Project ORION: Pioneering Europe's Leadership in Operator-Agnostic Multi-Orbit Phased-Array SATCOM

Abstract

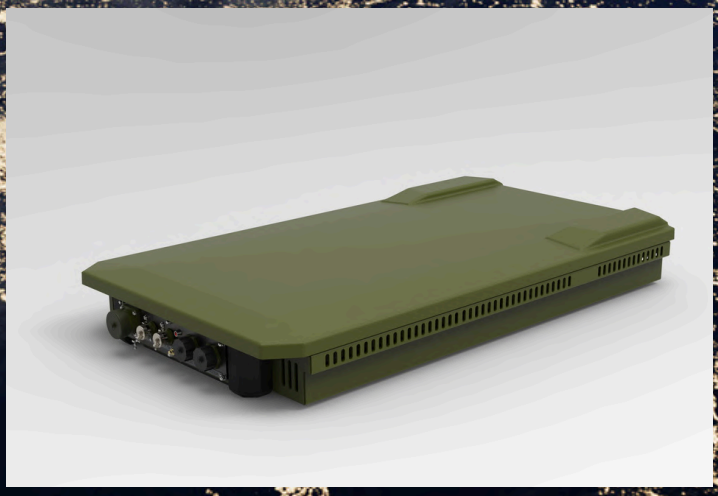
ReQuTech AB is a leading European developer of advanced, operator-agnostic, electronically steered phased-array antenna systems engineered for high-mobility, resilient, and multi-orbit communication environments.

Building on a strong industrial foundation and its longstanding partnership with the European Space Agency (ESA), the company has advanced the ORION programme—encompassing ORION, ORION II, and the forthcoming ORION III—into a flagship European initiative for dual-use, governmental, and high-performance commercial antenna technologies, with a primary focus on Ka-band systems.

The ORION programme supports key European strategic priorities, including autonomy, operator independence, and secure, resilient connectivity across LEO, MEO, and GEO networks. Its alignment with IRIS² objectives and technology roadmaps positions ORION as a strong candidate for future secure European satellite communication terminal ecosystems.

RESA L Ka on the move application

RESA L Ka fully integrated satcom terminal



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Executive Summary

ReQuTech AB is a European leader in advanced antenna systems, delivering operator-agnostic, electronically steered phased-array technologies for demanding mobility, resilience, and multi-orbit applications. With a strong industrial base in Europe and a growing global footprint, ReQuTech develops mission-critical communication platforms designed to meet the evolving requirements of governmental, defence, and dual-use applications.

Through a long-standing and strategic collaboration with the European Space Agency (ESA), the ORION programme—spanning ORION, ORION II, and the forthcoming ORION III—has matured into a cornerstone European effort for the development, validation, and transition to market of dual-use, governmental, and high-performance commercial multi-orbit electronically steered antenna (ESA) platforms, with particular focus on Ka-band systems. The programme addresses key European priorities, including strategic autonomy, operator independence, and resilient satellite communications across LEO, MEO, and GEO constellations. These are in-line with the IRIS^2 efforts in terms of frequency band of operations and technology readiness levels. This alignment positions ORION as a relevant terminal technology candidate for future European secure connectivity infrastructures, including IRIS^2-related user terminal ecosystems.

RESA L Ka on the move application

RESA L Ka fully integrated satcom terminal

ORION is conceived as a scalable and versatile terminal architecture, not a single constellation-specific product. Its operator-agnostic design enables interoperability with multiple satellite operators, full duplex, modularity, and network architectures, reducing vendor lock-in while supporting multi-orbit redundancy and long-term adaptability. The programme has progressed from foundational technology validation (ORION), through integrated system demonstrations and mobility use cases (ORION II), and now enters ORION III—focused on continuous validation, industrialization, certification readiness, and commercial deployment.

This whitepaper presents the technical achievements, system evolution, and forward roadmap of the ORION program, demonstrating ReQuTech's commitment to delivering a European, sovereign, and globally competitive SATCOM capability suitable for future defence, governmental, and high-performance commercial missions.

Problem description

Satellite communications are undergoing a fundamental transformation driven by the rapid deployment of new space constellations, the emergence of hybrid LEO/MEO/GEO multi-orbit architectures for Ka band, and increasing demand for resilient, low-latency connectivity in mobile and distributed environments. These developments are reshaping requirements across civil, governmental, and commercial sectors, where flexibility, continuity of service, and long-term adaptability have become key system drivers.

ReQuTech's goal is to provide a solution for the end customers—whether operating in governmental or dual-use contexts— for an open terminal architectures and resilience against geopolitical, regulatory, and commercial constraints. Systems that preserve customer control over usability, availability, and operational choice are essential for long-term service continuity. Open and interoperable terminal architectures enable users to select operators, constellations, and service models based on operational needs rather than external dependencies. This approach supports transparency, competition, and resilience while reducing long-term vendor and geopolitical lock-in.

Furthermore, conventional mechanically steered terminals and constellation-specific solutions face growing limitations in meeting these evolving needs. Future SATCOM systems must support seamless operation under motion, rapid satellite handover, and interoperability across multiple operators and orbital regimes, while remaining adaptable to future network evolutions and regulatory frameworks.

To address these challenges, ReQuTech initiated Project ORION in 2021. ORION was conceived as a dual-use technology development programme aimed at designing, implementing, and validating a fully electronically steered, multi-beam phased-array terminal architecture capable of operating across LEO, MEO, and GEO satellite networks. From the outset, the programme has emphasized operator agnosticism, modularity, and scalability to ensure applicability across a broad range of civil, governmental, and commercial use cases.

RESA L Ka is designed as an On-The-Move (OTM) and On-The-Pause (OTP) electronically steered SATCOM terminal for wideband civil and governmental Ka-band applications. The terminal employs separate receive and transmit phased-array apertures enabling full-duplex operation, supports operation across LEO, MEO, and GEO constellations, and provides fully electronic polarization switching in linear and circular modes (LP, LHCP, RHCP).

ORION Platform – Functional Overview

Functionality	Description
On-The-Move / On-The-Pause Operation	Designed for reliable On-The-Move (OTM) and On-The-Pause (OTP) operation in harsh and dynamic environments. The system maintains continuous satellite connectivity during motion as well as rapid deployment in stationary use cases.
Resilient Tracking & Navigation	All tracking algorithms and control functions are fully integrated and designed to operate in GPS-denied or degraded navigation environments, using sensor fusion and autonomous beam control.
Multi-Orbit Capability	Native multi-orbit architecture supporting operation across LEO, MEO, and GEO satellite networks, enabling orbit diversity, redundancy, and seamless handover between orbital regimes.
Mesh Functionality	Supports advanced multi-beam and mesh networking, enabling simultaneous links over Ku- and Ka-band. The architecture allows smart dimensioning of effective apertures and dynamic resource allocation between beams.
Fully Electronic Beam Steering & Polarization Control	Fully electronic scanning with no mechanical movement. Polarization is electronically selectable for both receive and transmit, supporting linear (including skew) and circular polarization (LHCP / RHCP).
Full Duplex Operation	Independent receive and transmit sections enable true full-duplex operation, allowing simultaneous uplink and downlink and flexible adaptation to different network and mission requirements.
Modem Integration & OpenAMIP Support	Supports internal and external modems. OpenAMIP-compliant interface enables standardized modem control and interoperability, including demonstrated integration with LEO constellations such as OneWeb (Ku-band).
Modular System Design	Fully modular architecture with separable antenna, RF, control, and interface modules. This allows scalable configurations, technology upgrades, and adaptation to different platforms and use cases without full system redesign.
Construction & Environmental Design	ESA-developed terminal with fully integrated ruggedized construction, including thermal management. The system is designed for outdoor operation with IP65-level environmental protection.
Future Scalability	Architecture designed to support future waveform, modem, and constellation integration through software updates and modular hardware evolution, ensuring long service life and adaptability.

Orion Project phases

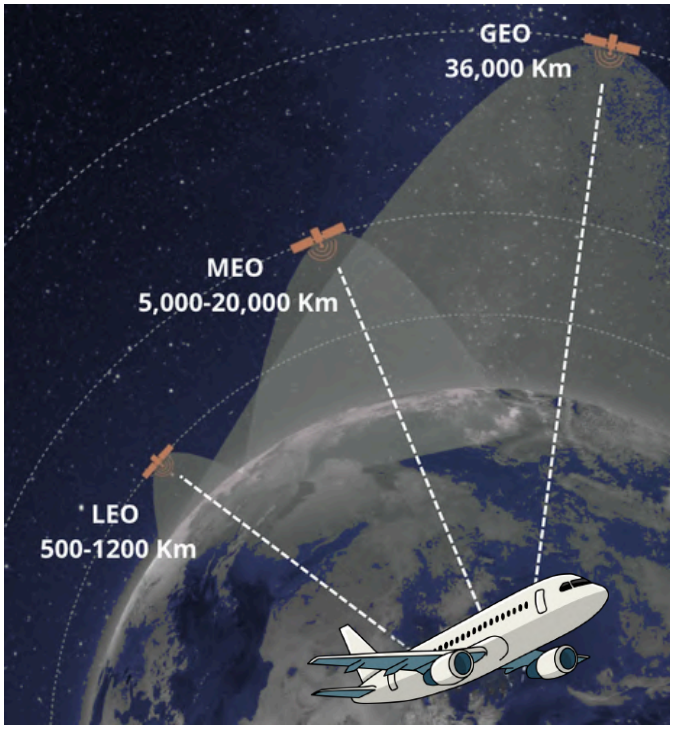
Through a close and long-standing collaboration with the European Space Agency (ESA), ORION has benefited from a structured framework for technical guidance, system-level validation, and collaborative innovation. This partnership has enabled the accelerated maturation of key phased-array technologies while ensuring alignment with European priorities in innovation, industrial competitiveness, and strategic autonomy.

Together, ReQuTech and ESA are advancing a European, dual-use phased-array SATCOM capability that supports both civil and governmental applications, reduces dependency on single-vendor or single-constellation solutions, and strengthens Europe's position in the global SATCOM market.

Orion (2021–2023): Foundations of a Ka-band Multi-Orbit Breakthrough

Project ORION began with the objective of creating an electronically steered multi-beam antenna for Ka band with a patented Mesh network functionality suitable for hybrid LEO/MEO/GEO mesh networking. This initial phase validated several critical technologies:

Multi terminal Local area mesh network can allow smart harvesting and convoys with long distance command and control



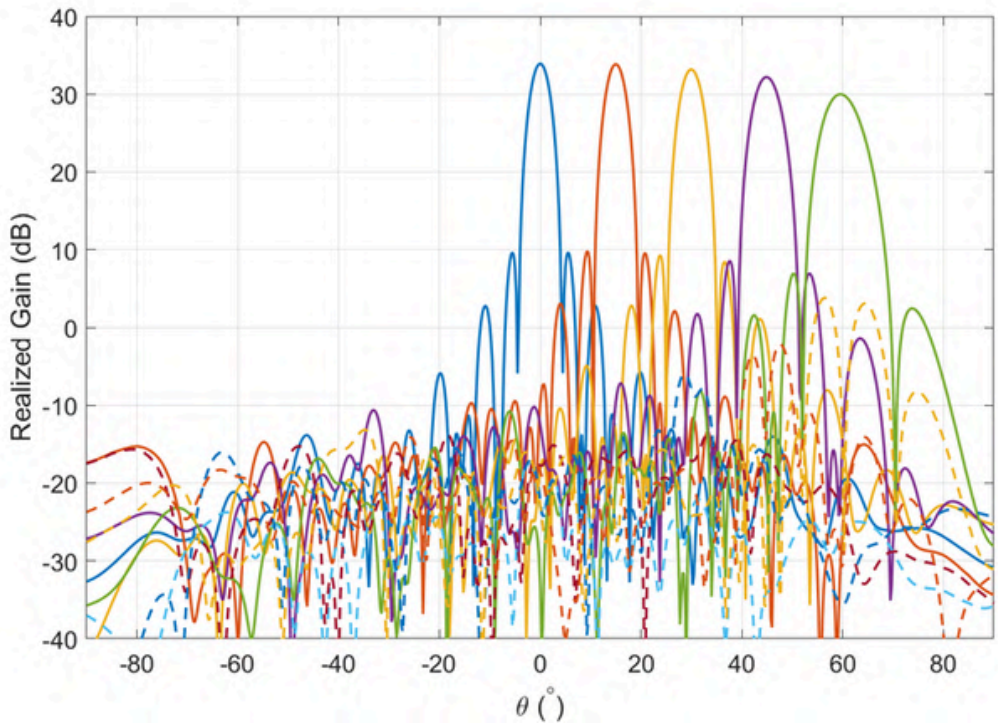
Multi terminal mesh network on one airplane can allow for full hemispheric coverage and handover between satellites for LEO/MEO/GEO functionality

Key Achievements

- Development of a multi-beam phased-array architecture enabling simultaneous links across orbits.
- Successful prototype testing across LEO, MEO, and GEO constellations in collaboration with ESA.
- Demonstration of dynamic beam steering with ultra-low switching latency.
- Proof of a mesh-capable network layer supporting multi-node connectivity.

ESA's involvement ensured rigorous validation, high-fidelity test environments, and conformance with future Satcom standards. Their support was instrumental in confirming the system's disruptive potential.

Orion Project phases



Realized antenna patterns on transmit for various scanning angles. With algorithms for cross-polarization suppression and aperture tapering implemented.

ORION II (2023–2025): From Prototypes to Pre-Market Technology

Launched in August 2023, ORION II continued our joint mission with ESA to bring the technology from concept to a fully integrated system.

Core Objectives

- Finalize antenna architecture and RF design.
- Validate the platform in Comms-On-The-Move (COTM) scenarios.
- Demonstrate real-world mesh-networking performance.
- Prepare for trials with a Tier-1 European client by late 2024.

Challenges and Achievements

The primary technical challenge was maintaining mesh network performance under dynamic movement, particularly when simultaneously tracking satellites across multiple orbits.

Requtech's engineering teams successfully advanced the antenna control algorithms, beam-management logic, and multi-orbit handover processes, confirming the system's suitability for high-demand mobility applications.

The outcomes of ORION II were recognized by ESA as groundbreaking, paving the way for the continuation of the program.

Orion Project phases

ORION III: Full production, Commercialization, Continuous Validation

Building on the success of the first two phases, ORION III will enter a new era: continuous validation, industrialization, and market deployment.

Going into the Orion III project the company production stability has reached a high yield antenna manufacturing and will continue on that roadmap.

With ESA's continued support, ORION III will:

- Mature the Requtech phased-array platform into a commercial-ready multi-orbit terminal.
- Expand cross-orbit mesh networking capabilities with enhanced resiliency and throughput.
- Validate performance across new and emerging European and global constellations.
- Strengthen Europe's industrial sovereignty in advanced antenna technologies.
- Prepare Requtech for mass-production scalability and deployment across aviation, maritime, land mobility, and governmental application sectors.

Requtech's Role as a European and Global Leader

Requtech's phased-array technology is built in Europe, for Europe, and for the world.

We are proud to contribute to a competitive European SATCOM ecosystem, supporting the ambitions of ESA, the EU, and the global market.

Our Core Strengths

- Deep expertise in multi-orbit phased-array design for Ku and Ka band
- Full vertical integration of RF, digital, and control electronics
- Proven capability in COTM and multi-beam applications
- Close technical partnership with ESA for validation and co-development
- A rapidly growing reputation as a world leader in multi-orbit ESA terminals

Leadership Voices

Quote from Dr. Omid Sotoudeh, CEO & Founder of ReQuTech AB

"The ORION program represents not only a technological milestone, but a clear demonstration of Europe's capability to lead the next era of global satellite communications. Through our collaboration with ESA, Requtech has transformed advanced phased-array innovation into a reliable, multi-orbit platform ready for commercial deployment.

As we move into ORION III, we remain fully committed to driving European excellence, strengthening industrial autonomy, and delivering world-leading SATCOM solutions for mobility, resilience, and multi-orbit connectivity. We now want to continue our validations with the leading Operators on Ka and Ku band and together launch the various terminals needed for the required verticals."

Quote from Dr. Giovanni Toso IEEE Fellow, European Space Agency (ESA)

"Requtech's achievements within the ORION program exemplify the impact that strong European partnerships can deliver. The progress made in multi-orbit, electronically steered antennas has been remarkable, and the results of ORION programme clearly demonstrate the potential of this technology for future satellite networks.

ESA is pleased to continue supporting Requtech into the next phase of development, ensuring rigorous validation, continued innovation, and a path toward a fully market-ready European SATCOM capability."

Conclusion

The ORION program represents far more than a technological milestone; it exemplifies how collaborative innovation can accelerate the next generation of satellite communication capabilities. While rooted in a strong European industrial base and supported by ESA, the programme ultimately reflects a broader commitment: delivering globally competitive, operator-agnostic connectivity solutions that meet the real operational needs of users, regardless of geography, mission profile, or network preference.

Through Requtech's engineering excellence and ESA's continued support, ORION III will advance one of the world's most capable multi-orbit phased-array platforms. Its combination of electronically steered performance, open architecture, and multi-operator interoperability positions the technology to serve a wide spectrum of users, from mobility operators to governmental entities. While reinforcing Europe's role as a trusted contributor to global SATCOM innovation, rather than promoting European-origin technology as a value in itself. Our goal is to ensure performance, reliability, and flexibility speak for themselves.

To illustrate the platform's versatility, ORION-derived technology is already proving its value in demanding real-world scenarios. For example, the RESA L Ka terminal, built on foundations laid during phases of the ORION programme, is being deployed in applications where secure, resilient, and high-throughput land and maritime communications-on-the-move are essential. In these environments, users require uninterrupted connectivity during dynamic operations, rapid handover between satellites, and the ability to operate on different constellations without lock-in.

While specific customers and mission profiles remain confidential, these deployments demonstrate how the technology enables situational awareness, mission coordination, and robust connectivity in highly mobile or remote environments.

Looking ahead, ORION III will deepen this trajectory by focusing on technical maturation, industrial scalability, and continuous cross-orbit validation. Requtech remains firmly committed to innovation, responsible leadership in next-generation antenna technologies, and long-term collaboration with ESA and global partners.

Together, we will continue expanding what is possible in satellite communication, driving performance, increasing resilience, and enabling a new era of flexible, operator-agnostic multi-orbit connectivity tailored to the real needs of users around the world.

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Requtech AB, based in Linköping, Sweden, is at the forefront of satellite communication technology. We specialize in developing high-performance, reliable satellite communication systems. Our mission is to revolutionize communication capabilities, enhancing global connectivity through innovative solutions.

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