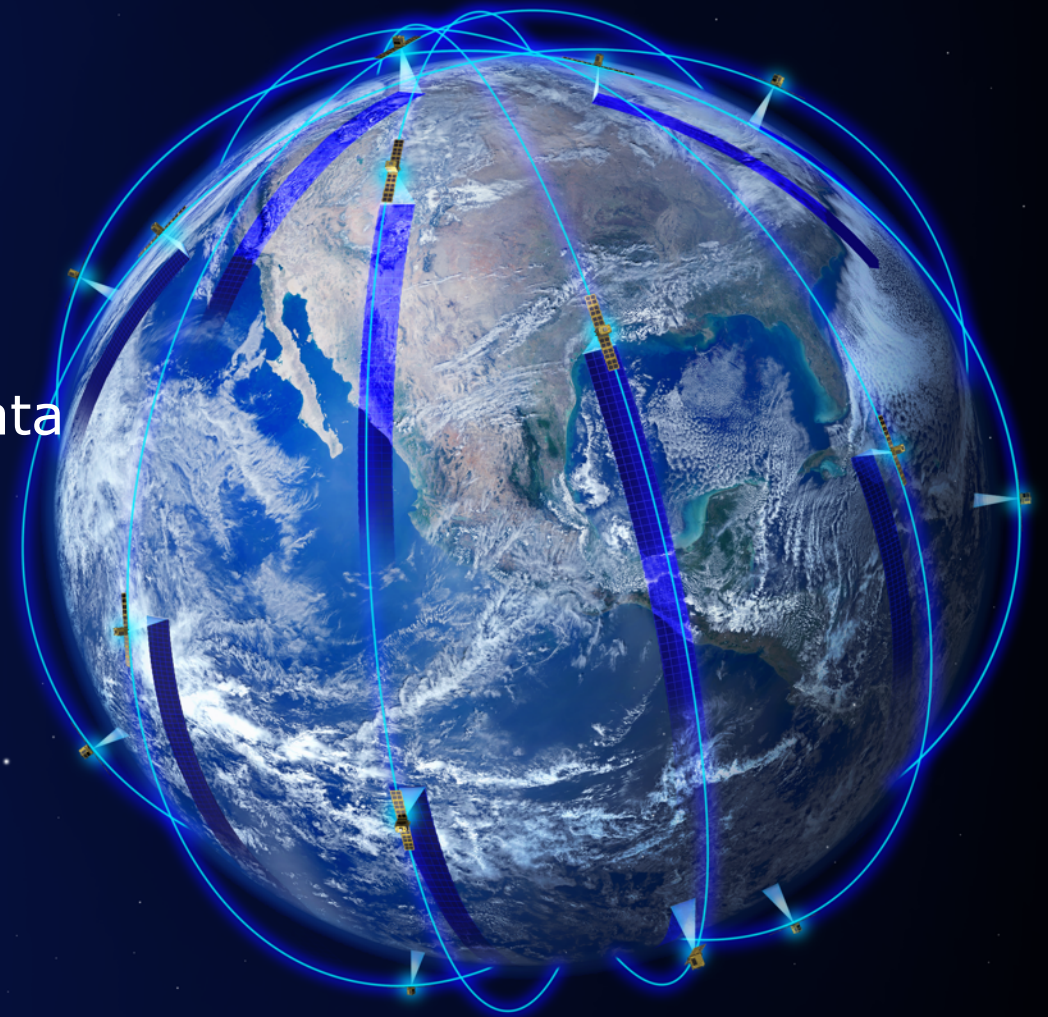Synspective

Synspective, its satellites and Analysis Ready Data

Gerald Baier, PhD

Manager, SAR algorithm unit

Who We Are

Synspective is a Tokyo-based start-up that develops and operates small SAR satellites and solution services using satellite data

Founded in 2018, the company has raised $200M in 4.5 years

180+ Members From 27 countries

Selected as one of the 10 most promising startups in Japan by LinkedIn (2020, 2021, 2022)

CEO Motoyuki Arai selected as one of Business Insider's 100 People Transforming Business in Asia
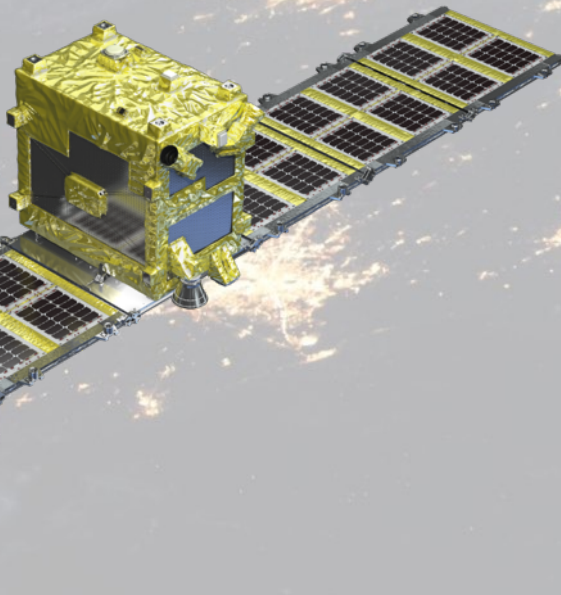
Award for Strategic Projects at World Satellite Business Week (WSBW) 2019

Ministry of Education, Culture, Sports, Science and Technology (MEXT) Minister Prize at the Japan Startup Award 2022

Geospatial World Leadership Award 2022

StriX specifications
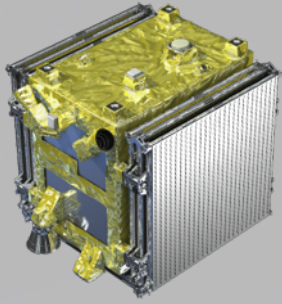
Mass: 125kg
Size: 5 x 0.7 x 0.7m (in orbit)
0.7m Cubic(at launch)

Parameter	StriX-α	StriX-β, StriX-1, StriX-3
orbit control	No	Yes (thruster)
off-nadir angle	15-45 deg	
antenna	passive honeycomb panel slot-array	
center frequency	9.65 GHz	
chirp bandwidth	SM: 75 MHz, SL: 300 MHz	
polarization	VV	
PRF	3000 ~ 7000 Hz	
duty	25%	
transmission power	1000 W	
noise figure	2.6 dB	

StriX Satellite Launches

Synspective has launched four satellites into target orbit, which have captured high-resolution imagery from all over the world.

| 項目	StriX-α	StriX-β	StriX-1	StriX-3
Dimension (before deployment)	Approx. 0.7m×0.7m×0.7m			
Dimension (after deployment)	Approx. 5m x 0.7 x 0.7m			
Weight	100kg level			
Orbit Type	sun-synchronous orbit	sun-synchronous orbit	sun-synchronous orbit	sun-synchronous orbit
Nominal altitude	500km (*)	561km	561km	561km
Orbit inclination angle	97.3 degree (*)	97.7 degree	97.7 degree	97.7 degree
Revisit period	Approx. 5 days (*)	1 day	1 day	1 day
Local Time at Ascending Node（LTAN）	10:30	21:00	21:00	15:00
	* It changes because StriX-α does not maintain orbit.			
Polarization	VV	VV	VV	VV
Off-nadir angle	15 - 45 degrees	15 - 45 degrees	15 - 45 degrees	15 - 45 degrees
Launch date	2020/12/15	2022/03/01	2022/09/19	2024/03/13
First image acquisition	2021/02/08/	2022/05/28	2022/12/12	Soon
Mission patch (logo)				
Mission Name	THE OWL'S NIGHT BEGINS	THE OWL'S NIGHT CONTINUES	THE OWL SPREADS ITS WINGS	OWL NIGHT LONG

＊For more information, please download a more detailed data/product guide from our website.
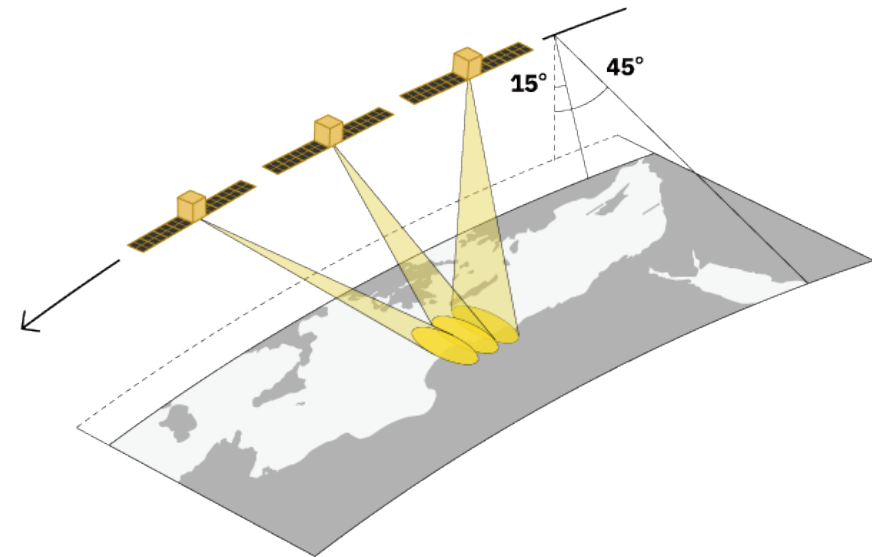
Observation modes

Stripmap
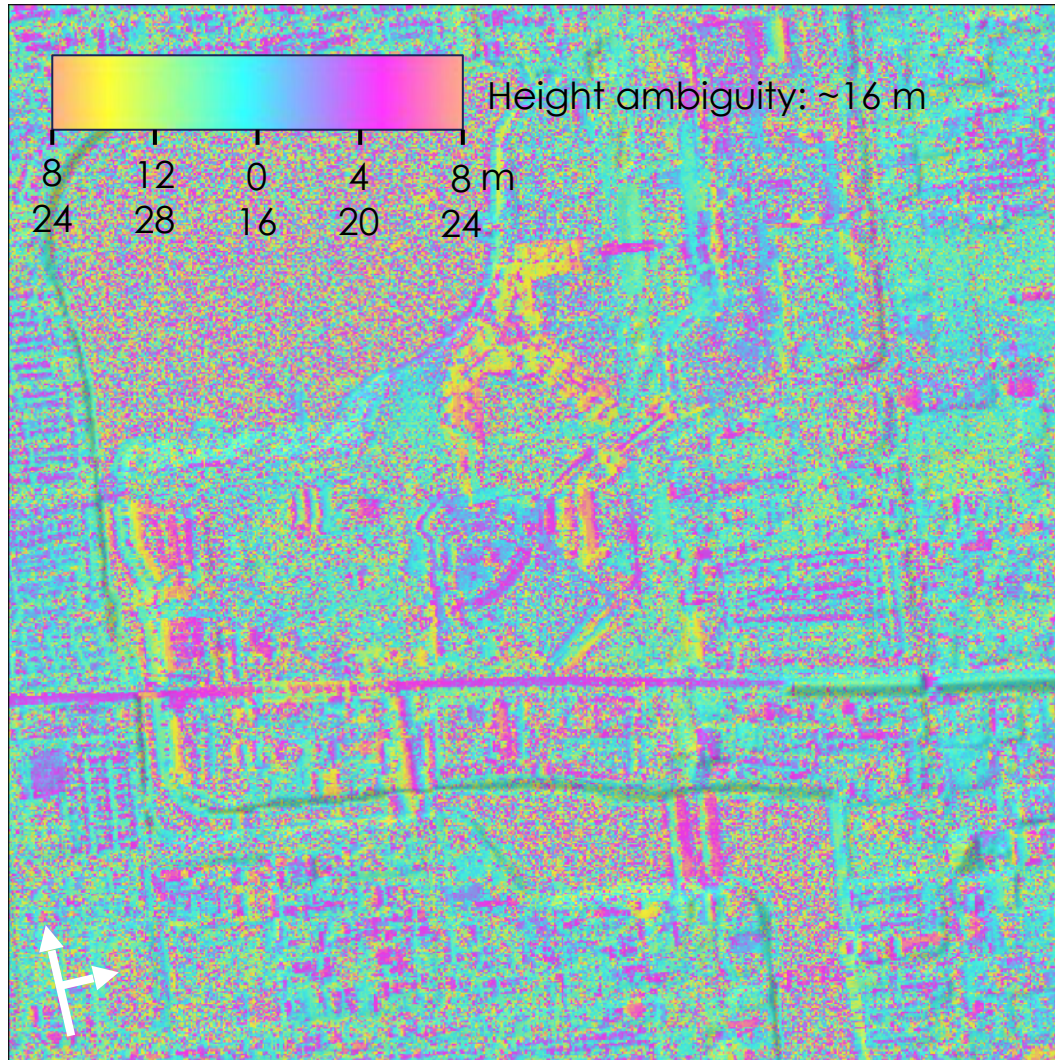20 x 50 km
3 m resolution (75 MHz)
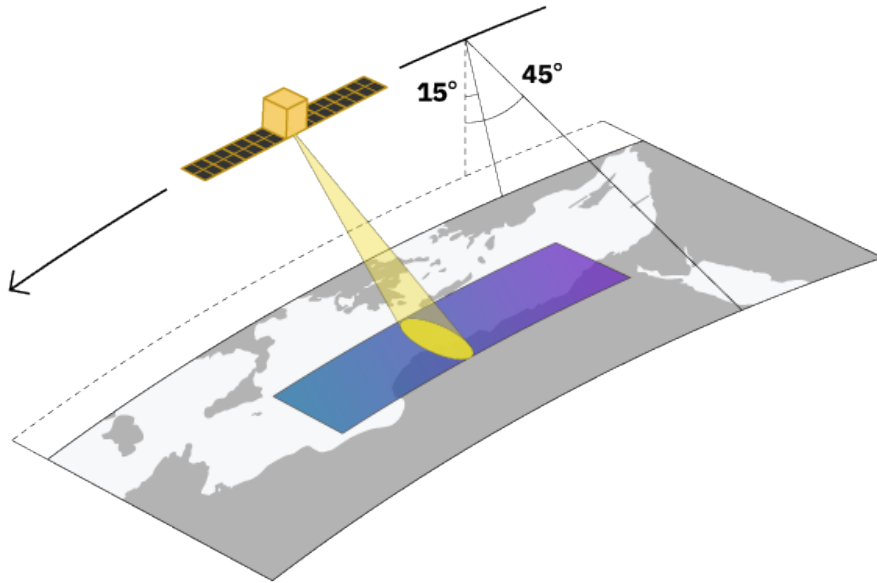
Sliding Spotlight
10 x 10 km
1 m resolution (300 MHz)

Samples available at https://synspective.com/gallery/

StriX-a
Haneda Airport, Japan

InSAR, sliding spotlight
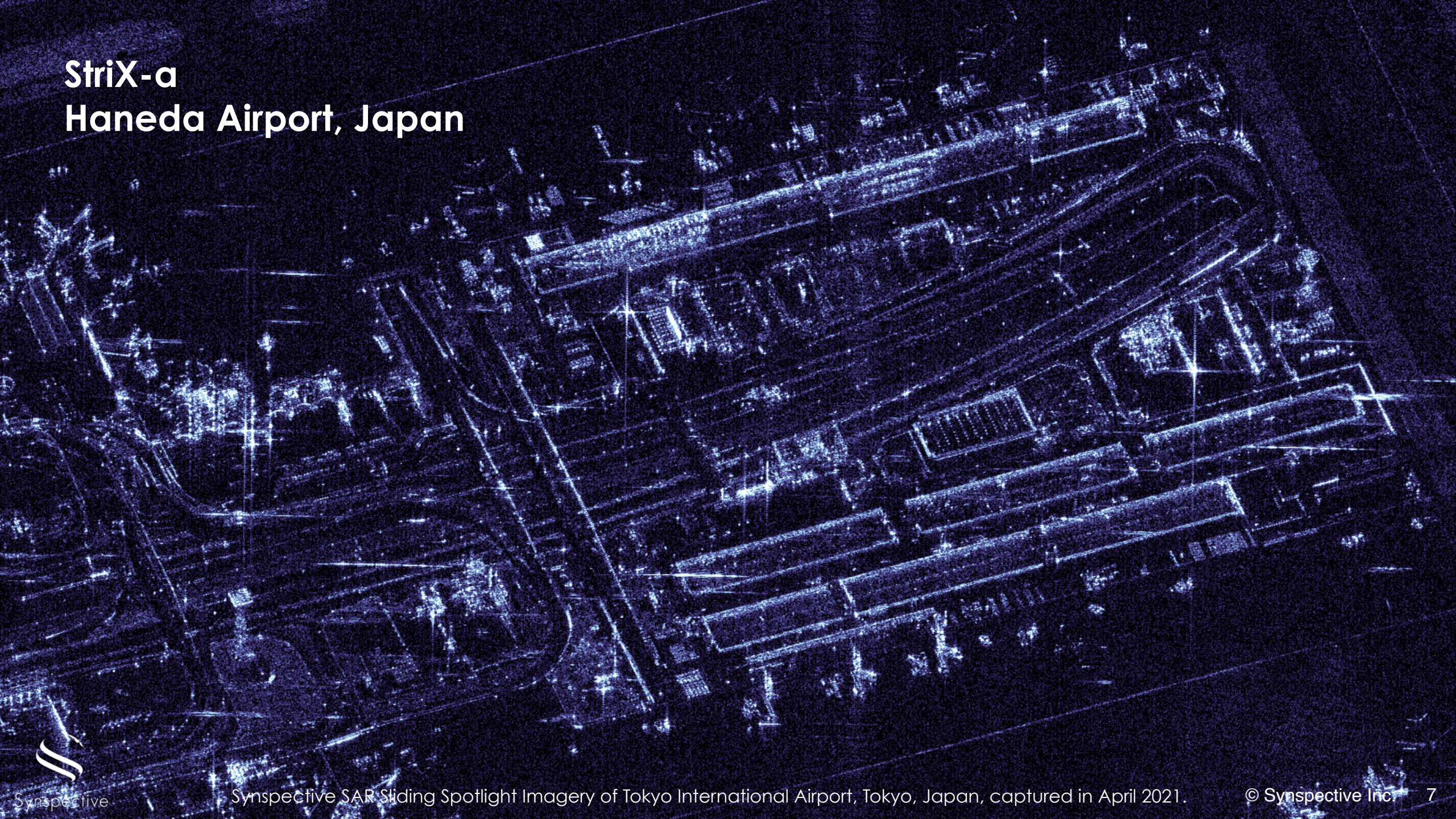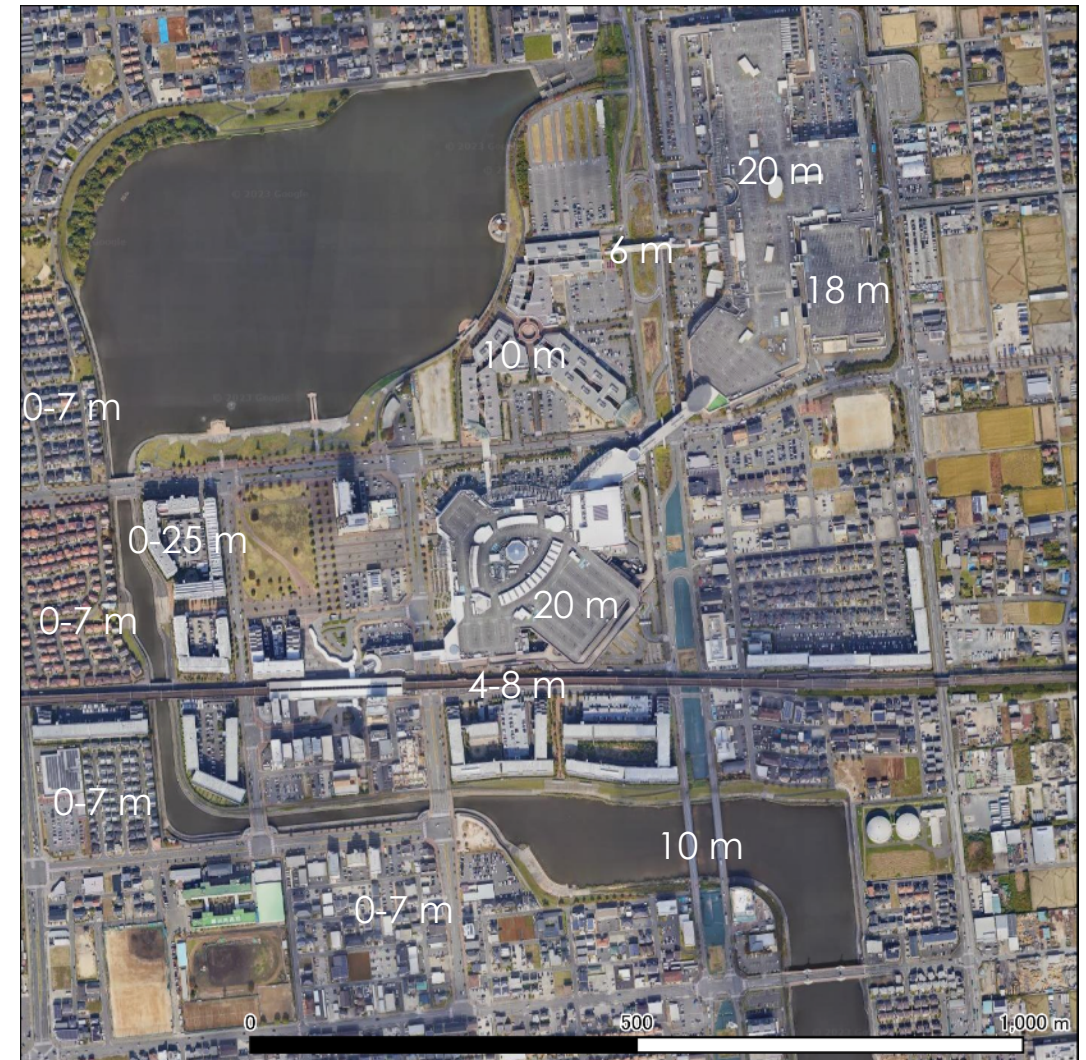
Yu Morishita et al., "Synspective's Small X-Band SAR Satellite (StriX) Constellation and its First InSAR Results," Fringe 2023

Synspective efforts towards Analysis Ready Data

- Calibration
  - K. Orzel et al. "StriX-α SAR satellite: demonstration of observation modes and initial calibration results" *EUSAR 2022*
  - Masanobu Shimada "Imaging from spaceborne and airborne SARs, calibration, and applications" 2019
- File formats & Metadata
  - CEOS, also used by ALOS-1 and ALOS-2
  - SICD https://github.com/ngageoint/sarpy
  - Following IEEE standard (https://sagroups.ieee.org/sar/) development
- Compatibility with 3rd party software
  - GAMMA, https://www.gamma-rs.ch/software
  - SARscape, https://www.sarmap.ch/index.php/software/sarscape/
  - SNAP, https://step.esa.int/main/toolboxes/snap/

Calibration

- Amazon rainforest
  - Radiometric accuracy
  - Pointing error elevation
- Rosamond corner reflectors
  - Resolution
  - Geometric accuracy
- Doldrums —> NESZ
- Short term goal: regular (and frequent) calibration reports
  - Missing automation
  - Fighting about capacity
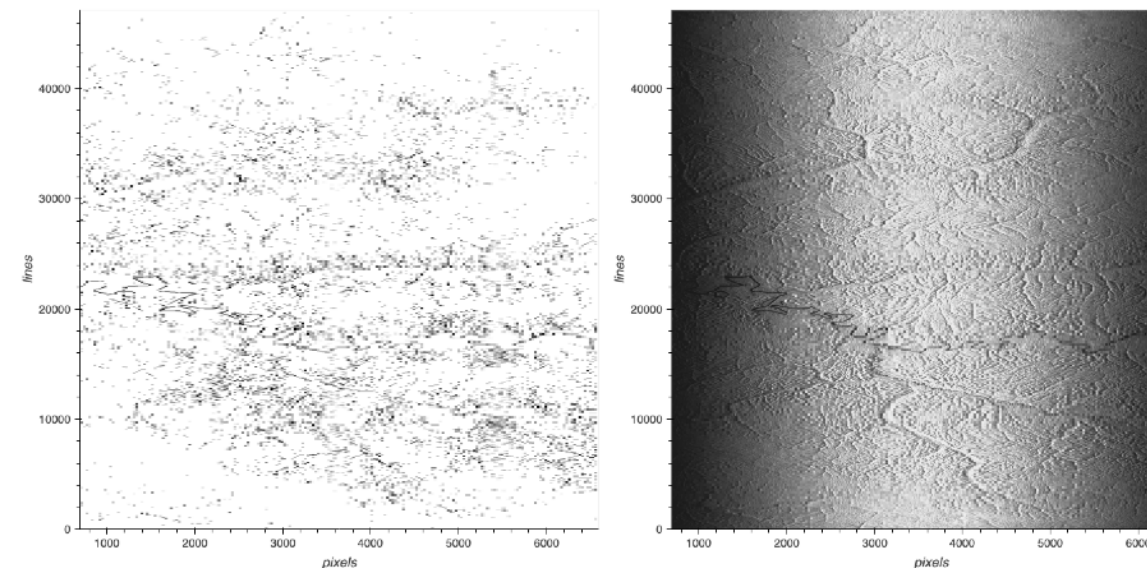
Stripmap acquisition of Amazon rainforest:
Inhomogeneous areas (left)
Amplitude with uncorrected antenna pattern (right)

K. Orzel et al., "The on-orbit demonstration of the small SAR satellite. Initial calibration and observations," *2022 IEEE Radar Conference*
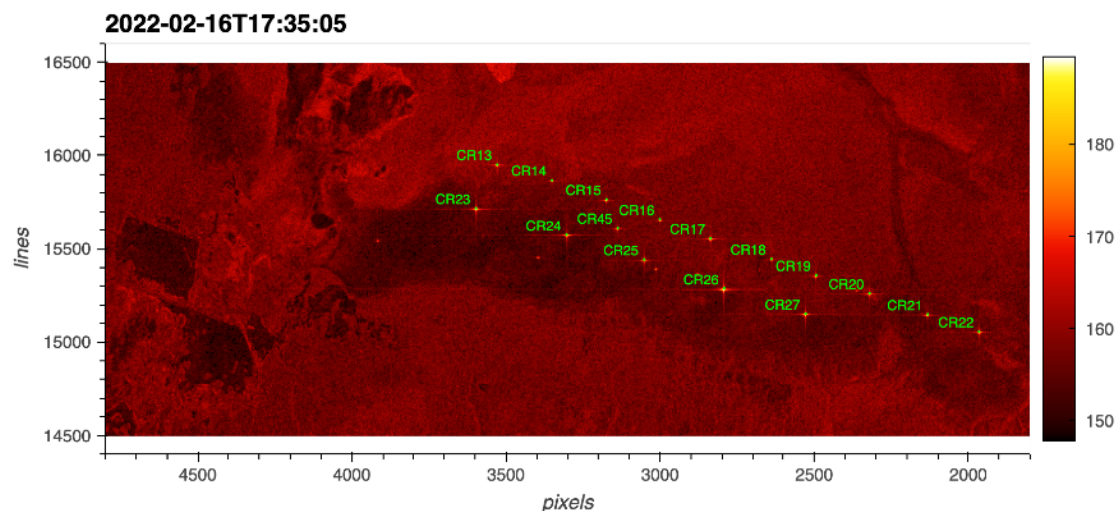
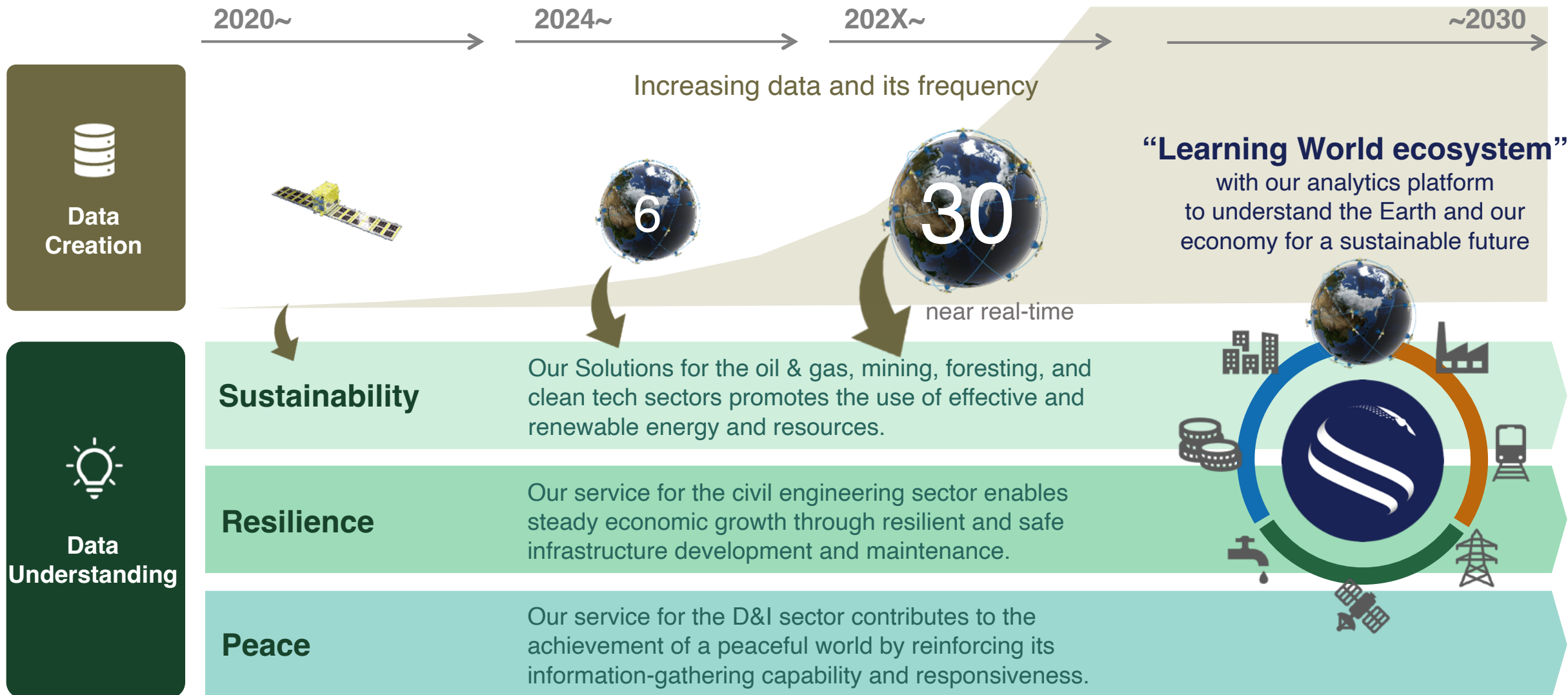Stripmap acquisition of Rosamond corner reflectors

Thoughts on CEOS-ARD

- Great documentation: [CEOS-ARD for Synthetic Aperture Radar specifications](#)
  - Will need time to be compliant
  - Additional raster data sound interesting (DEM, shadowing mask, …)
- InSAR
  - Excited about CEOS Geocoded Single-Look Complex images
  - Need to evaluate impact of our baseline accuracy
  - Coregistered Single look Slant range Complex (CoSSC) products?
    - Coherence raster as metadata?
    - Which coherence estimator was used?
- CEOS preferred file formats for L0, L1 and L2?
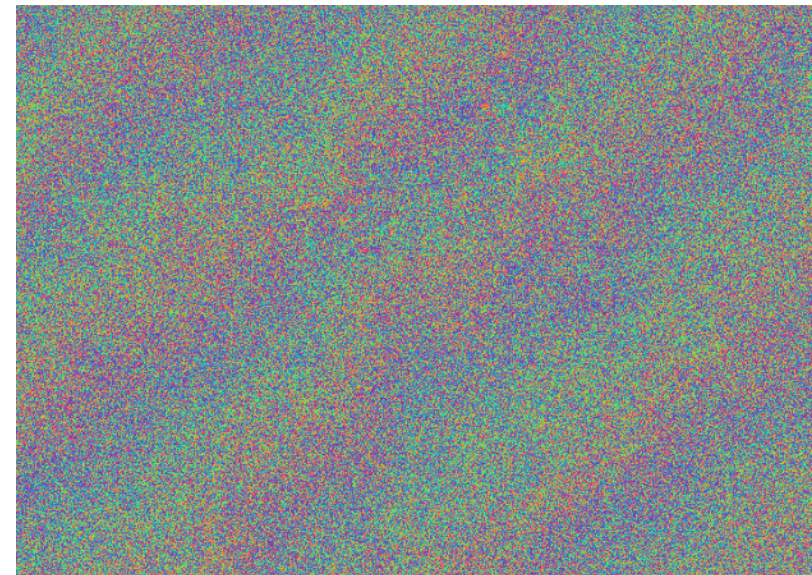
StriX SL 1-day interferogram: coherence and phase

Roadmap

Synspective aims to build the Learning World ecosystem with our analytics platform and near real-time SAR data to understand changes anywhere in the world.

2020~ → 2024~ → 202X~ → ~2030

Increasing data and its frequency

Data Creation

6

30

near real-time

"Learning World ecosystem"
with our analytics platform
to understand the Earth and our
economy for a sustainable future

Data Understanding

Sustainability
Our Solutions for the oil & gas, mining, foresting, and clean tech sectors promotes the use of effective and renewable energy and resources.

Resilience
Our service for the civil engineering sector enables steady economic growth through resilient and safe infrastructure development and maintenance.

Peace
Our service for the D&I sector contributes to the achievement of a peaceful world by reinforcing its information-gathering capability and responsiveness.

Synspective

Gerald Baier

Manager, SAR algorithm unit