STEP

SILICON AND T2SL EUROPEAN COLLABORATION FOR A NON-DEPENDENT SUPPLY CHAIN FOR LARGE ESWIR FPAS "STEP"

STEP EU - PROJECT

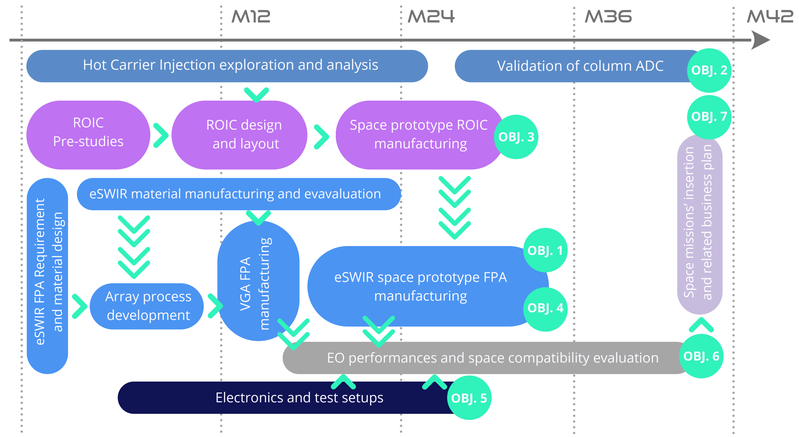
WWW.STEP-PROJECT.EU

THE STEP CONCEPT

The STEP project aims at establishing European autonomy in space technology by developing a full European supply chain for Type-II Superlattice (T2SL) based on extended Short Wave InfraRed (eSWIR) Focal Plane Arrays (FPAs). This initiative brings together leading European institutions, including **Airbus Defence and Space, IRnova, Fraunhofer IAF, and ISAE-SUPAERO**, to innovate and produce affordable large format high-performance eSWIR FPAs essential for future space missions. Focused on T2SL technology, STEP will enhance imaging capabilities for Earth observation and beyond, ensuring strategic independence in critical space technologies.

TECHNOLOGICAL APPROACH

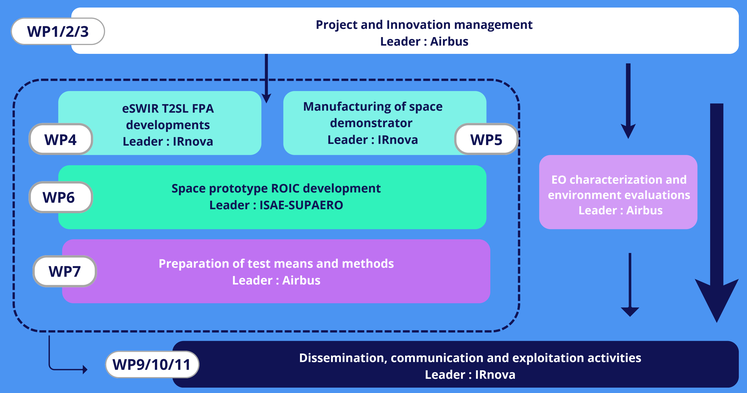
- eSWIR FPA Requirements Customization: Tailor eSWIR FPA requirements based on lessons learnt from Airbus's past and ongoing space developments, ensuring compatibility with future European space programs.
- eSWIR Material Design Enhancement: Upgrade T2SL PhotoDiode Array (PDA) material designs at IRnova to meet new eSWIR FPA requirements, with precise modeling for optimized performance.
- Material Manufacturing & Evaluation: Transfer design to Fraunhofer IAF for high-precision Molecular Beam Epitaxy (MBE) growth on 4" GaSb substrates, ensuring top-notch quality and uniformity.
- VGA FPA Process Development: Adapt and refine manufacturing processes for high-yield fabrication and hybridization of prototype eSWIR PDA, incorporating improved ARC development.
- ROIC Development: Design a high performances and large format ROIC by ISAE-SUPAERO with optimized functionalities for space, leveraging extensive CMOS Image Sensors design experience.
- Space Prototype Manufacturing: Design and fabricate a large format eSWIR PDAs compatible with the ROIC, focusing on uniformity and performance validation across large FPA areas.
- Electronics and Tests Setup Upgrade: Adapt IRnova's and Airbus's setups for comprehensive EO performance characterization and space environment compatibility validation.



AMBITIOUS SPECIFIC OBJECTIVES

- Objective 1: To validate the technology readiness of eSWIR T2SL for space applications by demonstrating high performance, space environment compatibility and high yield production of eSWIR FPAs with two FPA formats.
- Objective 2: To demonstrate the European non-dependence for eSWIR T2SL FPA production.
- Objective 3: To provide a suitable state-of-the-art Read Out Integrated Circuit (ROIC) optimized for Earth observation.
- Objective 4: To tailor eSWIR prototype FPA architecture and requirements to improve deployment for space business.
- Objective 5: To develop dedicated hardware and related software required to characterize and evaluate the T2SL eSWIR FPAs developed in the project.
- Objective 6: To characterize the main Electro-Optical performance of eSWIR VGA FPAs and eSWIR space prototype FPAs.
- Objective 7: To evaluate the capability of these FPAs to withstand critical space program environments.
- Objective 8: To set foundations for commercial exploitation and opportunities with the identified stakeholders and to define the roadmap for space mission insertion.

WORK DISTRIBUTION



- eSWIR FPA Requirements & Design: Airbus Defence and Space leverages its payload expertise to tailor eSWIR FPA requirements for future European Earth observation space missions.
- T2SL Material Design & MBE Growth: IRnova updates T2SL PDA designs, while Fraunhofer IAF ensures precise material growth, meeting stringent eSWIR specifications.
- FPA Manufacturing & Hybridization Process Development: IRnova optimizes manufacturing and hybridization processes for high-performance, large-area eSWIR FPAs.
- ROIC Development & Integration: ISAE-SUPAERO creates an advanced ROIC, incorporating space-specific features and operational flexibility.
- Prototype Manufacturing & Testing: IRnova fabricates PDAs for integration with ROICs, with Airbus conducting tests to validate performance and durability.
- Characterization Setup Upgrade & Performance Evaluation: Both IRnova and Airbus upgrade their setups to extensively characterize and evaluate FPA performance under space conditions.

IMPACTS

- **Strategic Autonomy:** Establish a robust, sustainable European supply chain for space technologies, directly contributing to securing critical technology supply.
- **Competitiveness Enhancement:** Develop affordable high-resolution sensors with superior performance, capturing new markets especially in Earth observation.
- **Broader Applications:** Successful demonstration expected to boost development of large format FPAs for additional wavelength ranges, bridging technological gaps.
- **New Space Market Expansion:** Facilitate the growth of IR observation channels in New Space markets, including small sat constellations and HAPS platforms, for diverse applications from hyperspectral imaging to CO2 monitoring.

PARTNERS

ISAE SUPAERO Institut Supérieur de l'Aéronautique et de l'Espace

IRnova

AIRBUS

Fraunhofer IAF

EVALUATION AND FUTURE STEPS

- ✓ **M7** **T2SL Wafer Delivery & Evaluation** *WP4 by Fraunhofer IAF*
- ✓ **M14** **ROIC Design Review** *WP6 by ISAE-SUPAERO*
- ✓ **M16** **Test Setup Upgrade TRR** *WP4 by IRnova*
- ✓ **M18** **High Performance VGA FPA Demo** *WP4 by IRnova*
- ✓ **M20** **ROIC Wafer Delivery to ISAE SUPAERO** *WP6 by ISAE-SUPAERO*
- ✓ **M22** **Airbus Test Setup Upgrade TRR** *WP7 by AIRBUS DS-F*
- ✓ **M23** **Space Prototype ROIC Wafer Validated** *WP6 by ISAE-SUPAERO*
- ✓ **M25** **First Space Prototype FPAs Delivery** *WP5 by IRnova to Airbus DS-F*
- ✓ **M26** **VGA FPAs Test Review Board** *WP8 by IRnova*
- ✓ **M30** **Second Space Prototype FPAs Delivery** *WP5 by IRnova to Airbus DS-F*
- ✓ **M35** **Protons Campaign Test Review Board** *WP8 by Airbus DS-F*
- ✓ **M42** **Space Prototypes FPAs Test Review Board** *WP8 by Airbus DS-F*

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