

It takes a village: the Methane conundrum

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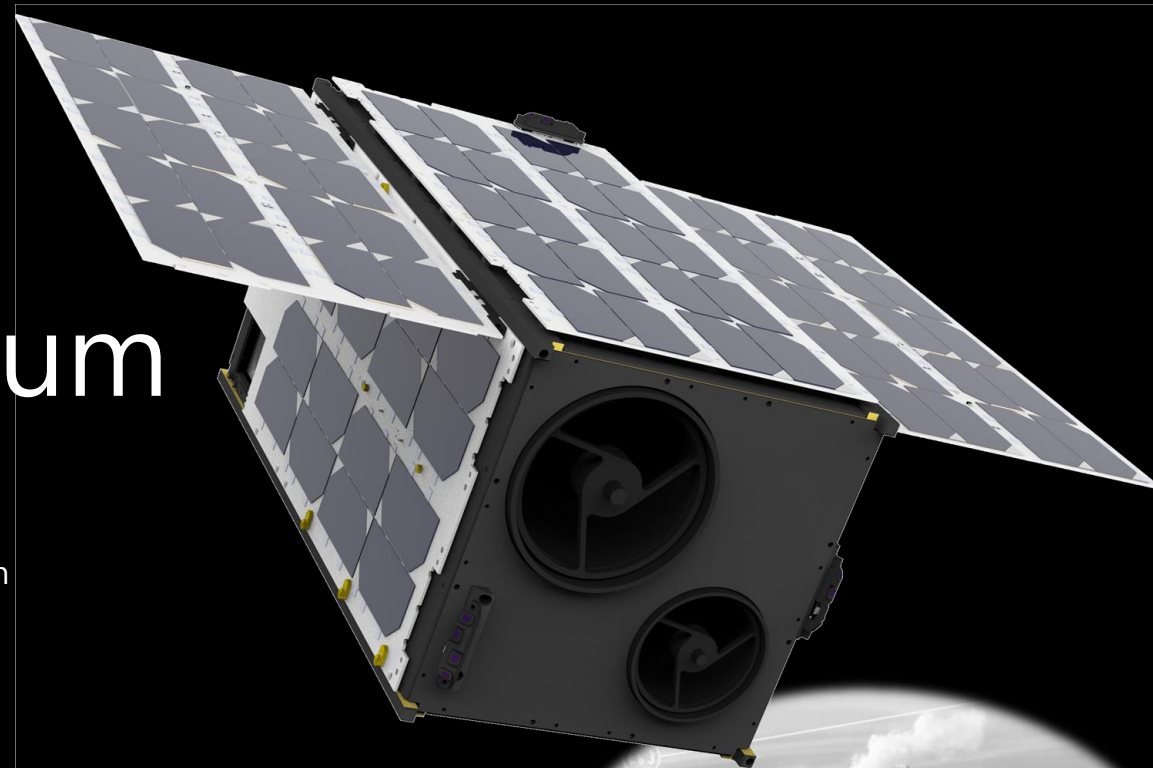
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Background

Achieving Zero – Two opposing stories

- More than 140 countries have set a NetZero target covering about 88% of global emissions and 92% of global GDP
- 89% global population covered by NetZero targets
- Over 13,000 non-governmental members joined UN's "Race to Zero" campaign

VS.

- Global GHG emissions set new record of 57.4 GtCO₂e (2022)
- G20 GHG emissions increased by 1.2% (2022)
- Current & historical emissions are highly unequally monitored
- Most net zero targets lack measurable key features

Methane: The missing data link

Global warming potential up to **82** times $>CO_2$
over a 20-year period

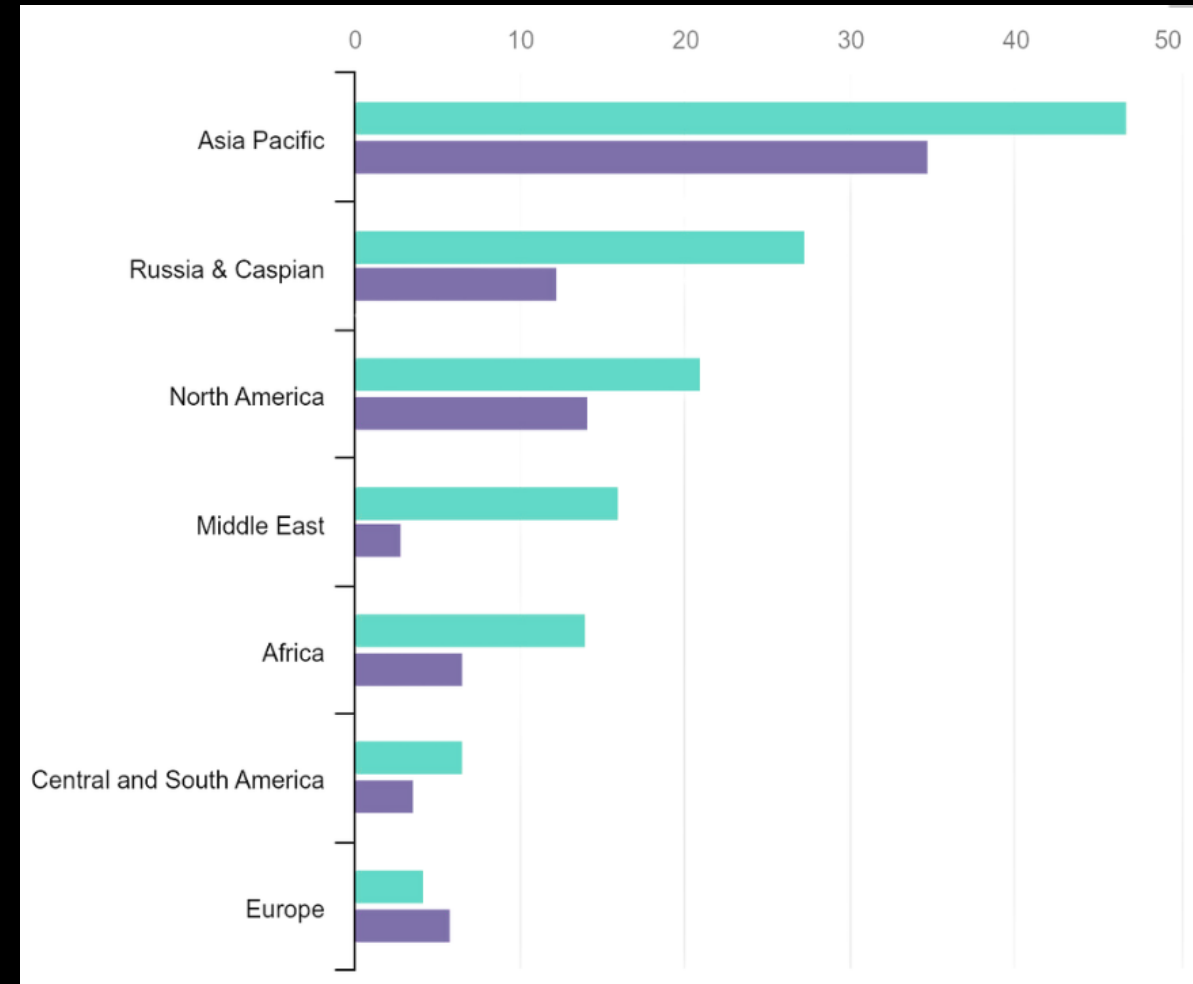
30% contributor current global warming

Fugitive emissions highly underreported

≈ 80%-90% in some sectors

High reporting discrepancies across

stakeholders and regions **2x-3x**



Global energy-related methane emissions
by region reported to the UNFCCC and estimates from the IEA, 2021

● International Energy Agency ● Reported to the UNFCCC

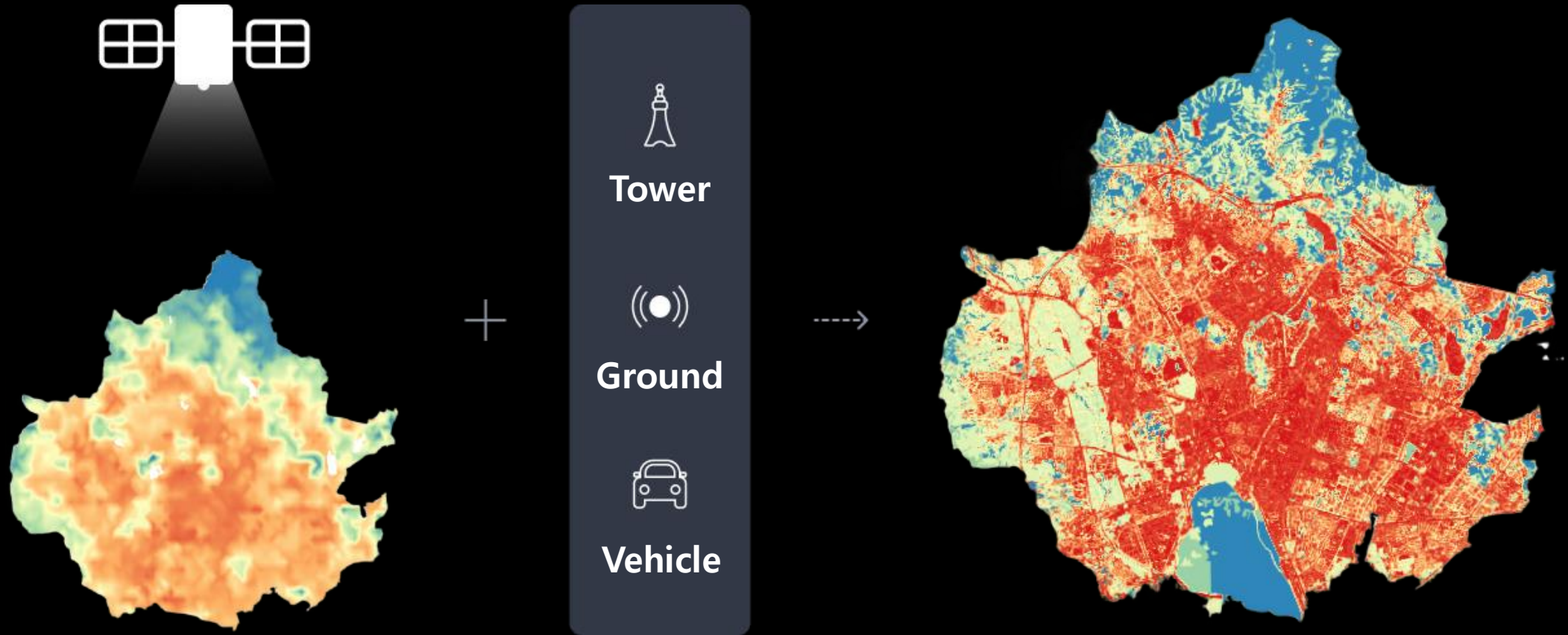
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MRV* & NarSha Project

*Measure, Report, & Verification

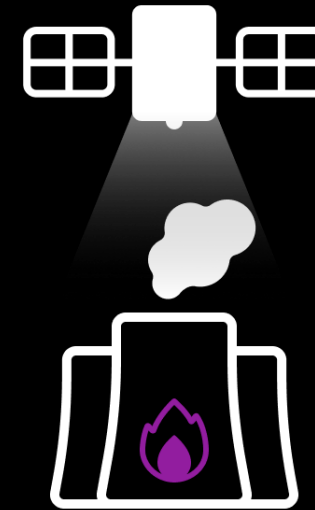
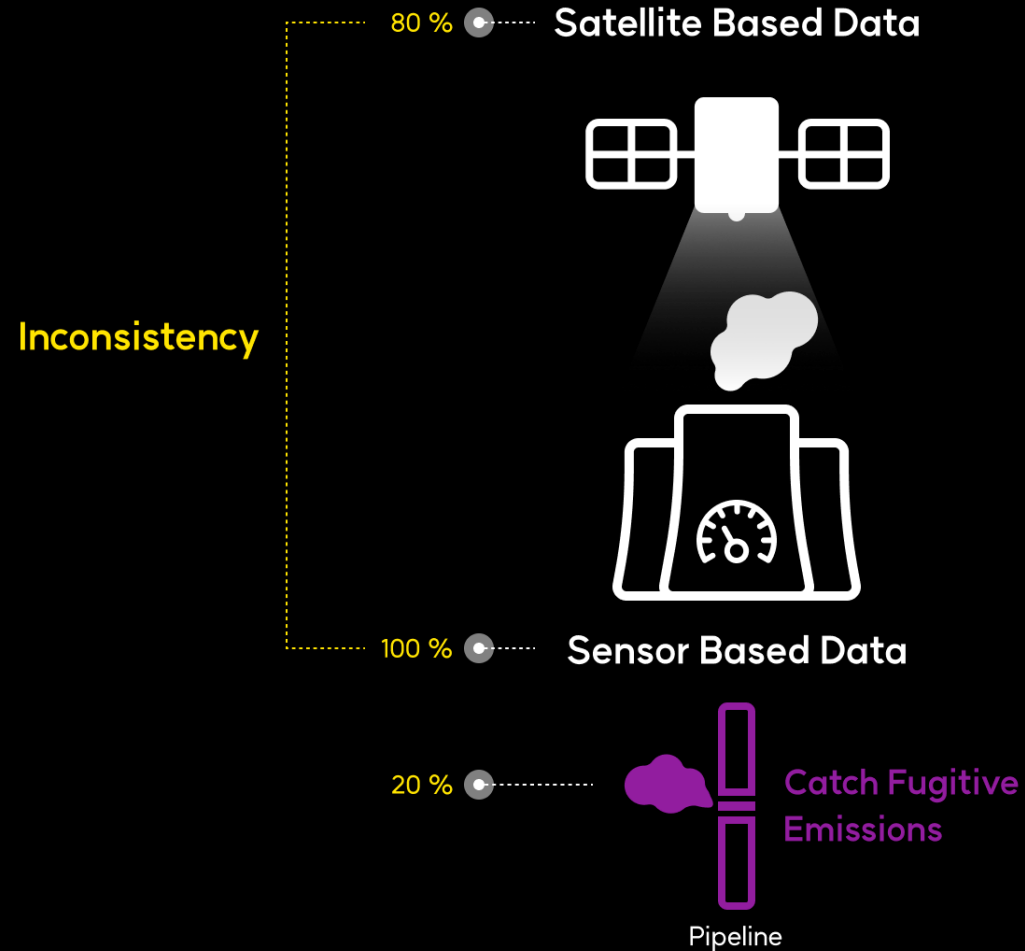
MRV: Why a Multi-Source System?

Multi-sourced satellite-based system to unlock the GHG point-source monitoring revolution

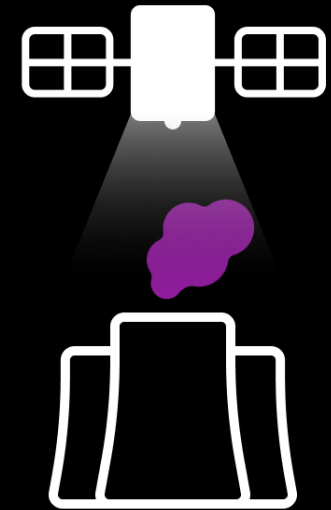


MRV: Closing Data Loopholes

Satellite data can fill in the gaps of **leakage** & **unknown emission sources**



Flaring



Venting

NarSha Project

The 1st Korean methane monitoring microsatellite constellation

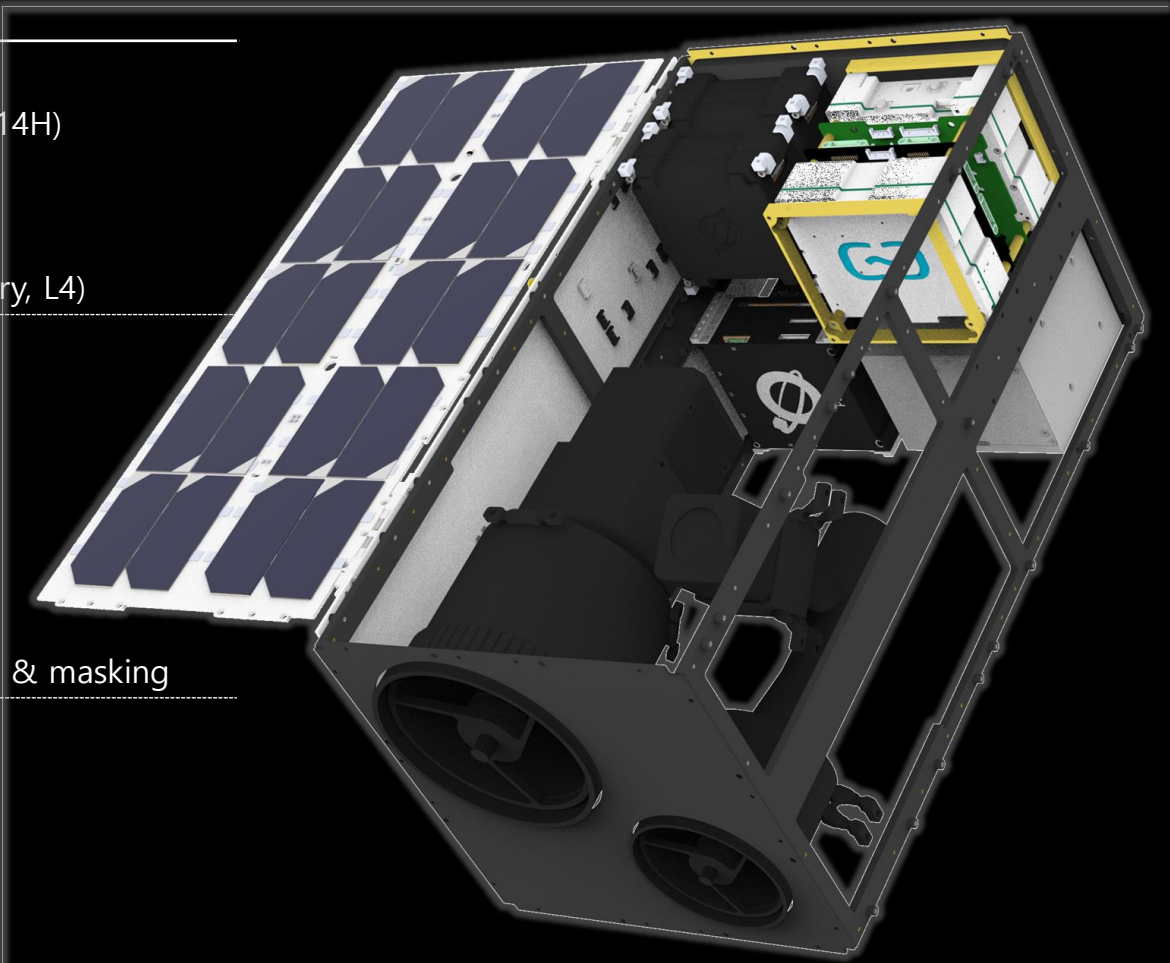


- The first Korean **methane monitoring microsatellite constellation mission** specifically designed to measure methane emissions.
- Initiative aligns with the Global Methane Pledge (GMP) aimed at **reducing methane emissions** worldwide as well as to establish a **dependable MRV system** in the global effort to mitigate anthropogenic greenhouse gas emissions.
- By supporting methane abatement efforts, especially in **East Asia**, NarSha will play a crucial role in **enhancing methane management practices** globally.
- The first launch is planned on Q4 2026.

NarSha Project

Microsatellite system design specifications

Contents		Performance
Mission	Lifetime	>3 yrs
	Orbit	500-600 km (SSO, LTAN/LTDN 10~14H)
	Detection Threshold	>100 kg/h
	Data Availability	L1, L2, & L4 (commercial)
	Data Delivery	<4 weeks/image (request-to-delivery, L4)
Spectrometer Payload	Spectrum	VNIR (400-1000 nm) SWIR (CH ₄ @1625-1670 nm)
	Spectrum Resolution	<0.3 nm
	Signal-to-Noise Ratio	>150 (@albedo 0.2 & SZA 60 deg)
	Swath	>10 km x 10 km
	Ground Sampling Distance	<25 m (@500 km)
	On-board Processing	Data compression, cloud-detection & masking
16U Bus Platform	Pointing Accuracy	<0.02 deg (3σ)
	Off-Nadir Pointing	up to 30 deg
	Power Generation	>80 Wh (@Sun-pointing & EOL)
	Battery Capacity	>150 Wh (@EOL, 8s2p)
	Data Interface	CAN bus, RS-422/485
	Data Downlink	up to 150 Mbps (512 GB storage)



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Mission Design & Operations

Mission Impact Objectives

Obj. #1

Pinpoint high-emission methane sources of **100 kg/h or more** to improve emission hotspots monitoring, response and mitigation efforts

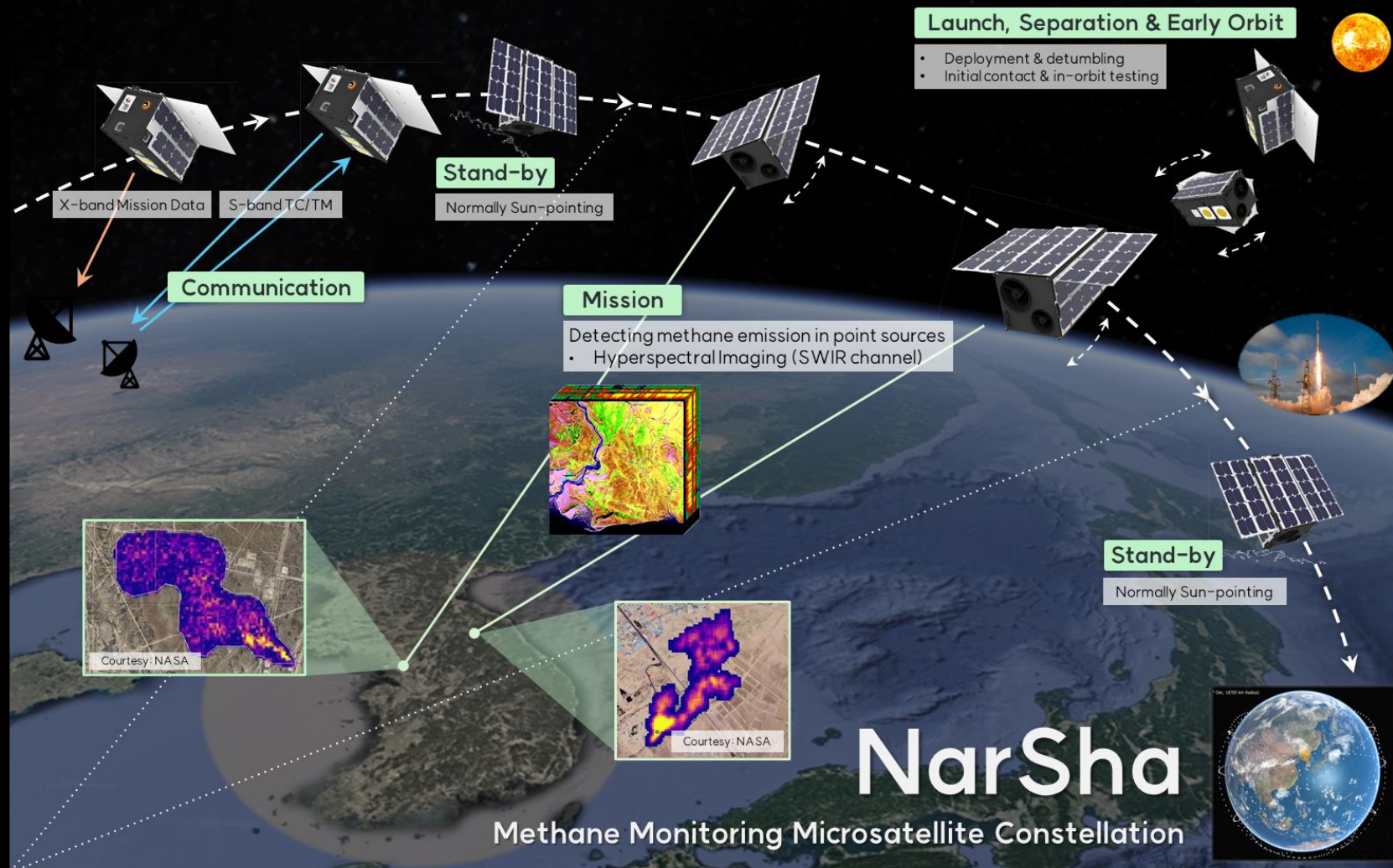
Obj. #2

Enhance observation frequency and bridge data gaps for critical sources by delivering timely, daily data

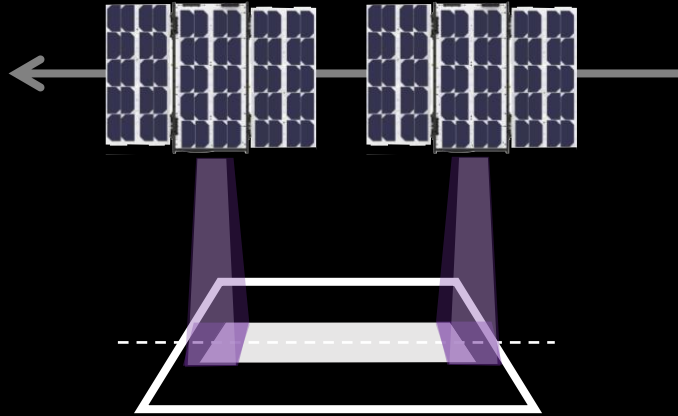
Obj. #3

Delivering actionable data faster: ensure stakeholders can take data-driven actions within a four-week window

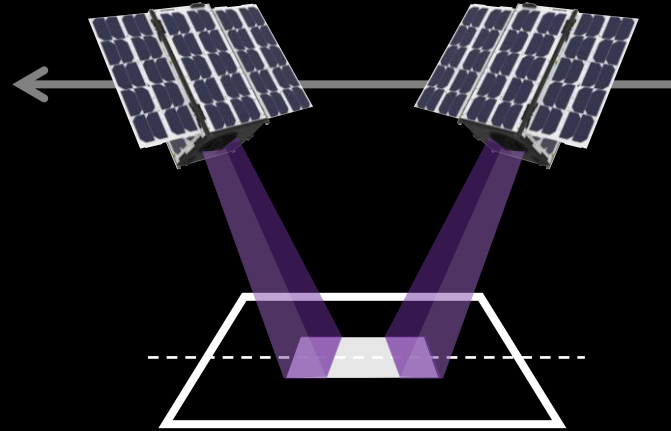
Constellation Operation Concept



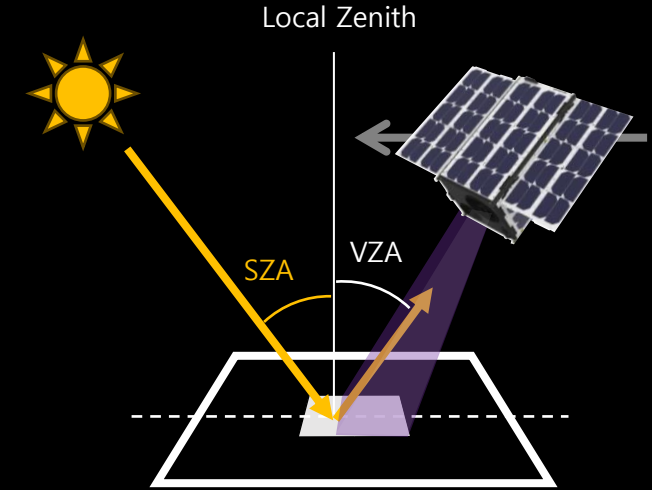
Constellation Operation Concept



Nadir Mode



Target FMC* Mode



Offshore Glint Mode

Nadir

$SZA^* < 85^\circ$

Nadir Pointing

Target FMC*

$SZA < 85^\circ$
 $VZA^{**} < 30^\circ$

FMC with 0%-100% of ground speed

Offshore Glint

$SZA < 75^\circ$
 $SZA \approx VZA$

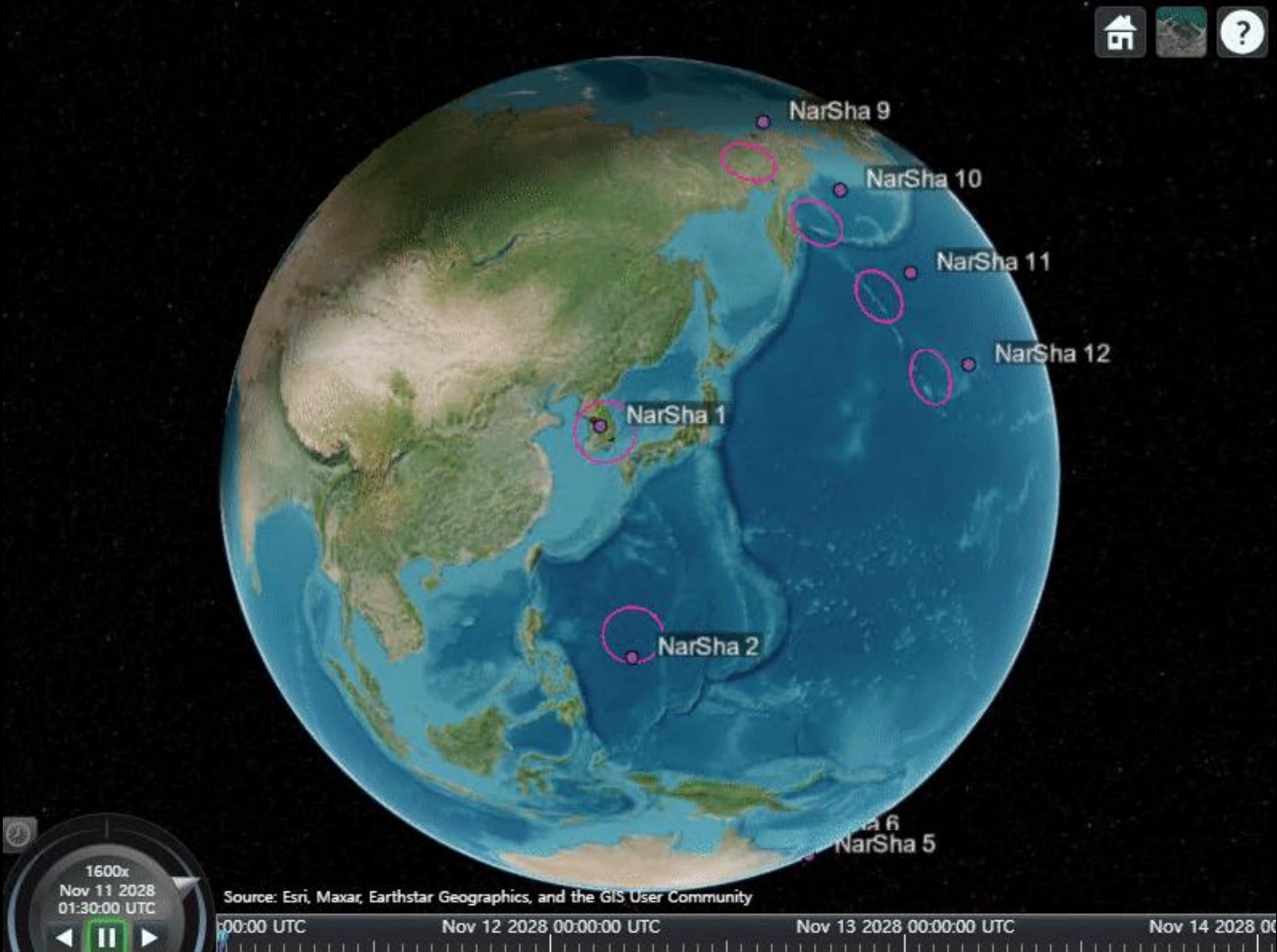
Target mode with $SZA \approx VZA$

*SZA: Solar Zenith Angle

*FMC: Forward Motion Compensation

**VZA: Viewing Zenith Angle

Constellation Design

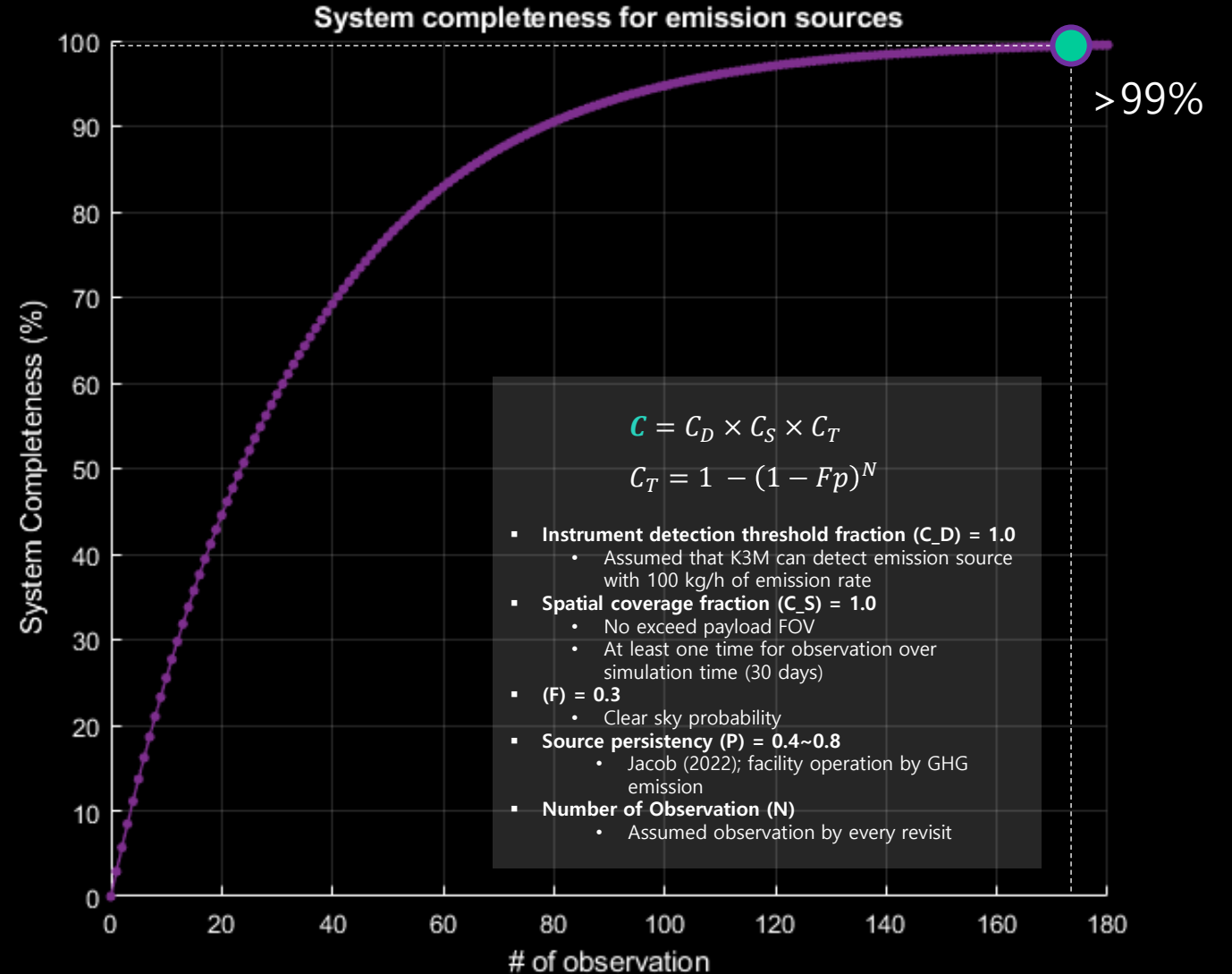


Orbit type	Circular Sun-Synchronous orbit
Altitude	500-600 km
Total # of satellites	12
Number of planes	4
# of satellites per plane	2 or 4
LTAN	10:30, 11:30, 12:30, 13:30

Constellation Design

The system obtains methane emission data of **99%** of targets within **2 weeks**

Total # of zones	8
Average # of observation per day	12.6
Average # of observation in 2 weeks	176.8



Thank You

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