



PRIVATE NETWORKS

Private 5G airborne networks transform outside broadcast for France TV and RAI



Impact & statistics

- **Lightweight low-power** architecture delivered up to 65 Mbps uplink in a 20 MHz channel over 1.5 km for HD/UHD streaming across race routes.
- Ultralight aircraft deployment **reduced airborne CO₂** from ~1,700 kg/hour to <40 kg/hour, and operational costs from ~£5,000+ to ~£200/hour.
- **Compact SDR-based 5G Core + gNodeB** drawing <150 W.
- **Full 5G core and RAN** included **remote radio heads** with omni or directional antennas mounted on drones, microlight aircraft or small fixed-wing aircraft.
- Network booted in 2–3 minutes, orders of magnitude faster than legacy RF chains.

Challenge

Broadcasters are facing shrinking budgets and growing pressure to cover smaller or mid-tier outdoor events. Traditionally this requires a helicopter transmitting to a high-altitude aircraft at 9,000 ft, supported by vans, trucks, engineers and high-power RF systems – an expensive, carbon-intensive “flying infrastructure stack”. France TV and RAI sought a cleaner, cheaper and more flexible way to cover smaller cycling, triathlon and rural sports events that would offer the same technical quality and could be deployed at short notice.

Solution

A temporary private network combined Neutral Wireless’ SDR (Software Defined Radio)-based 5G SA platform and lightweight airborne network infrastructure with cellular bonding on the Orange public network and Eutelsat’s LEO backhaul for connection off-site. The 5G cell was mounted on an ultralight fixed-wing aircraft and cameras were connected to the network using 5G-capable video encoders, streaming HD/UHD feeds with predictable uplink performance. This architecture can cut operational emissions, eliminate helicopters and high-altitude aircraft, reduce crew size and enable cloud-based production.

Revolutionary wireless connectivity for outside broadcast coverage

A temporary private 5G SA network, developed by Neutral Wireless and broadcast partners as part of the IBC Accelerator Media Innovation Programme, was deployed on an ultralight aircraft using Orange bonded-cellular and Eutelsat satellite connections to cloud and remote production, to explore more affordable and sustainable alternatives to legacy aircraft-based RF architectures.

Introduction

- **Background:** Outside broadcast operations have long depended on airborne radio frequency (RF) relay chains to cover dynamic, fast-moving sports such as cycling, triathlon and open-road racing. While suitable and affordable for premium events such as the Tour de France, helicopters and high-altitude aircraft are too expensive and carbon-intensive for smaller regional races and less prestigious events.
- **Use case context:** Private airborne 5G networks enable broadcasters to cover smaller sporting events more cost effectively with professional-grade production value, and provide connectivity for additional content and IP-based workflows.
- **Technology rationale:** Units are small, lightweight and draw very little power. They can also boot up in two to three minutes. This flexibility allowed the team to mount the 5G cell onto an ultralight fixed-wing aircraft.
- **Objectives:** This project sought to prove that temporary private 5G networks, combined with lightweight airborne deployment, could deliver the same editorial value at a fraction of the cost, emissions and complexity, while offering increased flexibility through the use of off-the-shelf devices and smartphones.



Challenges

- **Operational issues:** Airborne broadcast coverage has traditionally used helicopters to capture images and receive feeds from chase motorbikes, and forward them to high-altitude aircraft that relay the signals to ground receivers. This creates a heavy infrastructure stack: specialist RF equipment, high-power COFDM links, flight engineers, trucks, generators and complex coordination between air and ground teams.
- **Environmental and logistical constraints:** Helicopter and high-altitude aircraft systems take hours to prepare, require fair weather conditions, create significant noise pollution and consume large amounts of fuel.



Solution

Neutral Wireless' SDR-based 5G platform is a breakthrough in outside broadcast coverage, fusing the 5G Core and gNodeB in a compact, ultra-portable unit.

- **Technology overview:** With private 5G, the ultralight becomes a flying 5G cell, creating a broad, stable, IP-native coverage bubble below. Ground cameras, motorbike units, commentary positions and roaming journalists simply attach to the airborne cell using commercial encoders such as the Haivision Pro460 or Sony PDT-FP1, or off-the-shelf smartphones. Because the network can be uplink-optimised to use a 1:3 resource ratio (a public network is typically 3:1 downlinked optimised), the airborne cell can sustain hundreds of megabits per second of HD or UHD video traffic depending on channel size. LEO satellite backhaul via Eutelsat OneWeb provides resilient, globally-routable IP transport, ideal for cloud production environments. Bonded-cellular connectivity provides a secondary path for lower-bitrate transcoded feeds and remote access to the aircraft.

- **Spectrum:** Licensed by the French Ministry of Armed Forces to use a 20 MHz channel (2310–2330 MHz) in its n40 spectrum at 25 dBm (316 mW)
- **Coverage:** 1–1.5 km radius when flying at 300 m
- **Uplink-biased TDD frame structures** offer over 400 Mbps uplink near the aircraft (dependent on channel size).
- **Hardware and devices:** UE ecosystem including Haivision Pro460, Sony PDT-FP1, Samsung smartphones and prototype low-latency UHD encoders.

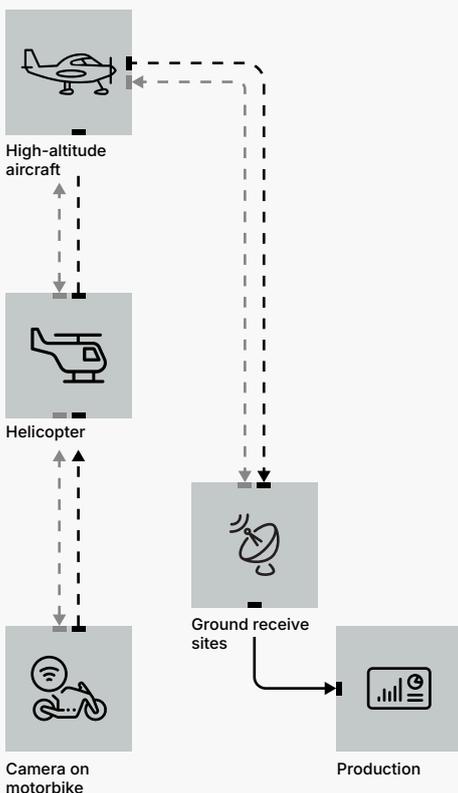
This solution enables full bi-directional IP workflows previously impossible without cable runs or unviable ground-based radio systems. As demonstrated in earlier deployments, return video, talkback, tally and camera control can all run through the same 5G link, simplifying rigging and reducing equipment count.

Figure 1
Architecture diagram

Source: Neutral Wireless

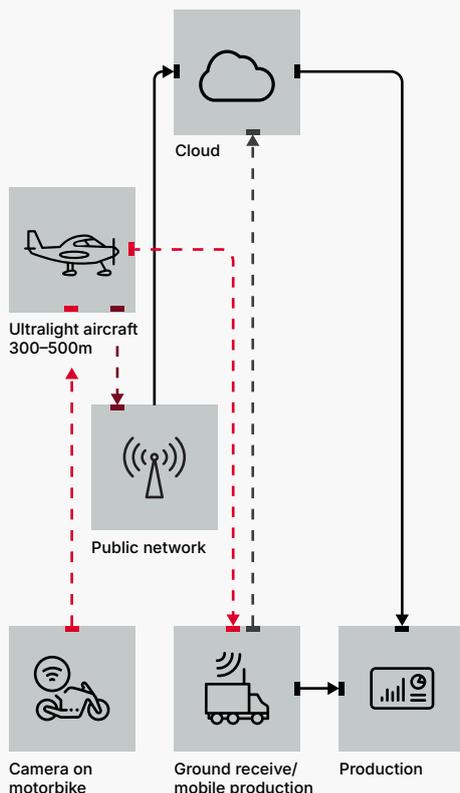
Conventional COFDM Wireless Camera Links

---> COFDM video → Cabled/backbone
---> Control/intercom



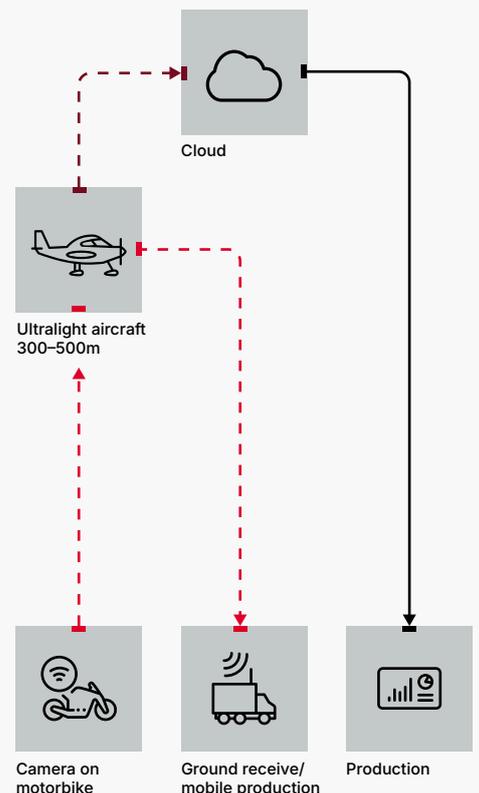
IBC Accelerator POC

---> Private 5G --> LEO
---> Public 4G/5G bonding → Cabled/backbone



Potential Future Wireless Camera Workflow

---> Private 5G → Cabled/backbone
---> LEO



Impact and benefits

Private airborne 5G networks make it practical and sustainable for broadcasters to cover smaller sporting events, enabling broadcasters to deploy quickly with professional-grade production value.

- **Environmental transformation:** The impact of switching from helicopters and high-altitude aircraft to ultralight aircraft is substantial. Helicopters typically burn 285 litres of fuel per hour (roughly 715 kg CO₂/hour), while the high-altitude relay aircraft burns an additional 400 l/hour (another 1,000 kg CO₂/hour). Combined, this airborne chain exceeds 1,700 kg CO₂/hour. In contrast, an ultralight burns around 15 l/hour, producing only 35 kg CO₂/hour – a 98% reduction. Cloud-based production – now mainstream thanks to bi-directional IP connectivity – further reduces a broadcaster's on-site footprint.
- **Financial savings:** Operational costs drop by 95–97%, enabling broadcasters to cover events that were, as France TV explained, "previously unaffordable". The airborne 5G cell also eliminates the need for RF trucks, high-altitude engineering teams and generator-supported receiver sites.
- **New creative opportunities:** Directors gain creative freedom, with coverage along entire race routes or in challenging terrains, and the ability to integrate roaming shots seamlessly. As one participant described it, "it opens up creative opportunities for telling the story."
- **Rapid deployment:** Networks boot in minutes rather than hours.
- **Smaller crews:** Fewer engineers and no high-altitude specialists are needed.
- **Resilience:** Private 5G remains robust even when public networks struggle under crowd load, as demonstrated during the Coronation of King Charles in 2023 when a similar private network infrastructure enabled more than 60 devices from 20 international media outlets to provide reliable remote contributions.
- **Consistency:** Camera feeds remain stable thanks to predictable uplink and controlled QoS.
- **Scalability:** Additional ground cells or airborne relays can extend coverage with minimal configuration.
- **Flexibility:** SDR allows quick retuning for spectrum changes, country regulations or unique geography.

Partnerships and ecosystem

Delivering an airborne private 5G network for live broadcast required far more than technical innovation. It depended on **close collaboration across the broadcast and connectivity ecosystem**, bringing together broadcasters, network specialists, satellite operators, device vendors, production partners and academic expertise.

Each organisation contributed a critical capability, but the real value was integration. Broadcasters articulated real production needs while technology partners translated them into deployable solutions. As one project participant noted, "No single company could have done this on its own – it only works when everyone brings their part together." Neutral Wireless' agile platform, combined with Eutelsat's non-terrestrial backhaul and production-ready devices, enabled rapid iteration under live conditions.

The collaborative working model was equally important. The IBC Accelerator framework encouraged openness, trust and fast decision-making. As another partner reflected, "The pace we achieved came from solving problems together, not handing them off." The challenges were not just technical – they also included navigating spectrum and aviation regulations. In just five months, the team went from initial idea to real-world deployment using a customised aircraft.

As private 5G moves into operational use, this project demonstrates that **ecosystem partnerships are fundamental** to scalable, sustainable innovation in outside broadcast.





Key takeaways

This project demonstrates that temporary private 5G SA networks fundamentally change the economics, environmental impact and technical possibilities of outside broadcast – a profound shift towards sustainable, agile, IP-native production. Lightweight airborne 5G cells deliver:

Quantifiable environmental and financial benefits

- Broadcasters achieve 98% lower CO₂ emissions and 95–97% cost reduction by replacing helicopters and relay aircraft with ultralight aircraft equipped with SDR-based core and RAN. These savings enable more frequent coverage of small and mid-tier sports events, many of which were historically unaffordable.

Significant process optimisation

- The use of SDR technology allows rapid spectrum reconfiguration, 2–3 minute boot times and fast deployment in any terrain. Crews are smaller, vehicles are fewer, logistics are simplified and on-site setup times shrink dramatically. By integrating directly with cloud production, entire galleries, master control rooms and cable runs can be eliminated.

Participating organisations: D&B Solutions, Eutelsat, Haivision, Neutral Wireless, Open Broadcast Systems and Shure.

Improved technical performance and creative possibilities

- Stable uplink, predictable latency and bidirectional IP enable directors to access roaming shots, mobile cameras, return feeds, tally, talkback and full camera control. Airborne 5G cells provide kilometres of coverage without needing mountaintop relays or complex RF meshes.

Partnerships drive innovation

- The companies and organisations involved in this project demonstrated that rapid, multi-vendor collaboration can produce broadcast-ready solutions in record time. This partnership model, combining network expertise, aviation operations, device integration and editorial requirements, provides a blueprint for future deployments.

Project champions: Adapt Media Services, BBC, EBU, France Télévisions, Orange, Globo, QTV, RAI Radiotelevisione Italiana, RTÉ and University of Strathclyde.



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