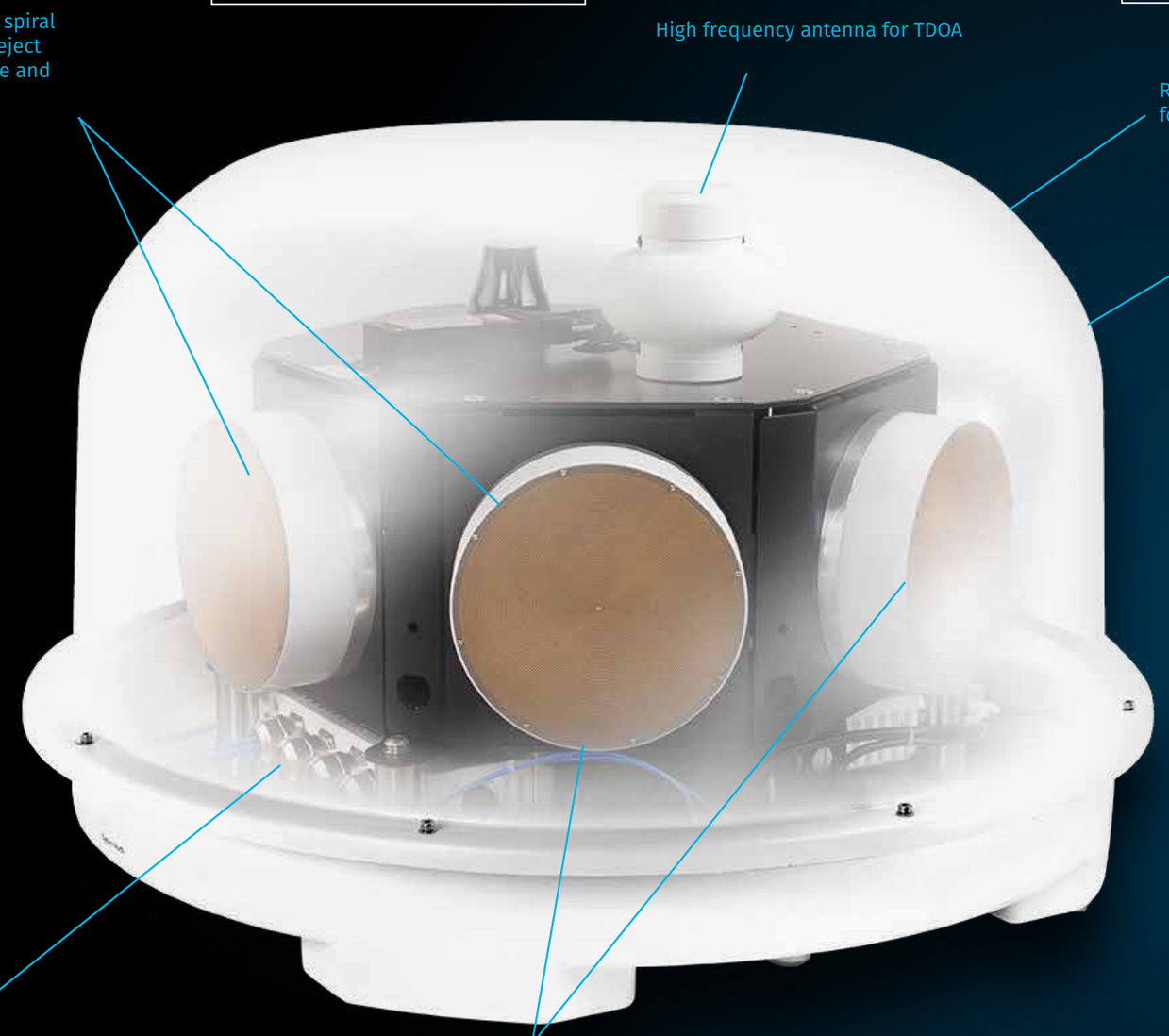
Data is processed on the Node reducing backhaul requirements and enabling control from anywhere in the world

RUGGED DEPLOYMENT

Designed to withstand everyday vibration without affecting calibration or performance

PROPRIETARY ANTENNA DESIGN

Only CRFS can produce this Array, because CRFS designed the unique antenna layout to deliver years of consistent accuracy without the need for regular, costly calibration.



THERMAL DESIGN

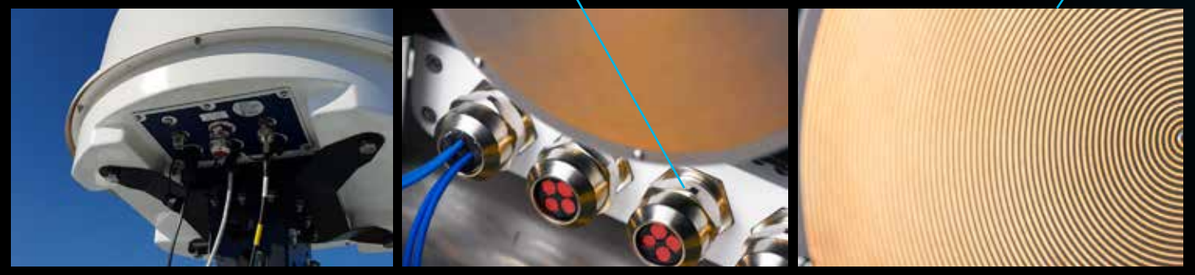
Carefully designed for optimal thermal management allowing operational deployment from -30°C to +55°C (-22°F to +131°F) without the need for active cooling.

HYBRID DF

Stand-alone AOA DF or simultaneous hybrid AOA/ TDOA operation

FLEXIBLE MOUNT

Can be easily vehicle, tower or pole mounted allowing for flexible redeployment in the future



Compact all-in-one unit delivering Spectrum Monitoring, AOA DF and TDOA up to 18GHz

A Software Powerhouse - RFeye Site

More than just AOA. State-of-the-art desktop application for comprehensive real-time monitoring and geolocation. All the functionality that RF experts require.

Designed by RF experts, for RF experts, RFeye Site is a vast suite of measurement and analysis tools in a single package, that can be easily deployed for any spectrum task or mission. It is almost infinitely versatile and provides a broad array of advanced functionalities combined in a single software application.

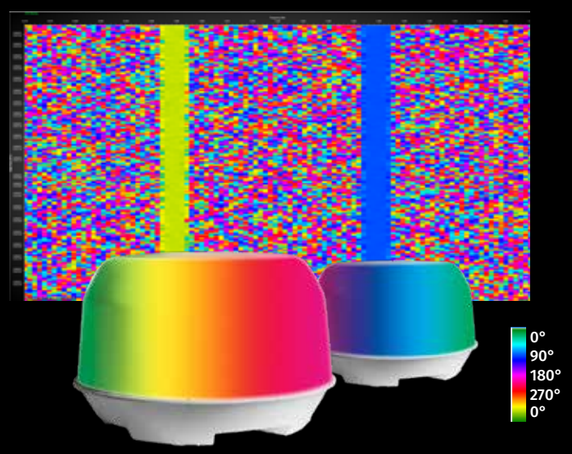
RFeye Site includes all essential functionality for spectrum monitoring and management tasks – from simple RF sweeps and IQ capture to detailed spectrum power/occupancy/bandwidth measurements and comprehensive 3DTDOA visualizations. It has a multi-mission capability that enables multiple spectrum monitoring and geolocation tasks to run simultaneously on the same nodes.

Users can further configure RFeye Site to perform pretty much any imaginable spectrum measurement or simulation. Some of the key elements of RFeye Site include:

- Indoor and outdoor real-time geolocation engine supporting AOA, TDOA, POA and hybrid
- Real-time EW and SIGINT data input and output
- Multiple data map overlays of node networks and geolocation results
- Alarms and triggered missions (e.g. sweep, IQ capture, geolocation) in response to frequency mask breakages
- Signal classification
- Real-time control of nodes and data analysis
- Post-analysis of recorded signals (including geolocation)
- Simulation and propagation modeling to optimize receiver networks for required coverage
- Terrain analysis and site planning for receiver coverage and geolocation coverage by type
- Simulation capabilities for testing of monitoring and geolocation scenarios

Features and Benefits

- Sweep & capture
- Mapping: 2D, 3D (TDOA), Satellite image
- Automation: Alarms, Masks & triggers
- Record & playback: Manual & automated
- Advanced geolocation methodologies
- Simulation & modeling: Emitters, receivers, structures & geo-data
- Terrain analysis and site planning
- Simulation modes to model system performance
- Full real-time control of nodes and data analysis
- Multiple data and map overlays
- Real-time EW and SigInt data input and output



Innovative visualization solutions to deliver fast operational workflow for AOA users

RFeye Site features a vast array of capabilities for AoA geolocation missions. Amongst those are a number of familiar capabilities found in traditional systems, and a host of unique innovative tools to help shorten user workflow and give operators target assurance.

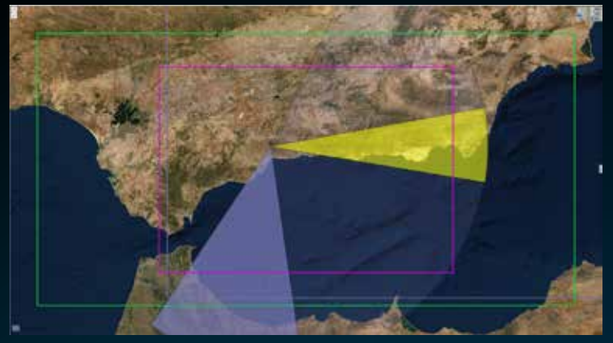
Key workflow considerations such as frequency selection for a missions signal of interest (SOI) are rapidly defined simply by dragging your cursor across frequency ranges. You can also easily apply power masks to avoid background noise.

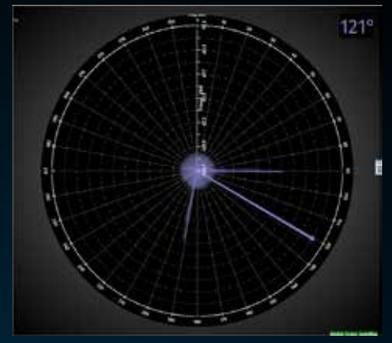
Bearing Waterfall
The bearing waterfall (shown on the left) divides compass bearings into color spectrum to extract visual patterns for the user. Even faint signal sources become a clear pattern using this tool. Frequency resolution can also be dynamically adjusted to differentiate multiple signal sources.

Quality Segments - Opposite page
Enabling bearing confidence is another user focused visualization tool which uses segments that continually adjust in width and color dependent upon the quality of the signal being received. A central line of bearing is displayed in the middle of this segment.

Polar Chart - Opposite Page
Polar bearing allows you to see what the Array itself sees. Conceptually a top down view of the Array showing bearing against signal power.

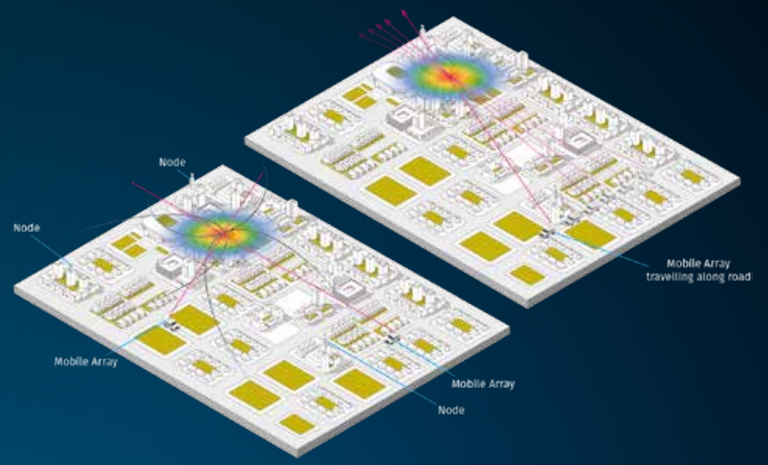
Pulsed & Sweeping Signals
Bearing averaging allows the identification of pulsed and sweeping signals by continuously combining measurements to create an average position for the signal source. This allows us to pin-point a sweeping target over a few rotations.





Cumulative AoA
When mounted to a moving vehicle, the RFeye Array can operate on a cumulative basis. As the vehicle moves, the line of bearing pivots on the signal source to create a lat/long geolocation and home in on the signal.

Hybrid Geolocation
With an omnidirectional antenna fitted to an Array, our software can combine both AoA and TDOA geolocation techniques to deliver positional confirmation against your target transmitter.



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

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

Arrange a Demo

Don't take our word for it

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

USA:
CRFS Inc.
4230-D Lafayette Center Drive
Chantilly, VA 20151
USA

Tel: +1 571 321 5470

International:
CRFS Limited
Building 7200
Cambridge Research Park
Beach Drive
Cambridge
CB25 9TL, UK

Tel: +44 (0)1223 859 500

Email: enquiries@crfs.com

Software Solutions

ST

RFeye Site

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

Monitoring, Geolocation, Indoor Geolocation, 3DTDOA MLAT, Signal Classification, Propagation, Map, Signal Verification

DV

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

MN

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 creates deployable systems to detect, identify and geolocate signals in complex RF environments.

We provide end-to-end automated solutions for spectrum management and deconfliction, interference hunting and threat detection, using our intelligent receiver technology, software and advanced analytics.

Our RFeye systems are widely deployed by military, intelligence, law enforcement and regulatory agencies around the world.

TRL 9

For further information or to schedule a demonstration visit:

crfs.com

CRFS

See through the noise

CRFS Inc
Chantilly, VA, USA
+1 571 321 5470
enquiries@crfs.com

CRFS Ltd
Cambridge, UK
+44 1223 859 500
enquiries@crfs.com

bsi. ISO 9001:2015 Quality Management
Certificate number FS576625