

REVOLUTIONIZING AIRPORT RADAR

Modular Airport Surveillance Radar, featuring non-rotating arrays offers a way to enhance performance in a cost-effective way

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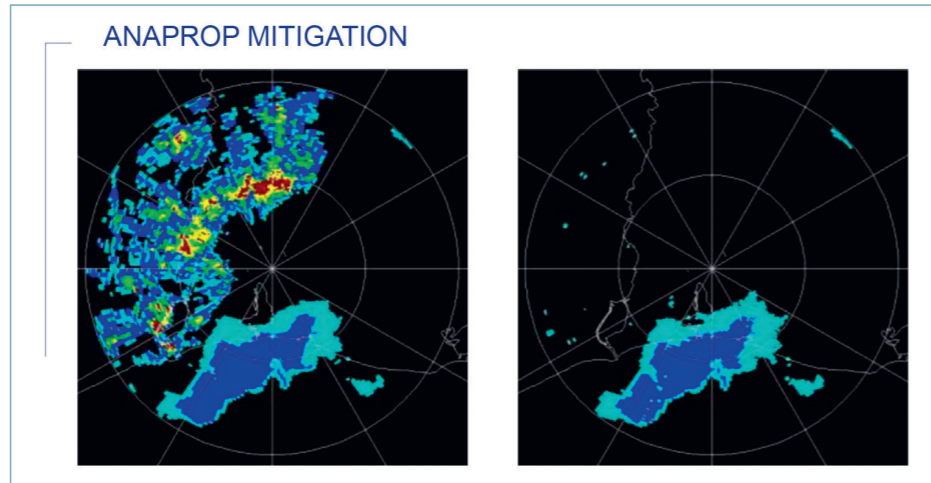
With Non-Rotating Arrays (NORA) starting to move from conceptual designs into commercial products, Modular Airport Surveillance Radar becomes a comprehensive solution for upgrades and system renewal.

The relevance of primary radar

Primary Surveillance Radars (PSRs), as part of combined Airport Surveillance Radar (ASR) systems, play a crucial role in ensuring the safety and efficiency of airport operations. Unlike secondary surveillance radars, ADS-B (Automatic Dependent Surveillance-Broadcast) and MLAT (multilateration), PSRs operate independently from onboard equipment. This capability is essential for providing a comprehensive and reliable picture of all aircraft, including those without properly functioning transponders. Drones and other small flying objects are also not equipped with transponders. In addition, the accuracy of GPS signals, on which ADS-B relies, is not always good.

PSRs enhance situational awareness for air traffic controllers by offering continuous real-time data on the position, speed, and direction of all aircraft within a certain radius of the airport. This information is vital for managing busy airspace, preventing collisions, and ensuring safe takeoffs and landings. Moreover, PSRs are indispensable in detecting and tracking unidentified or non-cooperative targets, providing an additional layer of security.

These radars are also essential for maintaining air traffic flow during transponder failures or malfunctions, ensuring



that aircraft can still be monitored and managed effectively. In adverse weather conditions or in areas with heavy air traffic, the robustness and reliability of PSRs are critical for maintaining operational safety.

Overall, PSRs remain a fundamental component of modern air traffic management systems, ensuring comprehensive coverage, enhancing safety,



Above: Anomalous Propagation before and after ASR-M processing
Below: The Frequency Synthesizer Unit, one of the ASR-M modules

and supporting efficient airport operations. Their ability to operate independently of onboard aircraft systems makes them an indispensable tool for air traffic controllers in managing both routine and emergency situations.

Modular system renewal

Twenty to thirty years is a normal lifespan for a PSR. In the world of electronics this is an eternity. Consequently, many PSRs suffer from obsolescence and substandard performance. They are no longer adapted to the changing environment with higher air traffic density and complex interferences.

Upgrading a PSR is generally less expensive than a full replacement, minimizing capital expenditure and making use of existing infrastructure. Upgrades can often be implemented incrementally, allowing for continuous operation of the radar system and minimizing disruptions to air traffic management. These upgrades can incorporate the latest technological advancements in signal processing, detection algorithms, and integration capabilities,



“ASR-M is a modular approach to airport surveillance radar, providing all necessary subsystems of an ASR to ANSPs and radar manufacturers”

Left: ASR-M houses all processor and receiver modules in a single rack

ASR-M is a modular approach to airport surveillance radar, providing all necessary subsystems of an ASR to Air Navigation Service Providers (ANSPs) and radar manufacturers. ASR-M incorporates cutting-edge technology. Its modules can be used in Service Life Extension Programs (SLEPs) and they can be integrated into brand new ASR designs.

improving the radar’s performance and accuracy. By upgrading key components, the operational life of the radar system can be extended, providing additional years of reliable service and removing the need for a full replacement. Upgrades also ensure that the radar system meets regulatory and safety standards without a complete overhaul, ensuring compliance with international and national aviation regulations.

Now, there’s a thin line between upgrading a system and renewing it step by step. By replacing obsolete or suboptimal performing modules in a phased approach, the system can be renewed completely over time. Typically, receiver and signal processor subsystem is the first to be replaced. Next can be a new transmitter or a completely integrated Non-Rotating Array (NORA) radar antenna. A modular renewal strategy involves gradually substituting parts of the radar system with newer modules, allowing for a phased transition to a state-of-the-art system. This approach maintains continuous operation and spreads the financial burden.

The cornerstone of airport surveillance
Intersoft Electronics’ Modular ASR (ASR-M) stands at the forefront of radar technology.

processing capabilities, which enable superior detection and tracking of aircraft with exceptional accuracy and reliability. True 3D height detection and sub-clutter visibility are differentiating features of ASR-M. Leveraging high-resolution radar technologies, ASR-M provides enhanced coverage and precision, ensuring comprehensive airspace surveillance, even in challenging environments.

One of the key strengths lies in its modular integration capabilities. Designed to seamlessly integrate with existing air traffic management systems, ASR-M facilitates a cohesive and coordinated approach to airspace surveillance. This integration enhances situational awareness and enables more effective decision-making for air traffic controllers.

In addition to its advanced capabilities in detection and tracking, ASR-M modules are characterized by their reliability and redundancy. Incorporating redundant components and fault-tolerant technologies, ASR-M ensures continuous operation and high availability, even in adverse conditions.

Scalability and adaptability are also key features of ASR-M. Its modular design allows

for easy upgrades and expansion, enabling it to adapt to evolving operational requirements and technological advancements. This flexibility ensures that systems remain at the forefront of airspace surveillance technology, capable of meeting the demands of future airspace environments.

Compliance with regulatory standards is another important aspect. Developed to meet stringent international and national regulatory requirements, ASR-M ensures safe and compliant operation in various airspace environments, providing peace of mind to airspace authorities and operators.

Overall, Intersoft Electronics’ ASR-M technologies represent a significant advancement in airspace surveillance and management. With its advanced capabilities, seamless integration, reliability, and scalability, ASR-M sets a new standard for air traffic surveillance, enhancing safety, efficiency, and security in the skies.

From concept to product

Non-Rotating Array (NORA) radar antennas have transitioned from conceptual innovations to tangible products now available in the air traffic management (ATM) market. These advanced integrated systems have been developed over the past years and are now being commercialized. NORAs are the ultimate modular ASR-M subsystem.

With the advent of cutting-edge electronic scanning technologies and reliable, maintenance-efficient designs, NORAs are being deployed in real-world applications, revolutionizing air traffic surveillance and management. Their availability as market-ready products signifies a major leap forward, providing air traffic controllers with enhanced tools to ensure safer and more efficient airspace operations. NORA radar antennas offer several advantages over



Above: Integrated NORA setup with radome
Below: NORA antenna with integrated power distribution

The reduced mechanical complexity of NORA antennas also translates to lower energy consumption, contributing to more sustainable and cost-effective operations. With no moving parts, these systems are inherently more energy-efficient, aligning with increasing demands for environmentally friendly and economically viable solutions in air traffic management and surveillance.

A NORA offers a comprehensive upgrade by not only replacing the traditional rotating antenna but also integrating the power electronics within the same unit, effectively eliminating the need for a separate transmitter rack and high power signal transmission lines, including rotary joints. This integration streamlines the radar system, reducing the overall footprint and further simplifying installation and maintenance. Additionally, the integration of power electronics within the array enhances power efficiency, as the system can directly manage power distribution more effectively.

Overall, the advantages of NORA antennas, including continuous 360-degree coverage, higher update rates, reduced maintenance, improved detection accuracy, installation flexibility, and lower energy consumption, make them a superior choice for modern air traffic surveillance and management needs. These benefits enhance safety, efficiency, and reliability, ensuring that air traffic control systems can effectively meet the challenges of contemporary and future airspace environments.

NORA radar antennas have now become commercially available for both ASR and en-route radar applications. For ASRs, NORA technology delivers real-time, precise tracking of aircraft in the vicinity of airports, improving safety and efficiency, crucial for busy airport environments. For long-range radar, these systems ensure comprehensive monitoring of aircraft over large distances, enhancing en-route navigation and safety. Their commercial availability underscores their

reliability and readiness for deployment in diverse and demanding airspace environments, providing air traffic controllers with the superior tools they need for maintaining secure and efficient airspace management. ▽

traditional rotating antennas, making them an increasingly attractive option for modern air traffic management and surveillance applications.

One of the primary benefits of NORA radar antennas is their ability to provide continuous 360-degree coverage without the mechanical limitations associated with rotating systems. This continuous coverage ensures more accurate and timely detection and tracking of aircraft, enhancing situational awareness and safety.

The non-rotating design eliminates the mechanical wear and tear that rotating systems experience, resulting in lower maintenance requirements and longer operational lifespans. This leads to increased reliability and availability of the radar system, reducing downtime and maintenance costs.

Furthermore, NORA antennas can achieve higher update rates by applying multiple simultaneous beams.

This rapid electronic update capability is crucial for detecting and responding to fast-moving aircraft and other dynamic airspace situations. It allows air traffic controllers to make more informed and timely decisions, enhancing overall air traffic management efficiency.

The fixed nature of NORAs also allows for the use of advanced electronic scanning technologies. These technologies enable precise control over the radar beam, improving detection accuracy and resolution. This capability is particularly beneficial in cluttered or challenging environments, where distinguishing between different objects and accurately tracking their movements is critical.

In addition to the improved performance benefits, NORA antennas offer much greater flexibility when they are installed and deployed. Without the need for a rotating mechanism, these radar systems are very easy to install in a variety of different locations, including on towers, rooftops, and mobile platforms. This flexibility can be particularly advantageous for in areas with limited space or in rapidly changing operational environments.



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