METASENSING
RADAR SOLUTIONS

From Space to Decisions: The Power of SAR Intelligence

MetaSensing's role in enabling next-generation SAR-driven applications

COMMERCIAL IN CONFIDENCE

Bridging the Gap: From Advanced SAR Payloads to Actionable End-User Intelligence

MetaSensing's role in powering the next generation of operational, user-centric downstream services

1 Transforming Key Sectors with High-Veracity Data

- **Operational Security & Governance:** Enabling 24/7 monitoring for border security and "Dark Vessel" detection through high-resolution SAR imagery.
- **Infrastructure & Agriculture:** Providing high-precision data for monitoring critical assets and crop growth, ensuring reliable decision-support regardless of weather or light conditions.

2 Scaling Global Solutions via High-Performance Payload

- **Smart Cities & Disaster Management:** Leveraging the SAR payloads to monitor urban stability and respond rapidly to environmental crises.
- **High-performance constellations:** Enhancing global services by delivering frequent, reliable, all-weather data through the integration of SAR into multi-sensor ecosystems.

3 Enabling Operational Intelligence for End-Users

- **Integrated and user-friendly platforms:** Transforming complex SAR data into actionable information, enabling fast decision-making even for non-expert users.
- **Scalable access to downstream services:** Ensuring continuous availability and efficient delivery of geospatial intelligence for large-scale operational applications.

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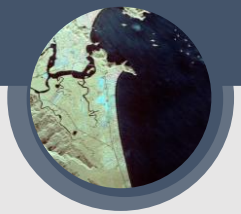
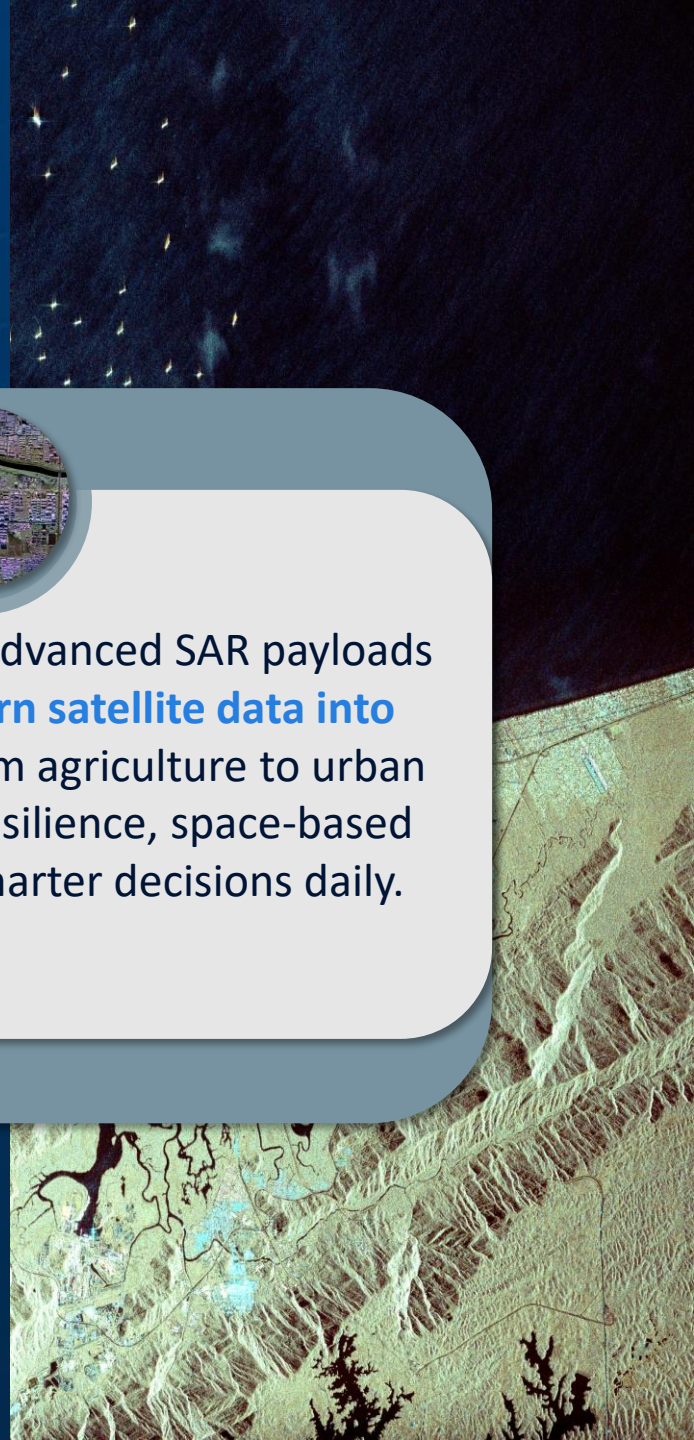
From Space To Smart Decisions

How Earth Observation Is Powering A More Sustainable World



Earth observation satellites are vital for understanding and managing our planet. Technologies like SAR (Synthetic Aperture Radar) allow us to **monitor Earth's surface accurately, anytime and in any weather**.

MetaSensing develops advanced SAR payloads that help industries **turn satellite data into actionable insights**. From agriculture to urban planning and climate resilience, space-based intelligence enables smarter decisions daily.



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From Data to Decisions: Actionable Insights from SAR Imagery

- The true value of Earth observation lies not merely in data acquisition, but in its ability to generate actionable insight and support operational decision-making.
- SAR systems, designed and engineered to ensure data quality, continuity, and reliability, enable consistent high-precision monitoring regardless of weather or lighting conditions.
- From crop analysis to infrastructure stability monitoring, SAR data allows the timely detection of changes, trends, and potential risks, supporting fast and informed decisions across a wide range of applications.
- MetaSensing is at the forefront of this evolution, developing advanced SAR payloads that transform data into reliable information, enabling scalable solutions for Earth observation and monitoring.

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MetaSensing: The Cutting-edge SAR Technology Provider

MetaSensing is a Hi-Tech SME specialized in the development and production of Synthetic Aperture Radar (SAR) technology for Defence, Commercial and Academic customers.

We provide cutting-edge SAR technology solutions empowering users to collect all-weather, day & night, high-resolution imagery intelligence.

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MetaSensing: 18 Years of Dedicated Radar Excellence

- MetaSensing specializes exclusively in the design and manufacturing of advanced SAR payloads for Space and Airborne missions.
- Serving Commercial and Defense customers worldwide with all-weather, day-and-night high-resolution imagery intelligence.
- MetaSensing does not compete with airborne or satellite operators. This non-vertically integrated model ensures we remain a trusted partner, providing modular solutions without conflict of interest.
- Cutting-edge technology across all frequency bands: (X, C, L, P, Ku, and Ka).

MetaSensing StarSAR-X in NOX

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One Group Across 3 Countries

MILANO | ROMA | CASSINO

Manufacturing, R&d, Sales, Production, Services, Business Development, Marketing, Customer Support, Hr

SINGAPORE

Commercial Hub, Strategy & Investment Planning

LEIDEN

Group Holding and Data Processing

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European Offices

Leiden (The Netherlands)

SAR Data Processing

Turin

Aircraft

Rome

BD & Marketing office

Milan

System design and real time algorithm development

Cassino /Rocca D'Evandro

Electromechanical design and assembly

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Key Clients & Partners Worldwide (Selection)

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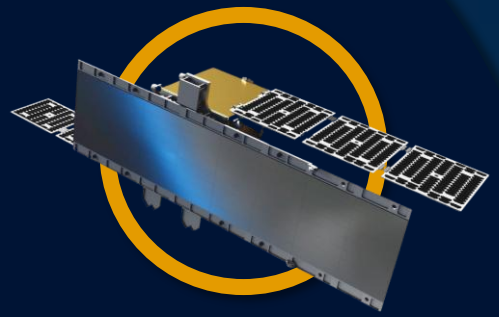
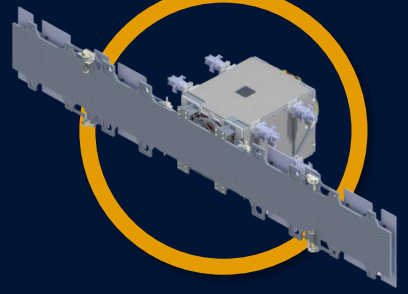


STARSAR-X

HIGH PERFORMANCE X BAND SPACEBORNE SAR

High-end sar payload for maximum performance, flexibility, and advanced imaging capabilities - Slant range resolution up to 0.125 m



PHOENIX

LOW MASS X BAND SPACEBORNE RADAR SYSTEM

Power-efficient sar payload optimized for microsatellites and scalable missions

GUARDIAN

MULTIMODE AIRBORNE SAR

X-band multichannel SAR for surveillance of critical wide areas. Real-time functions, high resolution, Scanning, Stripmap, Spotlight), GMTI, MMTI).

MetaSAR

COMPACT MULTI-CHANNEL MULTI-FREQUENCY SAR SENSOR

P-, L-, C-, X-, Ku-, Ka-bands available small size, low power consumption, particularly suited for small aircrafts or UAVs.

18 Years Of Sar Technology Solutions

2008

MetaSensing

Incubated by ESA Business Incubation Center

2010

First commercial high-resolution Airborne SAR

MetaSensing BV

Established European HQ

2015

FastGBSAR & MetaSAR Family systems completed

RadarSensing S.r.l.

For the in-house production of electro-mechanical components

2016

2x ESA tenders won for advanced Satellite SAR airborne demonstrator development

MetaSensing AP Pte Ltd

Founding of APAC HQ for development of commercial network

2017

Aircraft purchase

Development of Guardian & StarSAR-X

MetaSensing Italia S.r.l.

Creation of entity solely dedicated to Defense & Space

Last 5 years

2021

2023

2026

MetaSensing Srl

=

MetaSensing Italia + RadarSensing

SELECTED FOR
R&D PROJECTS FUNDING

KAISAR

NOCTUA

Agenzia Spaziale Italiana

MetaSensing Srl

PROGRAMMES

IRIDE

esa

CRISTALair

DRISHTI

GALAXEYE

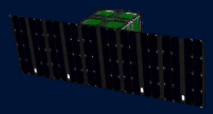
SAILS

Agenzia Spaziale Italiana

GUARDIAN

MILKOR

AIR | LAND | SEA | CYBER



MetaSensing Srl

PROGRAMMES

RADARSAT

KEPLER

SIRB

EDGE

HULEO

REMRED SPACE TECHNOLOGIES

FADA

ST Engineering

TII Technology Innovation Institute

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SAR Images

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SAR Polarimetric Images

Polarimetric X-band

Polarimetric L-band

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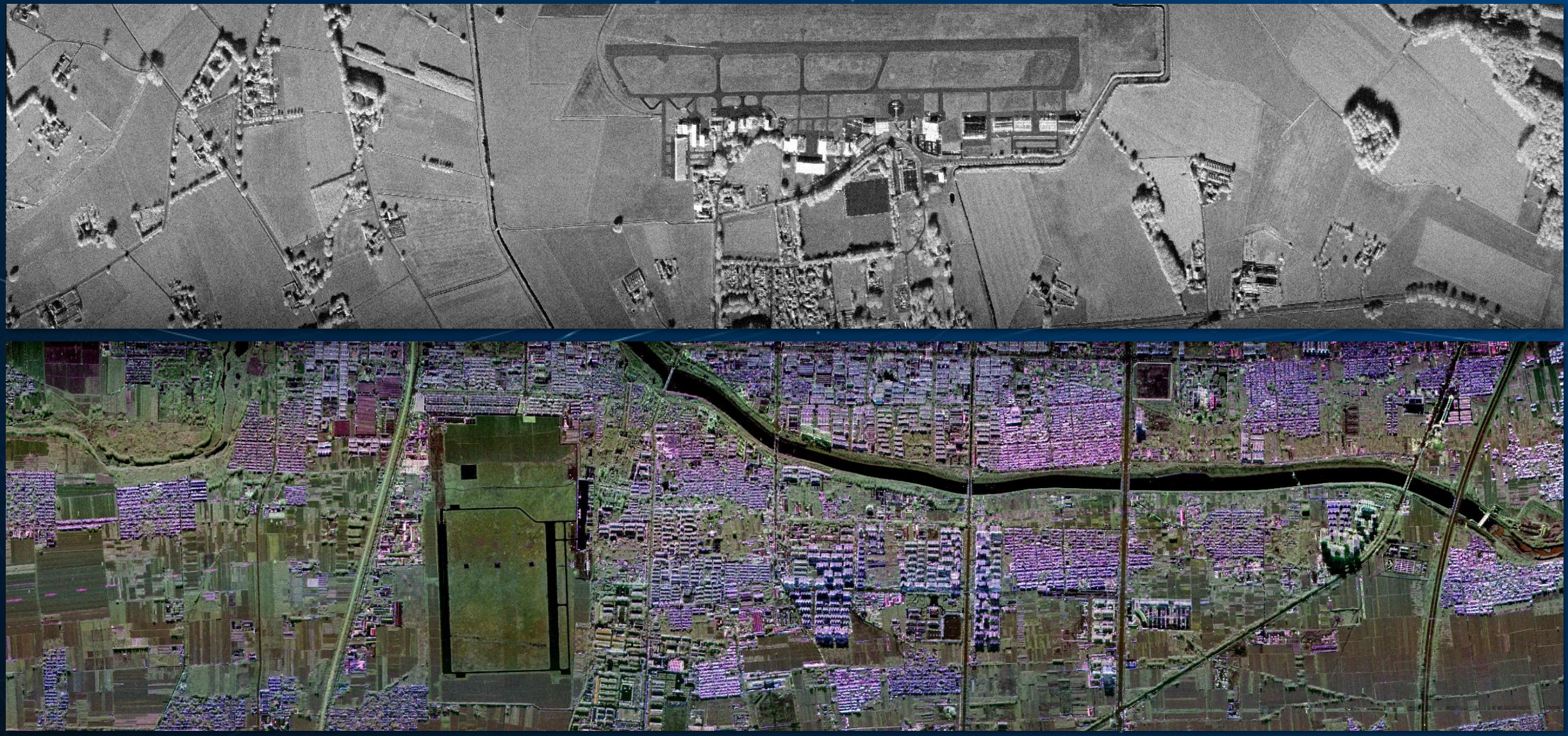
MetaSensing Airborne SAR Images



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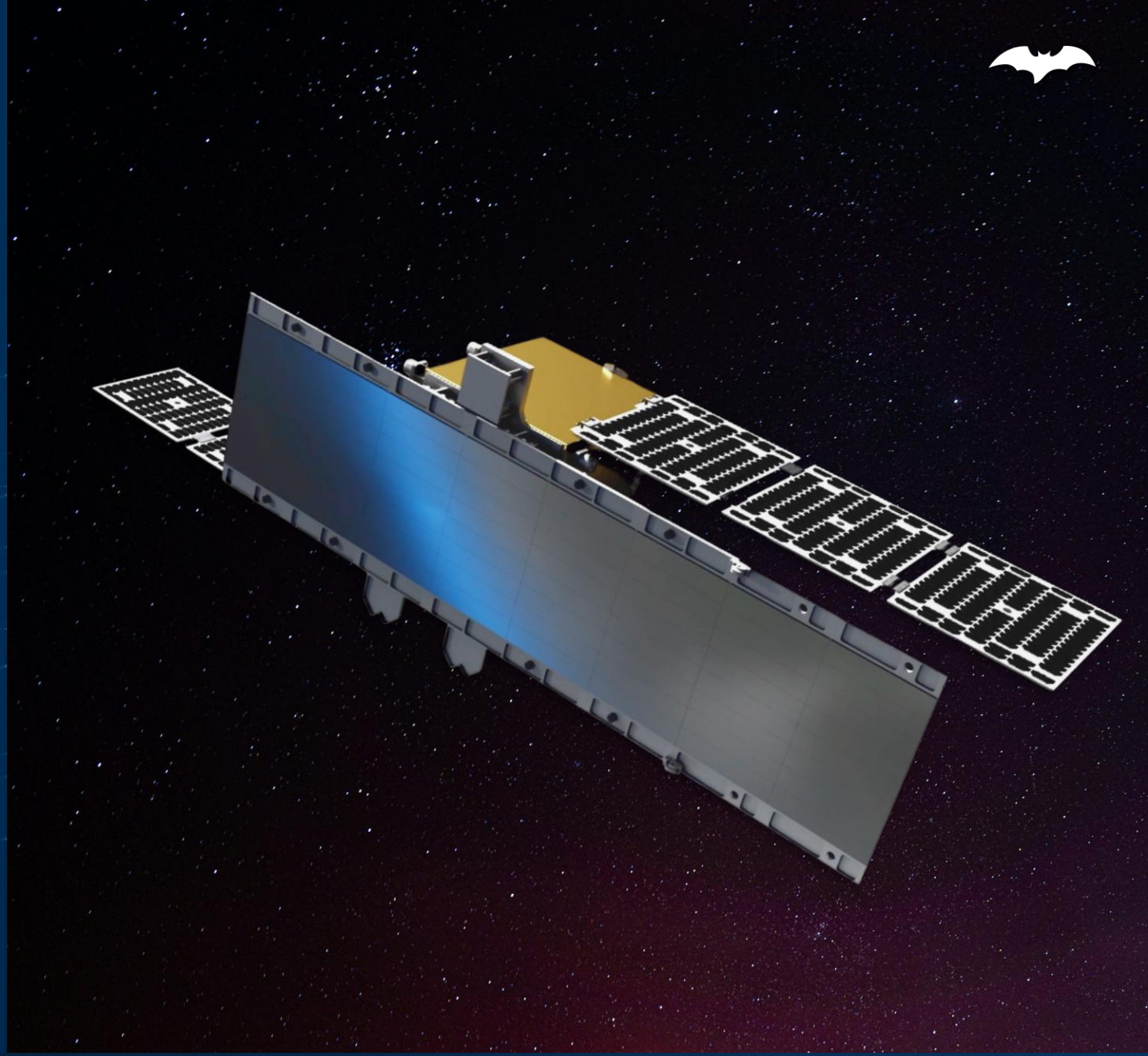
StarSAR-X

High-end SAR payload for maximum performance, flexibility, and advanced imaging capabilities



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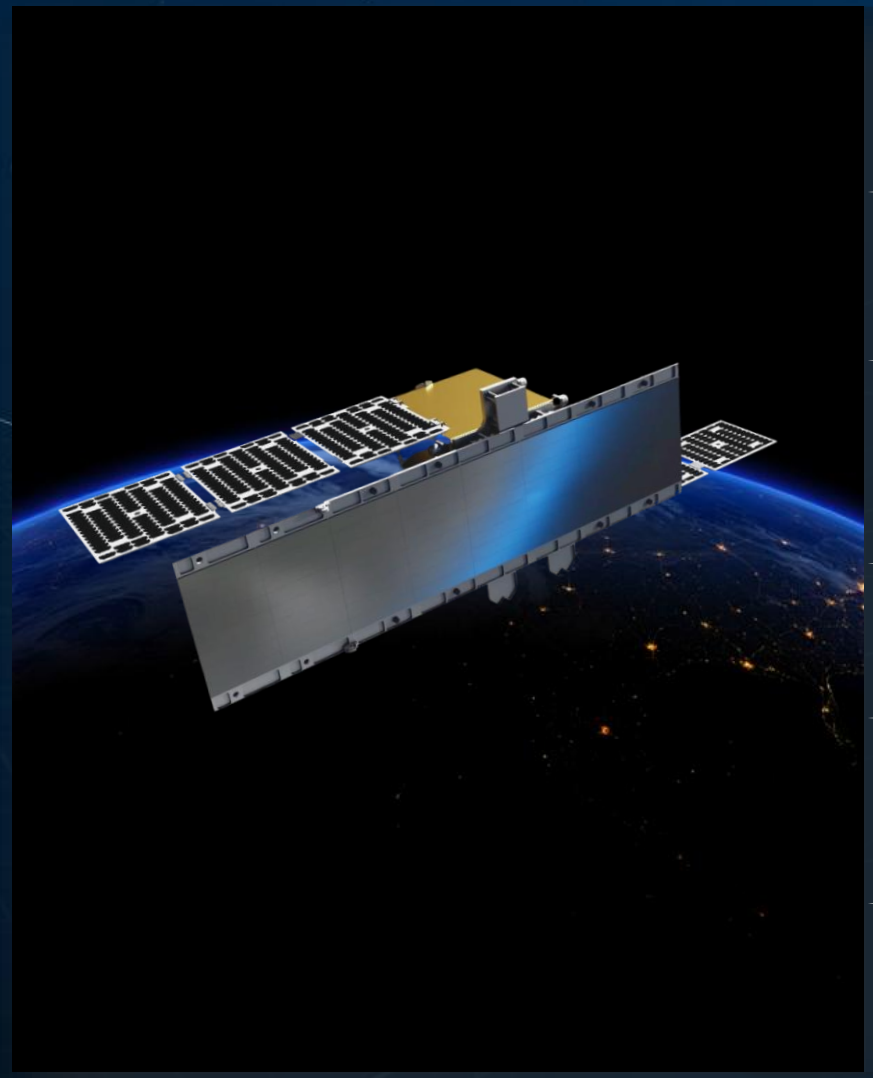
StarSAR-X SAR Payload



OVERVIEW

- The **StarSAR-X** is the **high performance X band** radar system which MetaSensing offers with the most advanced capabilities.
- It is a completely phased array radar system with electronic steering in both azimuth and elevation, enabling the implementation of all the SAR imaging mode: **Stripmap, Spotlight, ScanSAR, TopSAR.**
- Based on a **microstrip patch array antenna**, it comes both in single and full polaritazion configuration.
- The included calibration line and the **thousands of digital controlled Transmit/Receive Modules (TRMs)** allow for a very precise calibration of the generated SAR image, both in terms of phase stability and radiometric accuracy.
- With slant **range resolution up to 0.125 m**, the StarSAR-X is the right system for very high performance SAR images.

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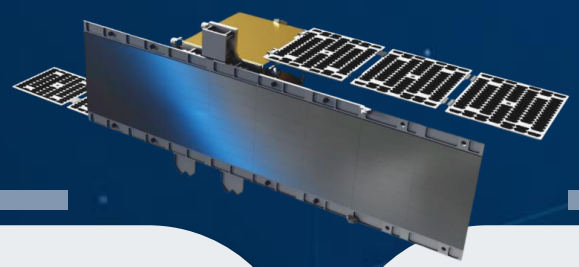
StarSAR-X SAR Payload



KEY FEATURES

- **High Performance X-Band Radar**: StarSAR-X offers top-tier performance for radar applications.
- **Fully Phased Array System**: Features electronic steering in both azimuth and elevation.
- **Versatile Imaging Modes**: Supports all SAR imaging modes, including Stripmap, Spotlight, ScanSAR, and TopSAR.
- **Microstrip Patch Array Antenna**: Built on advanced antenna technology for superior performance.
- **Multichannel Configurations**: Available in both single and digital multichannel for enhanced steering capabilities. 25 sec. dwell Spotlight acquisitions, at the highest possible resolution, without mechanical steering.

KEY BENEFITS

- **Advanced Capabilities**: StarSAR-X offers state-of-the-art features for optimal performance.
- **Versatility**: Supports a wide range of imaging modes, making it suitable for diverse applications.
- **Adaptability**: Multichannel configurations enable customization to meet specific mission requirements.
- **Superior Performance**: Built on advanced antenna technology for exceptional signal quality.
- **Enhanced Mission Effectiveness**: Provides reliable and precise data in various environmental conditions, ensuring mission success.

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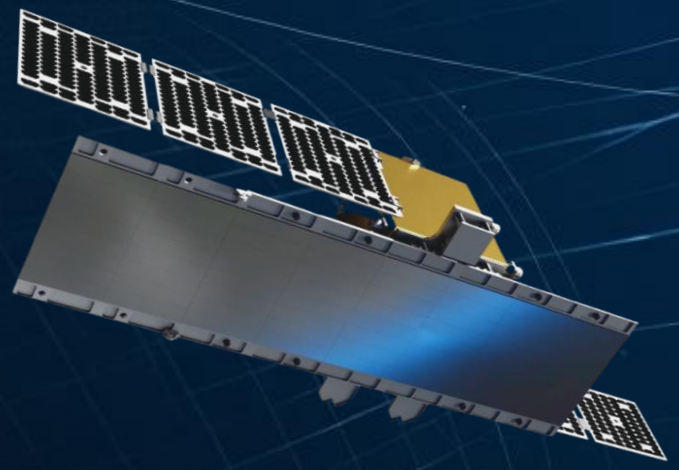
StarSAR-X SAR modular Payload configurations examples

Key Features:

- **Antenna Type:** Phased Array
- **Operating Frequency Band:** X-Band



Parameter	Config. 1 – 4x TRM-16 modules per tile, 8 tiles	Config. 2 – 5x TRM-16 modules per tile, 8 tiles	Config. 3:4x TRM-16 modules per tile, 10 tiles	Config 4: x TRM-16 modules per tile, 8 tiles
Radiating antenna dimension (elevation x azimuth)	(OPTION SSX-A)	(OPTION SSX-B)	(OPTION SSX-C)	(OPTION SSX-D)
Phase centers (elevation x azimuth)	0.35 x 3.2 m	0.44 x 3.2 m	0.35 x 4.0 m	0.70 x 3.2 m
Electronic Steering angle in Elevation	16 x 32	20 x 32	16 x 40	32 x 32
Electronic Steering angle in Azimuth	+/- 20 deg	+/- 20 deg	+/- 20 deg	+/- 20 deg
RF peak power	+/- 5 deg	+/- 5 deg	+/- 5 deg	+/- 5 deg
DC power consumption	2.0 kW	2.5 kW	2.5 kW	4.0 kW
Slant range resolution	2.3 kW	2.8 kW	2.8 kW	4.6 kW
Sensitivity at 30 deg incidence angle, @0.5 meter slant range resolution, 20% duty cycle, Spotlight mode	> 0.125 m	> 0.125 m	> 0.125m	> 0.125m
Sensitivity at 30 deg incidence angle, @1.5 meter slant range resolution, 20% duty cycle, Stripmap mode	< -14.0 dB	< -16.5 dB	< -16.5 dB	< -23.0 dB
Incident angle full performance access, with -20 dB Total ambiguity	< -17.5 dB	< -20.0 dB	< -20.0 dB	< -26.5 dB
Incident angle recording data	15-35 deg	15-40 deg	15-38 deg	15-42 deg
SAS (SAR Antenna Subsystem) payload mass	15-50 deg	15-50 deg	15-50 deg	15-50 deg
SES (SAR Electronic Subsystem) payload mass	~70 kg	~78 kg	~85 kg	~140 kg
Payload interface	~10 kg	~10 kg	~10 kg	~10 kg
Total Mass	~90 kg	~98 kg	~105 kg	~155 kg

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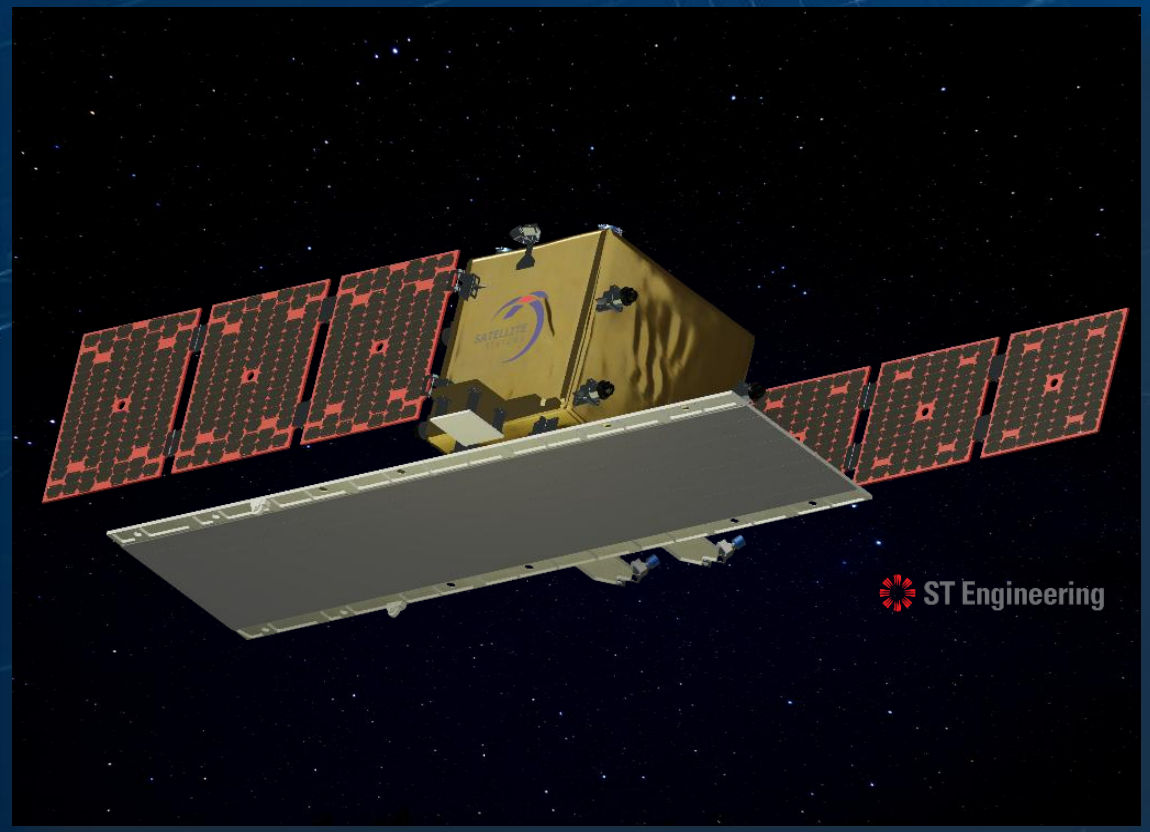
SIRB Program For UAE

MetaSensing has been awarded a contract to provide its **StarSAR-X SAR payloads** for the UAE's national SAR constellation program, **SIRB**, led by FADA (EDGE Group), with ST Engineering supplying the satellite platform.

The program will deliver **high-resolution, all-weather, day-and-night Earth observation capabilities**, supporting applications such as security monitoring, infrastructure surveillance, environmental analysis, and disaster response.

MetaSensing will also contribute through a **technology and knowledge transfer program**, enabling the development of sovereign space capabilities in the region and strengthening its position in the growing global SAR market.



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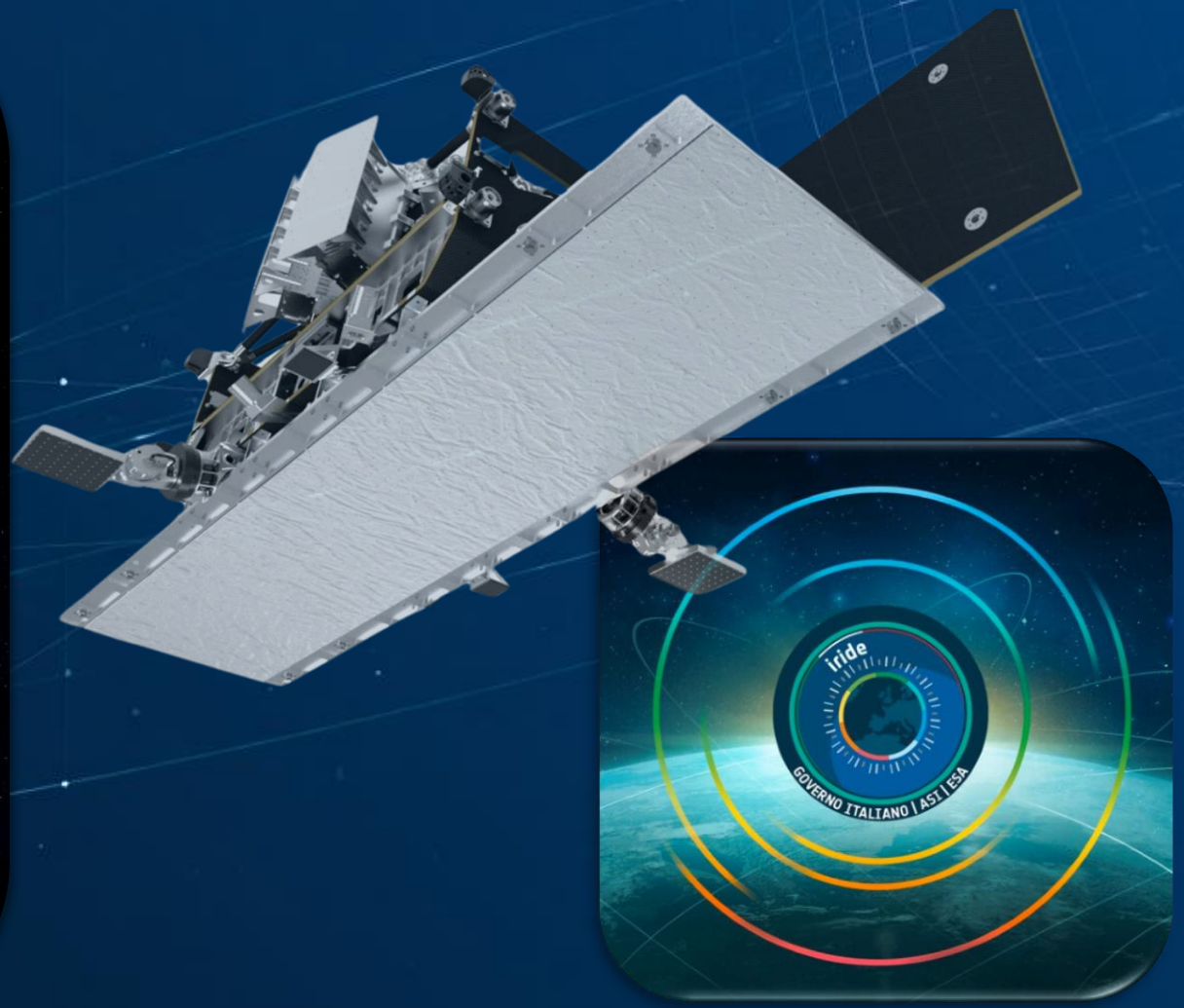
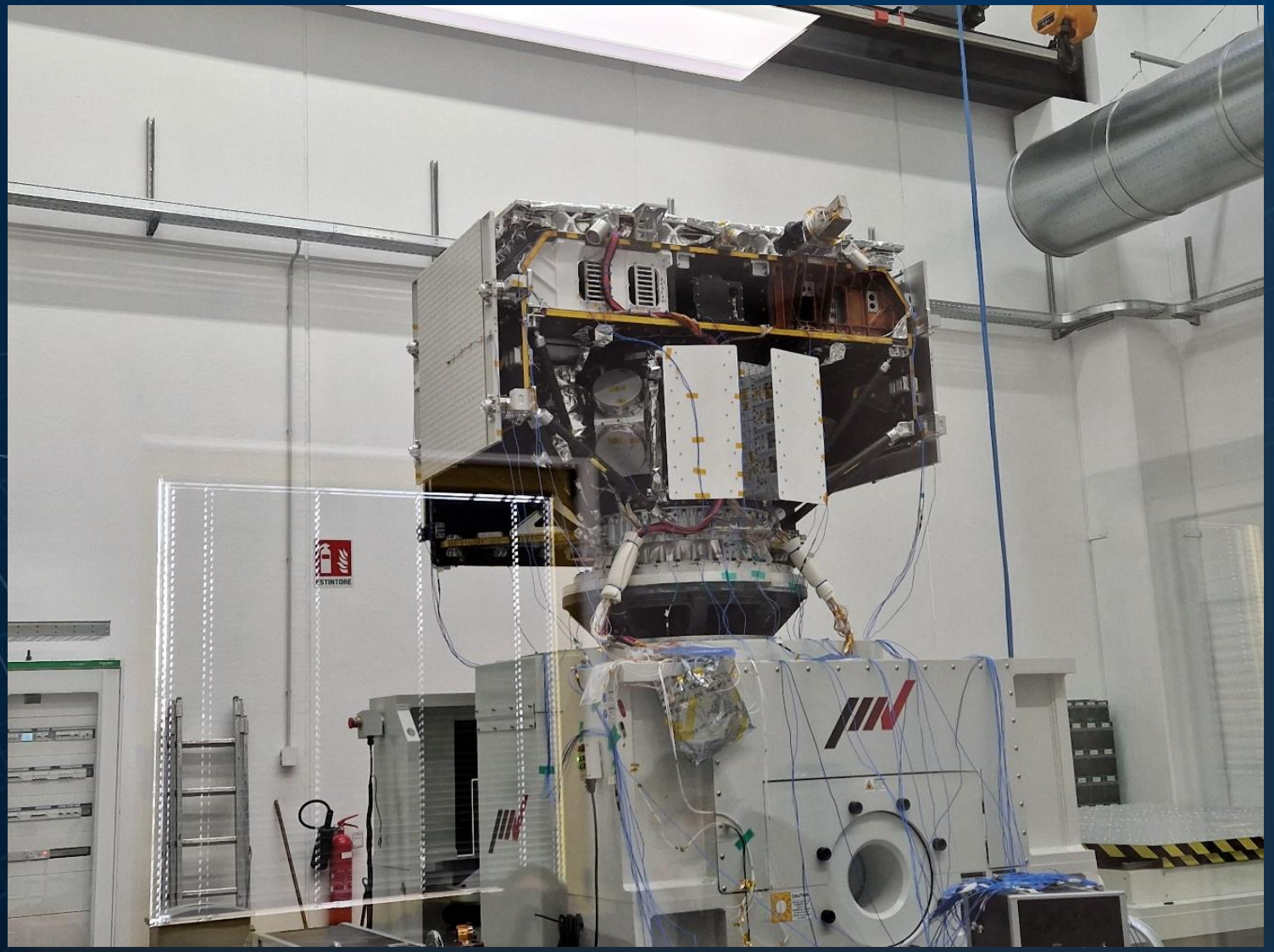
IRIDE Program - NOX Mission

StarSAR-X SAR Payload

IRIDE is a space-based observation program launched under Italy's National Recovery and Resilience Plan (PNRR), led by ESA and ASI.
D-Orbit will supply and operate a SAR satellite, NOX, featuring a **MetaSensing** designed radar sensor.



StarSAR-X SAR Payload For IRIDE Mission



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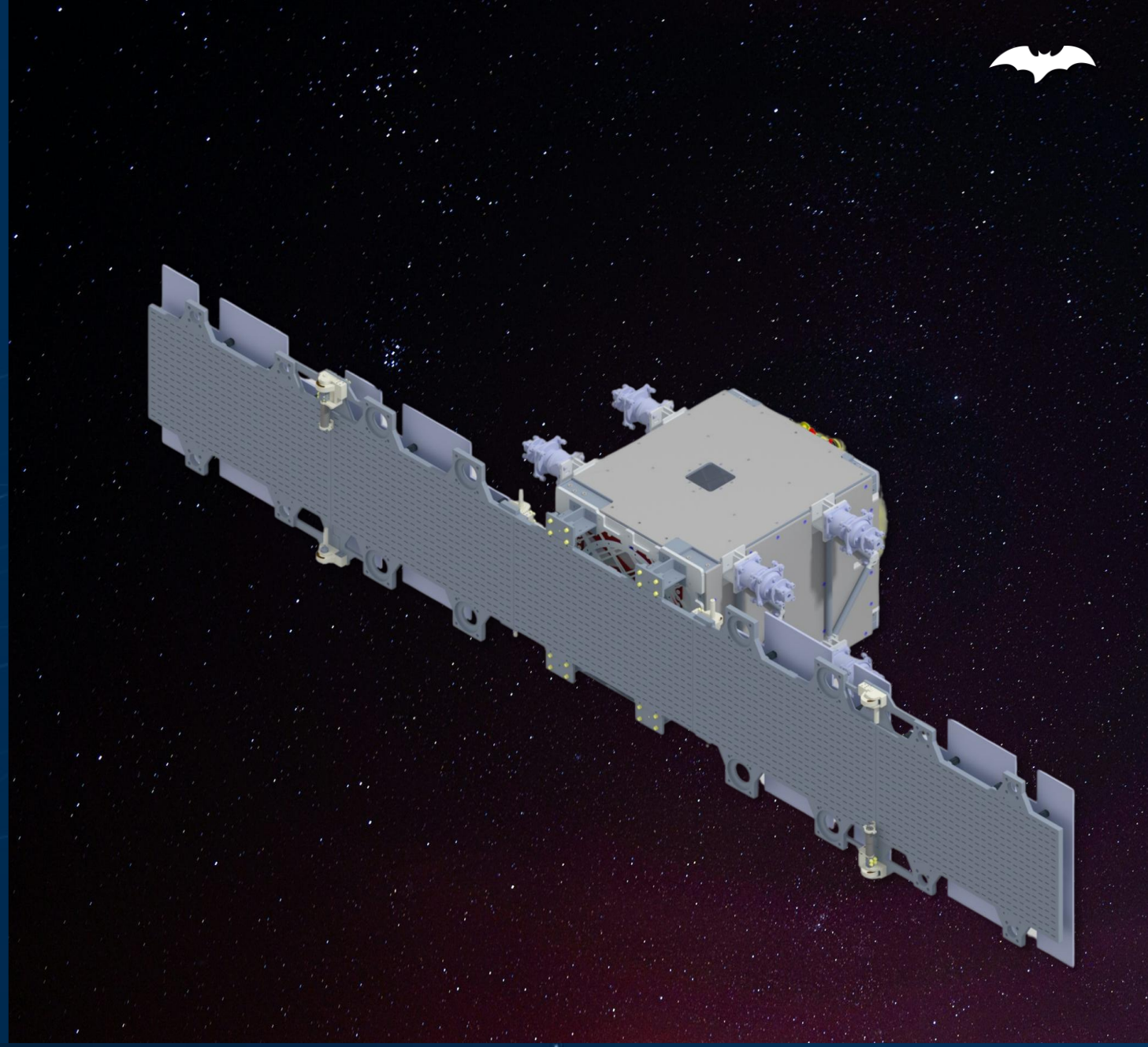
PhoeniX

Power efficient SAR payload optimized for microsatellites and scalable missions



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Introduction

PhoeniX is a spaceborne payload engineered to meet the rigorous mass constraints of microsatellites, with a starting **weight ranging from 70 to 170 kg.**

The transmitted power is generated by few high-power amplifiers while a slotted waveguide antenna guarantees a high efficiency with extremely low loss in terms of irradiated energy.

With a **resolution up to 0.125 meter and Stripmap and Spotlight imaging mode**, the PhoeniX system allows the user to generate very good quality SAR images which can address both commercial and security market needs.

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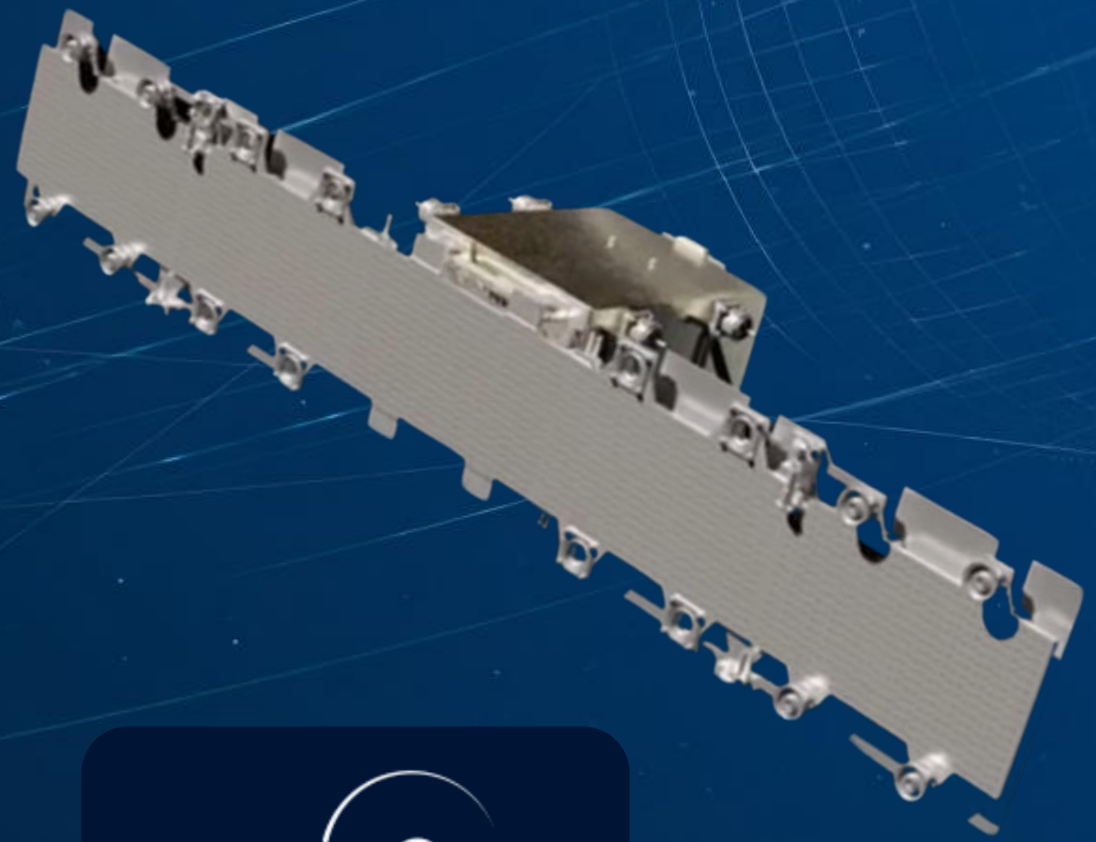
Drishti Program - SAR Constellation

PhoeniX for Galaxeye

Indian Government' Drishti Mission is Galaxeye's multi-sensor (SAR + MSI) imaging satellites, providing all-time, all-weather information for any point on Earth. With the ability to capture high-resolution images from multiple sensors, including optical and SAR, these satellites can detect military camouflage, track troop movements, provide surveillance in low-light conditions, track crop growth, monitor urbanization, detect changes in the Earth's surface, and much more.

MetaSensing will produce the SAR sensors for the constellation.



GALAXEYE

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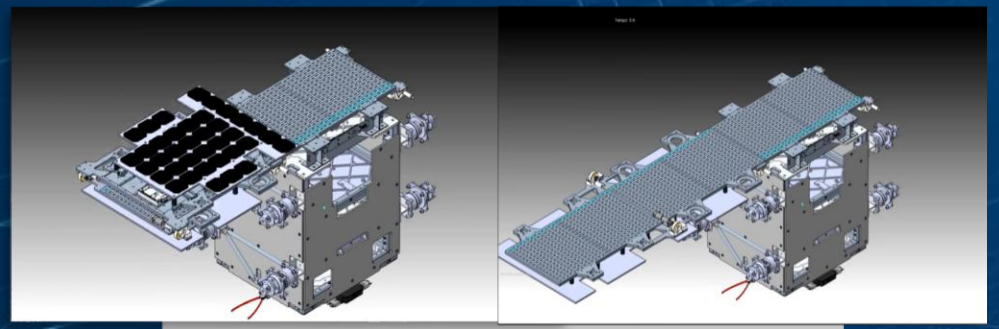
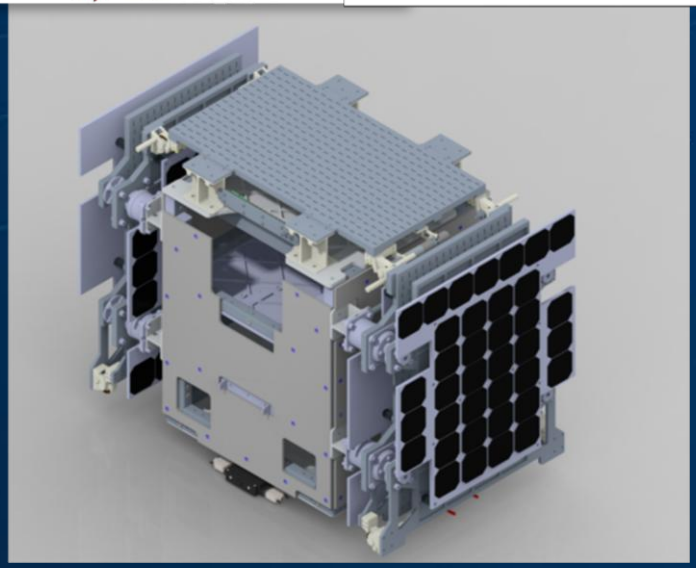
Phoenix Specifications (Drishti Mission)

The single polarized slotted waveguide design has been finalized, achieving an optimum solution for an X-Band signal **up to 700 MHz and 1200 MHz bandwidth**.

Antenna Type	Slotted Waveguide	Antenna Type
Dimension	0.35 x 3.37 m - 0.70 x 4.56 m	Dimension
Antenna Mass	50 – 140 kg	Antenna Mass
Frequency	X Band	Frequency

ACQUISITION MODE	Swath Width [Km]	Resolution (slant Range x Azimuth)
Spotlight HR	5 x 5	0.25 x 0.25 0.125 x 0.125
Spotlight	10 x 10	0.5 x 1.0
Stripmap HR	30 x 140	0.5 x 2.0
Stripmap	30 x 140	1.0 x 2.0
Stripmap LR	30 x 140	2.0 x 2.0





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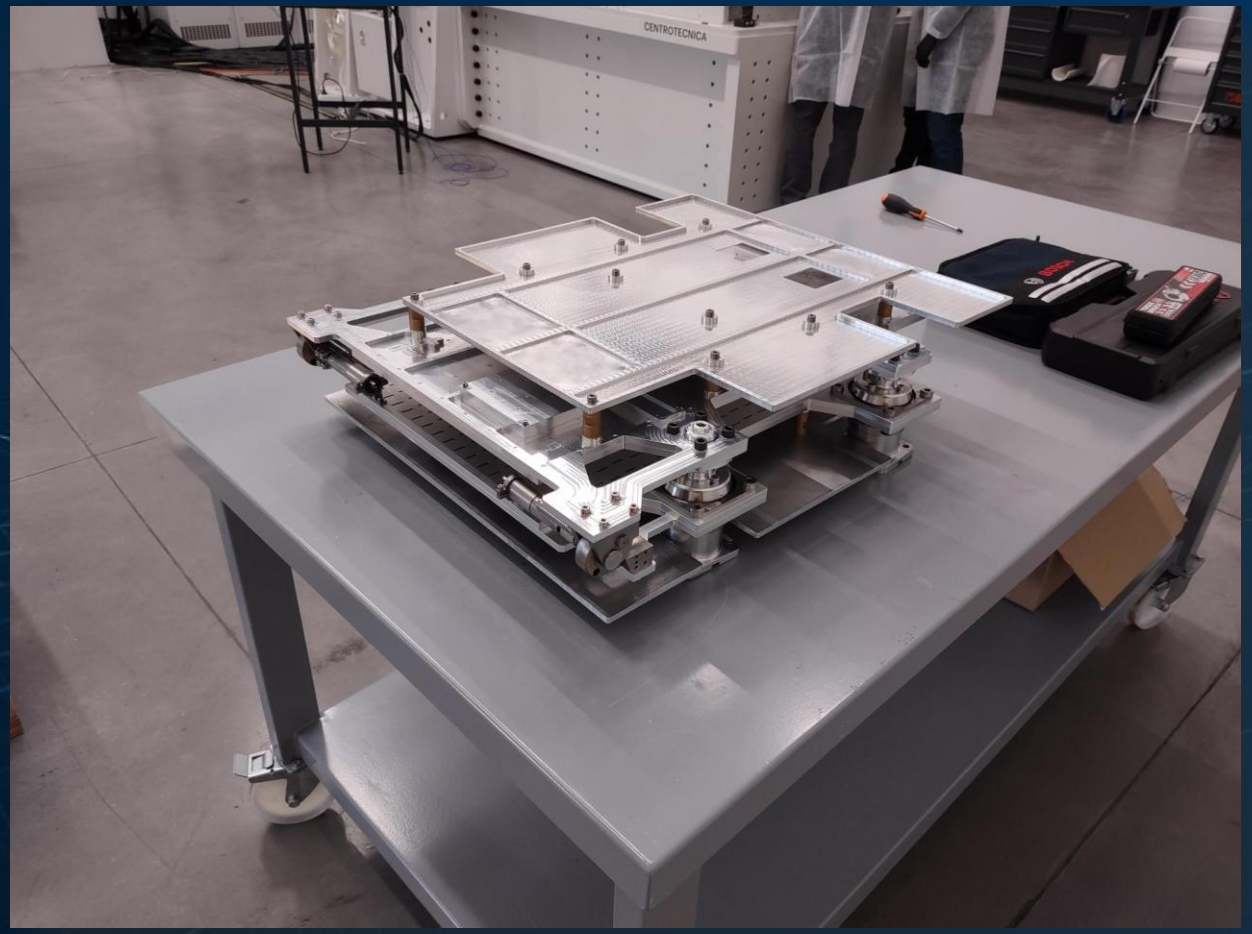
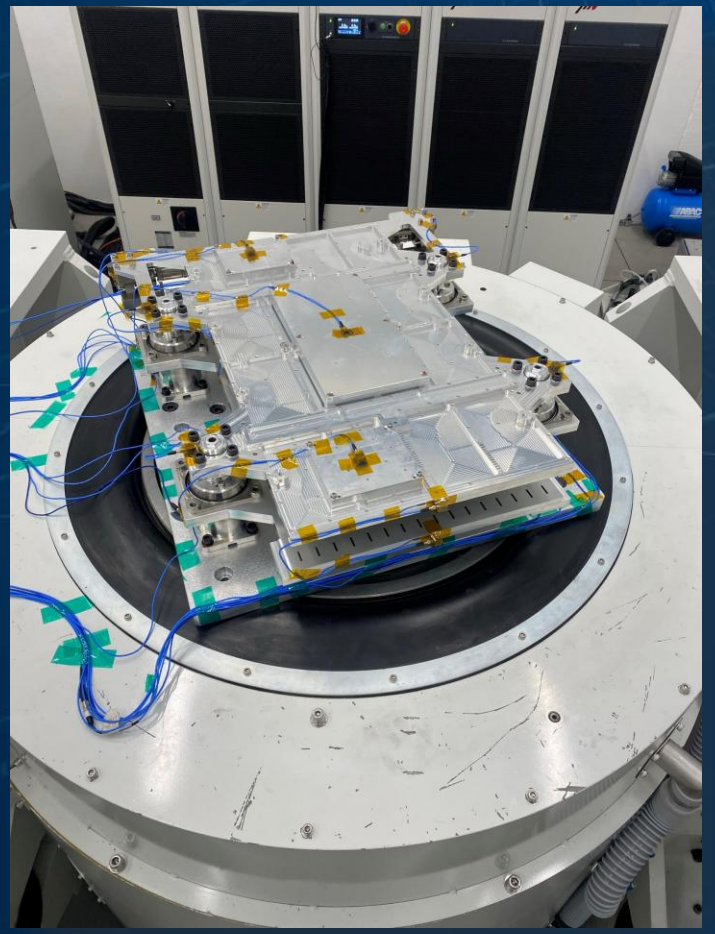
Phoenix Qualification

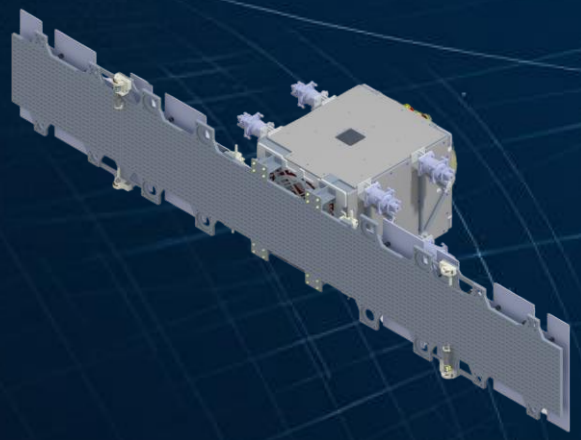




MetaSensing SAR Payload: PhoeniX basic and advanced

Key Features:

- **Antenna Type:** Slotted Waveguide
- **Operating Frequency Band:** X-Band



Parameter	PhoeniX Gen1 – 1x TRM-100W modules per tile, 10 tiles	PhoeniX Gen1 – 3x TRM-50 modules per tile, 10 tiles	PhoeniX Gen1 – 4x TRM-100 modules per tile, 10 tiles	PhoeniX Gen2 – 16x TRM-15 modules per tile, 10 tiles	PhoeniX Gen2 – 16x TRM-15 modules per tile, 12 tiles
Radiating antenna dimension (elevation x azimuth)	0.35 x 3.37 m	0.53 x 3.37 m	0.70 x 3.37 m	0.70 x 3.80 m	0.70 x 4.56 m
Phase centers (elevation x azimuth)	1 x 10	3 x 10	4 x 10	8 x 40	8 x 48
Electronic Steering angle in Elevation	NA	+/- 5.0 deg	+/- 5.0 deg	+/- 10.0 deg	+/- 10.0 deg
Electronic Steering angle in Azimuth	+/- 1.5 deg	+/- 1.5 deg	+/- 1.5 deg	+/- 3.0 deg	+/- 3.0 deg
RF peak power	1.0 kW	1.5 kW	4.0 kW	4.0 kW	4.8 kW
DC power consumption	1.2 kW	1.8 kW	4.6 kW	4.6 kW	5.5 kW
Slant range resolution	> 0.25 m	> 0.25 m	> 0.25 m	> 0.125 m	> 0.125 m
Sensitivity at 30 deg incidence angle, @0.5 meter slant range resolution, 20% duty cycle, Spotlight mode	< -10.6 dB	< -15.9 dB	< -22.6 dB	< -23.7 dB	< -26.0 dB
Sensitivity at 30 deg incidence angle, @1.5 meter slant range resolution, 20% duty cycle, Stripmap mode	< -14.1 dB	< -19.4 dB	< -26.1 dB	< -27.2 dB	< -28.1 dB
Incident angle full performance access, with -20 dB Total ambiguity	15-36 deg	15-41 deg	15-42 deg	15-43 deg	15-44 deg
Incident angle recording data	15-50 deg	15-50 deg	15-50 deg	15-50 deg	15-50 deg
SAS (SAR Antenna Subsystem) payload mass	~54 kg	~81 kg	~110 kg	~121 kg	~146 kg
SES (SAR Electronic Subsystem) payload mass	~10 kg	~10 kg	~10 kg	~10 kg	~10 kg
Payload interface	~10 kg	~10 kg	~10 kg	~10 kg	~10 kg
Total Mass	~74 kg	~101 kg	~130 kg	~141 kg	~176 kg

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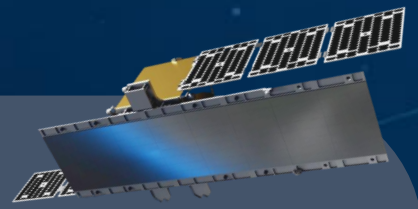
StarSAR-X vs. PhoeniX positioning

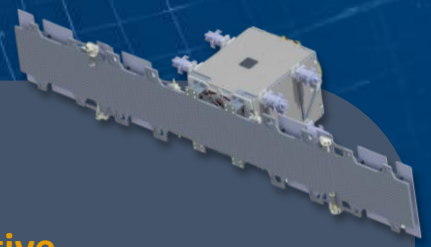
MetaSensing offers two complementary SAR payloads to address different mission needs in terms of performance, complexity, platform constraints, cost vs capability trade-off



StarSAR-X Payload

- **High-performance | Robust | Advanced SAR**
- **Advanced SAR architecture** (high steering capabilities and polarimetry)
- **Designed for high-end Earth Observation missions**
- **Enhanced**:
  - acquisition capabilities
  - polarimetry
  - Multichannel for Digital Beamforming
- **Suitable for:**
  - high-resolution imaging
  - interferometry & demanding applications

- **Trade-off**: higher complexity and resource demand



PhoeniX Payload

- **Power Efficient | Agile | Cost-effective**
- **Simplified SAR architecture**
- **Lower system complexity** → faster integration & reduced risk
- **Suitable for:**
  - High / medium resolution imaging
  - rapid deployment constellations

- **Trade-off**: Coverage and performance vs high-end systems

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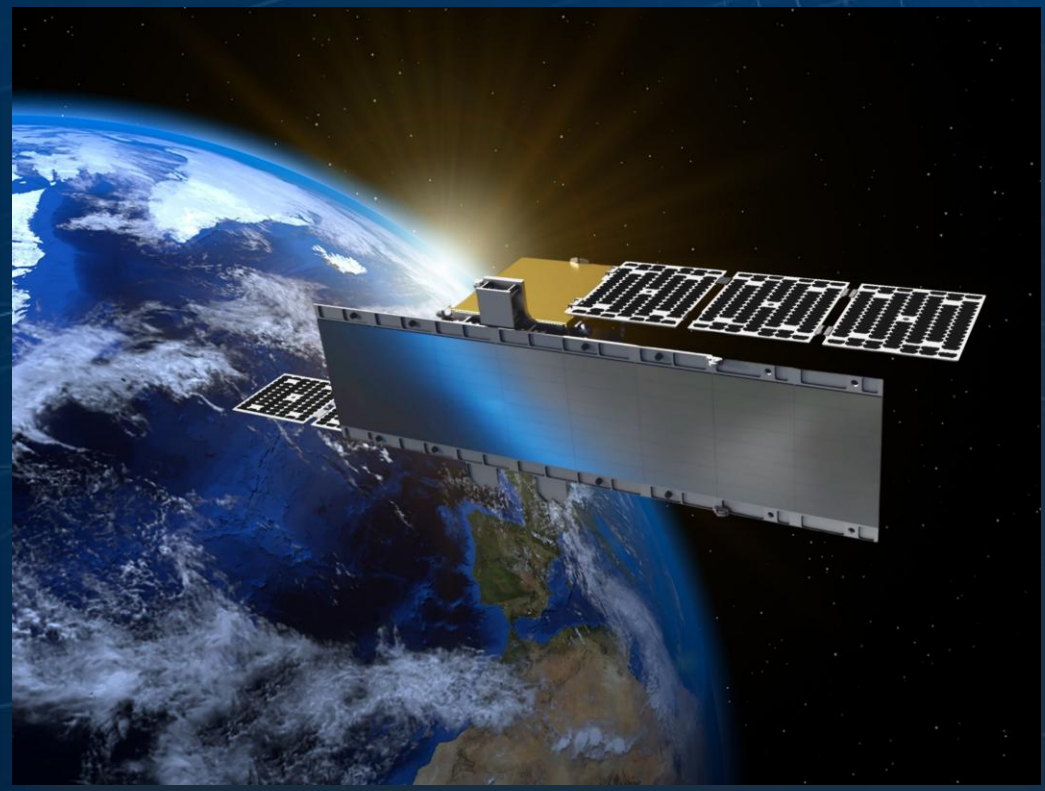
Why MetaSensing?

As demand for SAR payloads grows across commercial and government missions, tailoring performance to specific mission needs is more critical than ever.

SAR systems require careful trade-offs balancing resolution, weight, size, and power to achieve optimal results. With over 18 years of expertise in SAR development, MetaSensing delivers mission-specific payloads through a cost-effective, end-to-end approach, making it the ideal partner for high-performance, customized SAR solutions.



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- MetaSensing AP Pte Ltd, Singapore

- MetaSensing BV, The Netherlands

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