White Paper

COCHISA – European Core-Chip for Space Applications

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Introduction

The European Union has long recognized the importance of space as a driver of economic growth, innovation, and security. Satellite-based services already underpin roughly 10% of the EU's GDP, supporting navigation, communications, and Earth observation applications across all sectors of society (European Commission, 2023). Yet despite Europe's strong record in flagship programs such as Galileo, Copernicus, and GOVSATCOM, the continent remains dependent on non-European suppliers for several critical space technologies.

One such technology is the beamforming core-chip, a central building block for phased-array antennas used in satellite communications and Earth observation. These chips integrate key functions such as transmit/receive switching, gain control, phase shifting, and signal amplification. Without indigenous European solutions, manufacturers must rely on non-European vendors, often subject to U.S. export control restrictions under ITAR. This dependency undermines Europe's ability to act autonomously in space and slows down industrial competitiveness.

The COCHISA project (European Core-Chip for Space Applications) was launched under Horizon Europe to close this strategic gap. Running from November 2022 to October 2026, COCHISA is developing radiation-hardened, multi-channel beamforming chips in X-band (10 GHz) and Ka-band (28 GHz) using advanced SiGe BiCMOS technology. Beyond chip design, the project will demonstrate innovative packaging approaches and build a 100% European value chain, ensuring that Europe can access and exploit this key enabling technology free from foreign restrictions.

Motivation: Why Europe Needs COCHISA

Strategic Autonomy in Space

Space is increasingly a contested and strategic domain. The European Defence Industrial Strategy (2024) explicitly highlights the need for independent European access to critical space technologies to support both civilian and defence applications. In satellite communications, the reliance on foreign components has already posed challenges to export opportunities, with ITAR restrictions limiting Europe's ability to sell fully European-built systems to non-EU customers. Developing ITAR-free solutions like COCHISA is therefore not only a matter of technical capability, but also of geopolitical resilience and market competitiveness.

Economic Opportunity

The global space economy is expanding rapidly, with estimates placing its size at over USD 500 billion in 2024. Europe, however, accounts for only around 10% of global public space investments, while the United States and China dominate (OECD Space Forum, 2023). To maintain competitiveness, Europe must specialize in areas where it can both innovate and lead. Advanced integrated circuits for beamforming are precisely such an area.

Supporting European Flagship Programs

European programs such as IRIS², Copernicus NextGen, Galileo, and GOVSATCOM all require advanced antenna systems capable of handling large volumes of data securely and efficiently. Phased-array technology, underpinned by beamforming chips, enables satellites to switch beams dynamically,

connect with multiple users, and optimize bandwidth usage. Without European-developed chips, these flagship programs risk reliance on non-EU suppliers.

Bridging the Technology Gap

Existing solutions are often based on GaAs technology and are manufactured outside Europe. COCHISA proposes a different path: SiGe BiCMOS technology to integrate RF, analog, and digital functions on a single chip; radiation-hardened designs capable of surviving harsh space environments; and plastic, non-hermetic MMIC packaging, reducing cost while still withstanding the stress of launch and orbital operation.

Project Objectives

The main objectives of COCHISA are:

1. Develop European X-band and Ka-band core-chips with integrated beamforming functionalities, scalable channel counts, and radiation hardening.

2. Demonstrate TRL 7 for the X-band chip by the end of the project, validating performance in a relevant operational environment.

3. Build a 100% European supply chain, from semiconductor design and wafer production to packaging and qualification.

4. Pioneer non-hermetic MMIC packaging for space, lowering cost barriers and aligning with New Space commercial requirements.

5. Enable cross-sector applications, ensuring that chips developed for space can also support terrestrial defence, telecommunications, and radar applications.

Technical Approach

COCHISA's approach combines expertise in semiconductor design, radiation-hardening techniques, and advanced packaging. The core-chips integrate multi-channel RF switching (RX/TX), phase and amplitude control for phased-array beam steering, digital control via SPI interfaces, and on-chip amplification for improved efficiency.

A unique innovation is the introduction of non-hermetic plastic packaging. While conventional space MMICs rely on expensive hermetic packages, COCHISA demonstrates that robust plastic packaging can meet launch and orbital conditions, dramatically reducing cost and enabling larger-scale deployments.

The chips are fabricated using SiGe BiCMOS technology, a platform that combines high-speed bipolar transistors for RF performance with CMOS logic for integration and digital control. This makes it especially suitable for highly integrated, compact beamforming solutions.

Consortium

COCHISA unites a consortium of European research institutes, industry partners, and system integrators, each bringing critical expertise:

- IHP Solutions GmbH (Germany) – project coordinator, responsible for project management exploitation and dissemination.

- IHP – Leibniz-Institut für innovative Mikroelektronik (Germany) – chip design, chip fabrication and providing radiation-hardening concepts, and circuit design methodologies.

- IMST GmbH (Germany) – chip design.

- Thales Alenia Space (Italy) – system-level requirements and satellite integration perspective.

- Thales Alenia Space (France) – System requirements

- Alter Technology (France) – qualification, testing, and reliability assurance.

- Neways Advanced Microsystems (Netherlands) – advanced semiconductor packaging and production.

- Paradigma (Slovenia)- qualification, testing, and reliability assurance

This partnership ensures full coverage of the value chain, from design and wafer processing to packaging, qualification, and system demonstration, all within Europe.

Expected Impact

Industrial & Technological Impact

- Establishing European non-dependence in RF beamforming ICs.

- Positioning Europe as a competitive supplier in global satellite communications markets.

- Demonstrating TRL 7 prototypes, enabling fast industrial uptake.

Economic Impact

- Lowering costs for European satellite manufacturers through plastic MMIC packaging.

- Enabling participation in global LEO constellations and secure communications markets.

- Supporting Europe's share of the rapidly growing global space economy.

Strategic Impact

- Strengthening Europe's autonomy in space.

- Ensuring compliance with EU security and sovereignty objectives.

- Providing ITAR-free components for international markets.

Conclusion

The COCHISA project is a cornerstone initiative for Europe's future in space technology. By developing radiation-hardened, scalable X-band and Ka-band beamforming chips, and by establishing a complete European supply chain, COCHISA ensures that Europe will no longer rely on foreign suppliers for one of the most critical technologies in next-generation satellites.

This project directly supports European flagship programs, strengthens Europe's role in the global space economy, and contributes to the broader goal of strategic autonomy in space and defence. With a clear technical roadmap, a strong consortium, and alignment with EU space and semiconductor strategies, COCHISA is positioned to deliver transformative impact for Europe.

Sources

- COCHISA Project Website: https://cochisa-project.eu/

- European Defence Industrial Strategy, 2024: https://defence-industry-space.ec.europa.eu

- OECD Space Forum, The Space Economy in Figures, 2023: https://www.oecd.org/sti/inno/space-economy-in-figures.htm

- European Commission, Space Strategy for Europe: https://defence-industry-space.ec.europa.eu/eu-space-policy_en