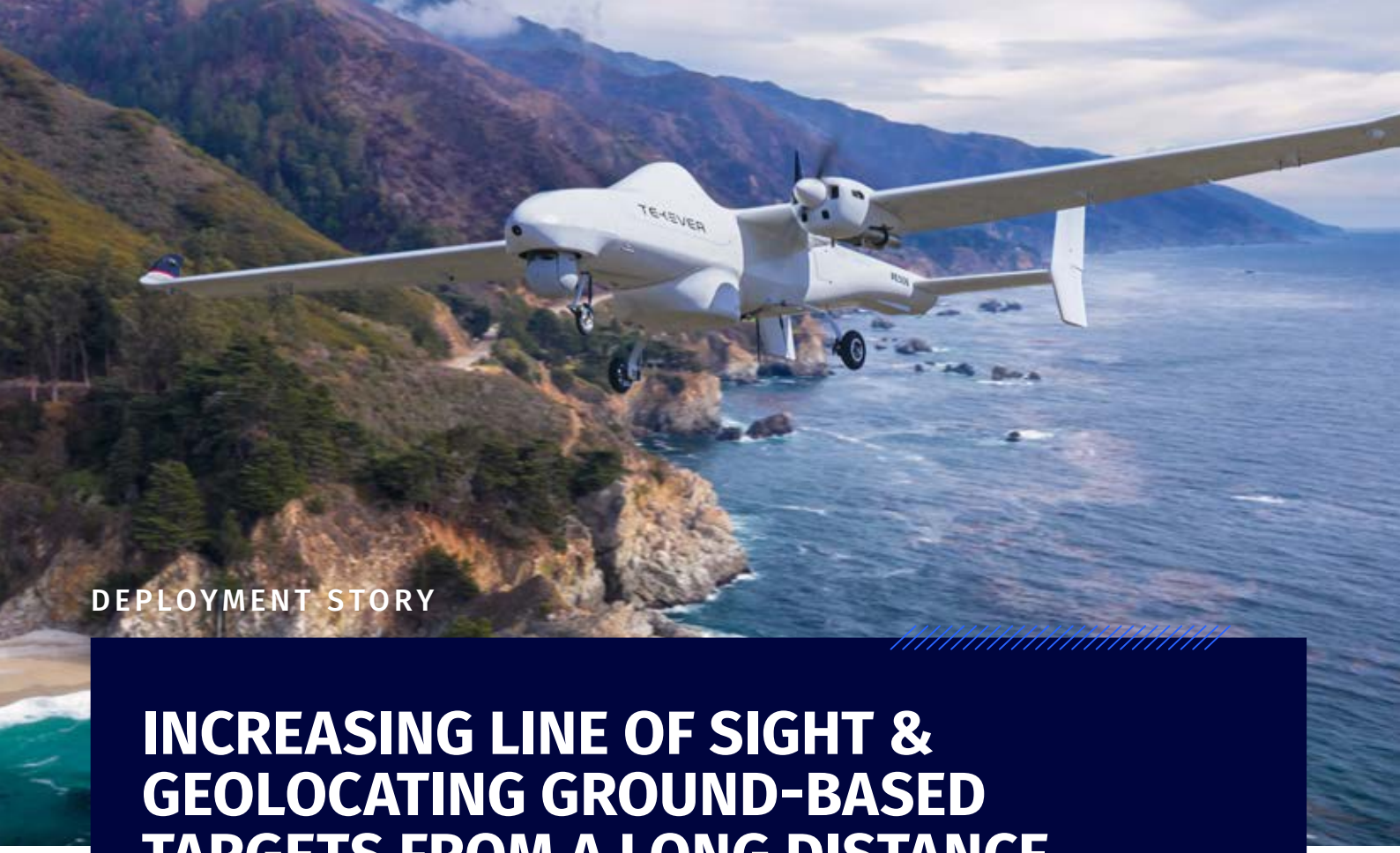


DEPLOYMENT STORY

INCREASING LINE OF SIGHT & GEOLOCATING GROUND-BASED TARGETS FROM A LONG DISTANCE

How TEKEVER & CRFS collaborated to fit UAS with ultra-sensitive RF receivers as a payload

Domain: Multi

Application: Intelligence, surveillance & reconnaissance

Customer: System integrator

PROBLEM – THE WORLD IS NOT FLAT

Armies, navies, coastguards, border control. Any agency monitoring a vast area of land or sea shares the same problem: geolocating ground-based targets from a long distance.

As the world is not flat, and it is impossible to see over the radio horizon, accurate and reliable geolocation from the ground is problematic. Increasing line-of-sight (LOS) is crucial for TDoA (Time Difference of Arrival) systems because it directly impacts the accuracy and reliability of the positioning measurements. A clear and unobstructed line of sight between the signal source and the receiving antennas is essential for optimal performance.

To see further, you need to go higher.

SOLUTION – FITTING DRONES AS A PAYLOAD ON UAS

Many customers use TEKEVER's drones for surveillance and CRFS' RFeye Nodes for geolocation. The TEKEVER AR5 has an endurance range of 20 hours, a payload capacity of 50 kg, and a cruise speed of 100 km/h. The RFeye Node is a lightweight and rugged RF receiver with a 100MHz IBW and a frequency range of up to 40GHz.

Yet these solutions were used separately for intelligence, surveillance, and reconnaissance (ISR) missions—until one customer saw the increased value of combining the two assets. They wanted to deploy highly-sensitive RF sensors on sub-tactical unmanned aerial systems (UAS).

The end-user wanted the altitude advantage TEKEVER UAS offered to allow CRFS' sensitive receivers to carry out advanced TDoA and geolocation of ground-based targets long distances away. So it brought the two companies together.

TEKEVER and CRFS co-coordinated the project and fit the AR5 RFeye Nodes for monitoring, I/Q capture, geolocation, and TDoA. The teams worked relentlessly, confronting a host of technical challenges. One of the most significant was that UAS have various transmitters onboard, so the technical teams designed a solution to establish the best position for the antennas and the required filtering. They used Silvus radios for the downlink of data from the Node to the ground station.

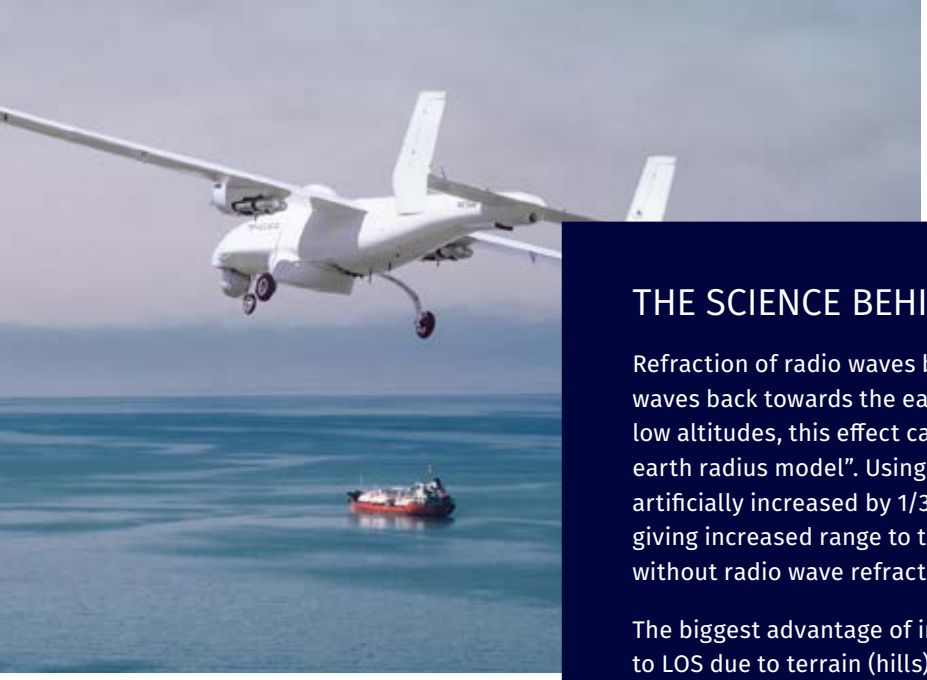
Field trials began after considerable joint engineering work and training on how to carry out RF measurements.

RESULT – INCREASED LINE-OF-SIGHT (LOS)

The combination of TEKEVER's UAS and CRFS' RFeye Nodes provides an increased line of sight, allowing teams to geolocate ground-based targets situated beyond the horizon using ultra-sensitive RFeye Nodes.

The partnership between TEKEVER and CRFS gave the end-user an asset with many potential applications—maritime surveillance, search and rescue, border monitoring, military ISR, and even regulatory spectrum monitoring. UAS fitted with an RF sensor as a payload can be employed for any application covering a large land or sea area while searching for ground-based targets.

The user can combine the integrated UAS with existing ground-based units to create an adaptable multi-domain network of receivers for advanced passive ISR over huge areas. Moreover, as increasing altitude allows signals to be detected at greater distances, spectrum monitoring receivers can be operated at greater distances from active combat zones.



THE SCIENCE BEHIND INCREASED LOS

Refraction of radio waves by the atmosphere tends to bend the waves back towards the earth so that they propagate further. For low altitudes, this effect can be approximated by using the “4/3 earth radius model”. Using this model, the radius of the earth is artificially increased by 1/3, making it appear slightly flatter and giving increased range to the horizon than would be expected without radio wave refraction.

The biggest advantage of increased height is overcoming blockage to LOS due to terrain (hills) and ground clutter (buildings and trees). Increased height becomes even more important in mountainous terrain.

For operations over water, surface-based radio receivers (mounted on a ship) are restricted to the maximum height of the ship’s superstructure or mast. In this case, the horizon distance will be limited to approximately 30 nautical miles. The only way to increase the range is by using an airborne receiver to increase the height.

EQUIPMENT USED

RFeye® Array

Direction finding from 20MHz to 40GHz

RFeye® Receiver (Node)

High-performance spectrum sensor (receive / record) to 40GHz

RFeye® Site

Real-time spectrum monitoring & geolocation toolkit

RFeye® Mission Manager

Automated spectrum monitoring & mission management

Want to discuss RF receiver (Node) integrations & ISR?

Talk to us

*Deployment arranged by **Darren Nicholls***

CRFS | EXTRAORDINARY **RF TECHNOLOGY**

CRFS is an RF technology specialist for defense, national security agencies and systems integration partners. We provide advanced capabilities for real-time spectrum monitoring, situational awareness and electronic warfare support to help our customers understand and exploit the electromagnetic environment.

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