



A New Standard for Earth Observation

NASA Commercial Small Satellite Data Acquisition - Webinar

Dave Jones – Engagement Lead, Mission Solutions
david.jones@capellaspace.com

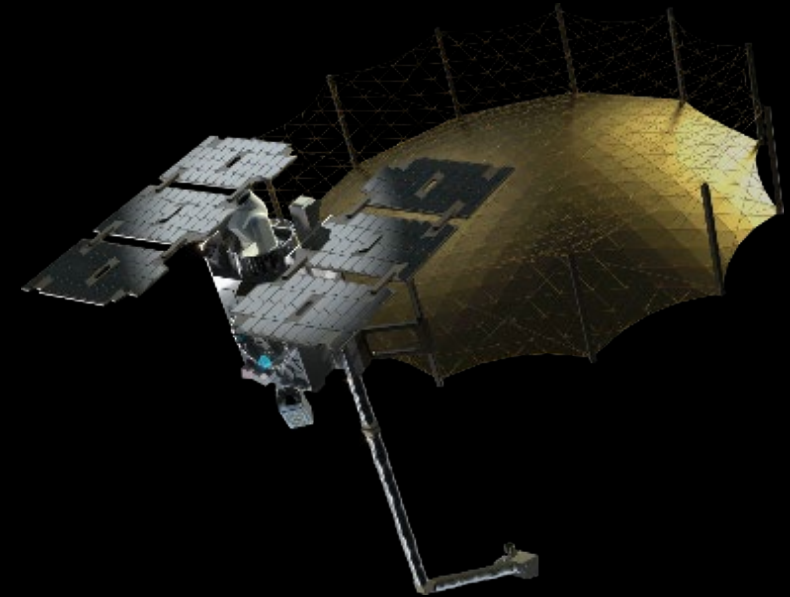
David Jones – Capella Space

- Currently the Engagement Lead – Mission Solutions team
 - Supporting End User requirements in the DoD and Intelligence Community
- Career Imagery Analyst – 28 +yrs.
 - US Navy from 1994 -2003
 - Contractor/Government Imagery 2003 – 2023
 - Deputy Operations Chief at SMDC GEOINT 2019-2023
 - NGA SAR Adjunct Instructor



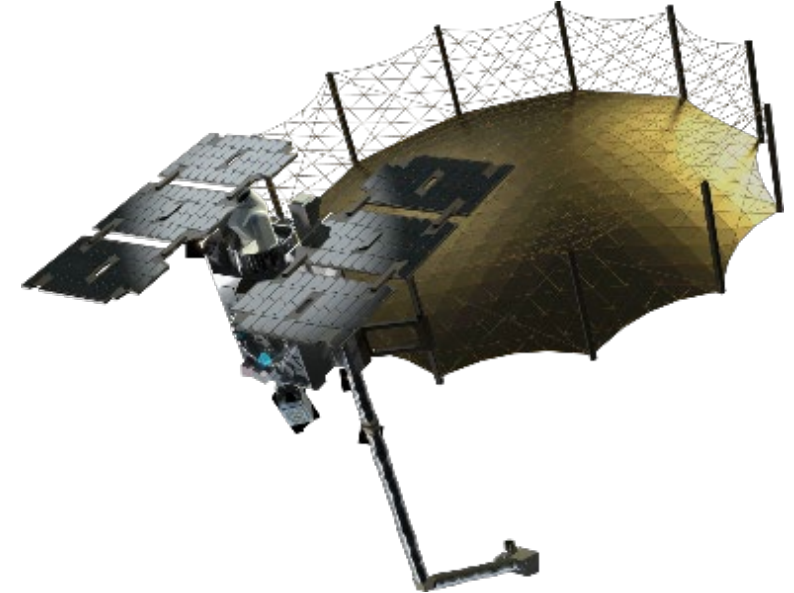
What is SAR?

- Originally developed in the 50's and 60's
- SAR is a form of radar
 - Using radio waves and measuring their response
- Aperture
 - Large antenna needed to achieve fine resolution (motion)
- Key features of SAR
 - High resolution
 - All Weather capability
 - Day and Night
- Miniaturization and Commercialization
 - Germany, Italy, etc were the first to commercialize
 - 2018 Capella launched the US's first COMSAR
- Applications for SAR
 - Earth Observation and Environmental Monitoring
 - Natural disasters (pre and post)
 - Military and Defense
 - Agriculture
 - Mapping (3D models)
 - Change detection
 - Releasability to partner nations

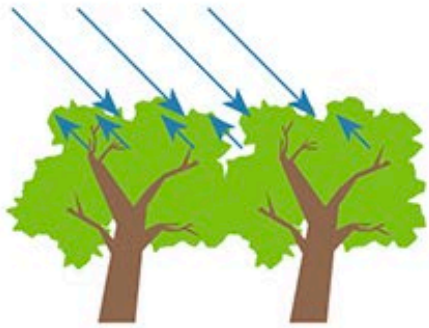


Advancements of the years

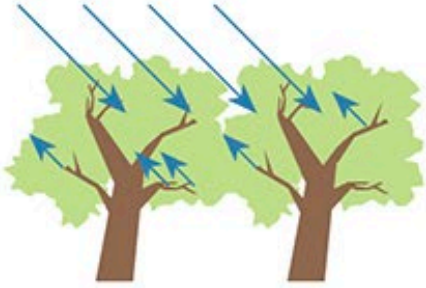
From air dropping imagery, to tasking and pulling down imagery from your iPhone



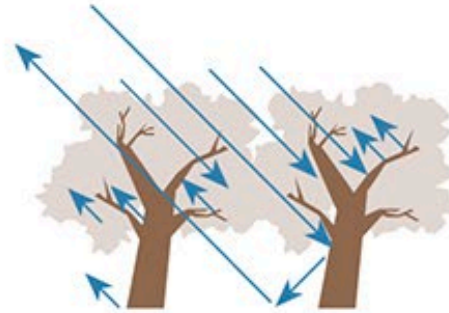
SAR Bands



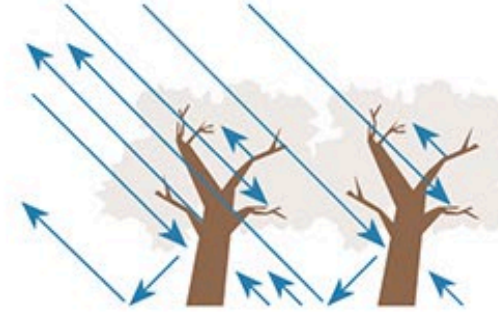
X-BAND 3 cm



C-BAND 6 cm

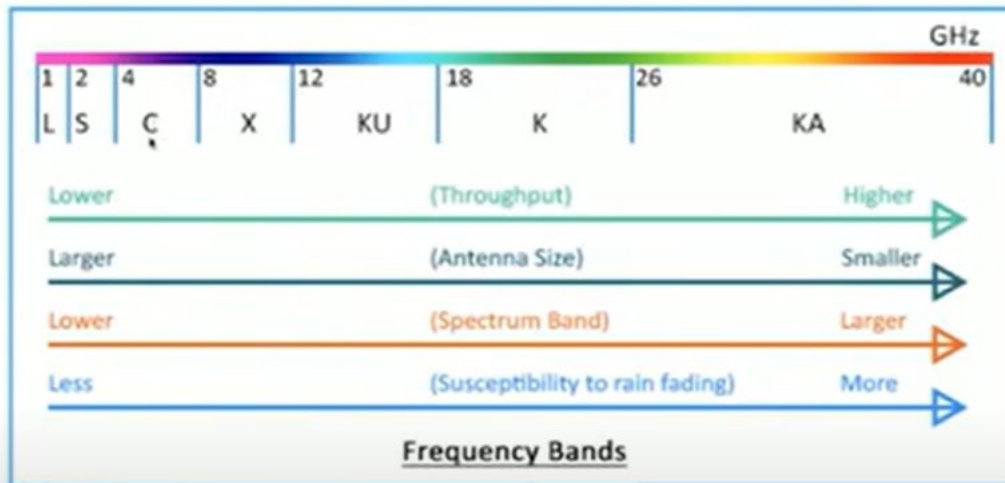


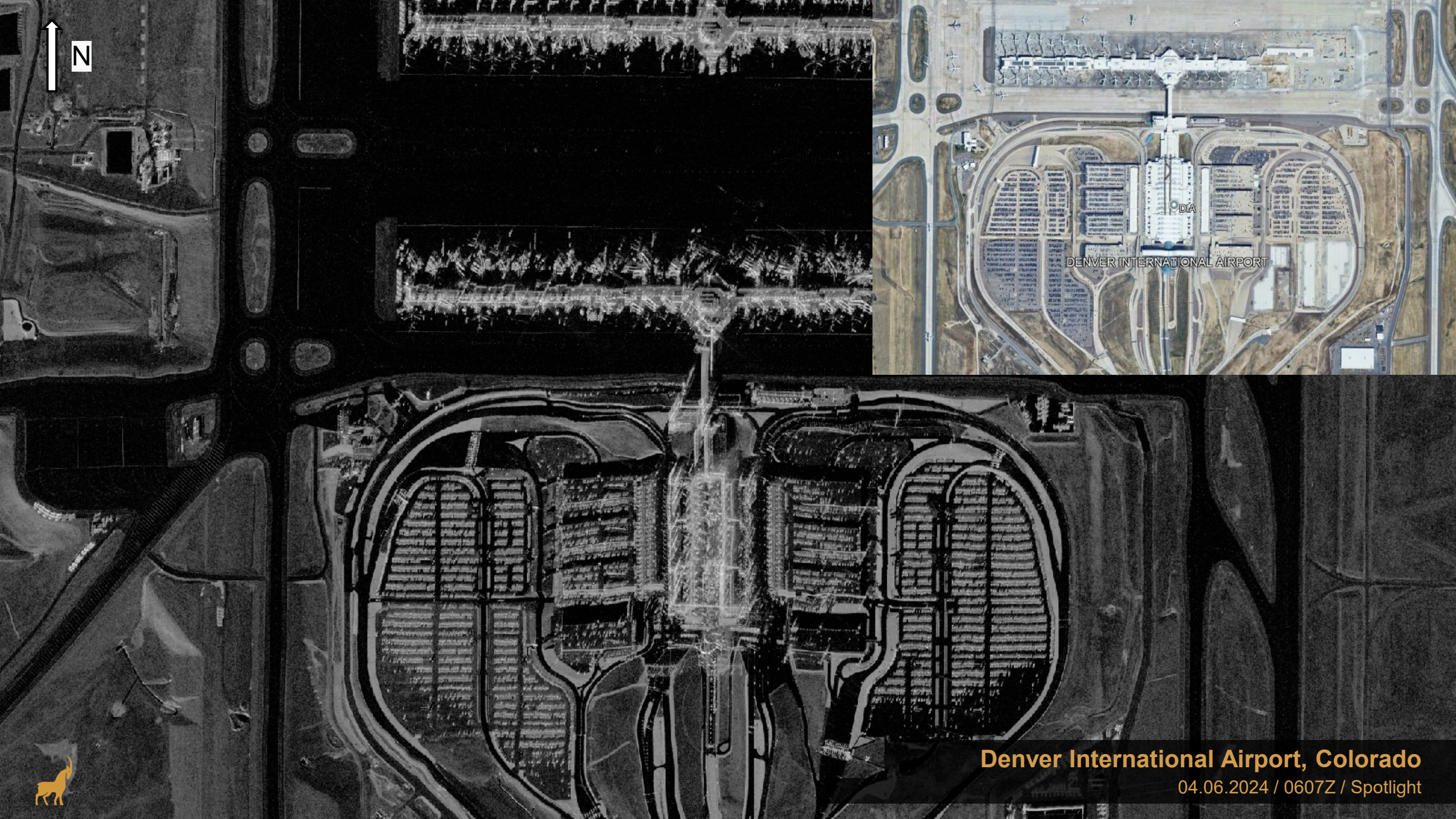
L-BAND 24 cm



P-BAND 65 cm

Frequency Bands

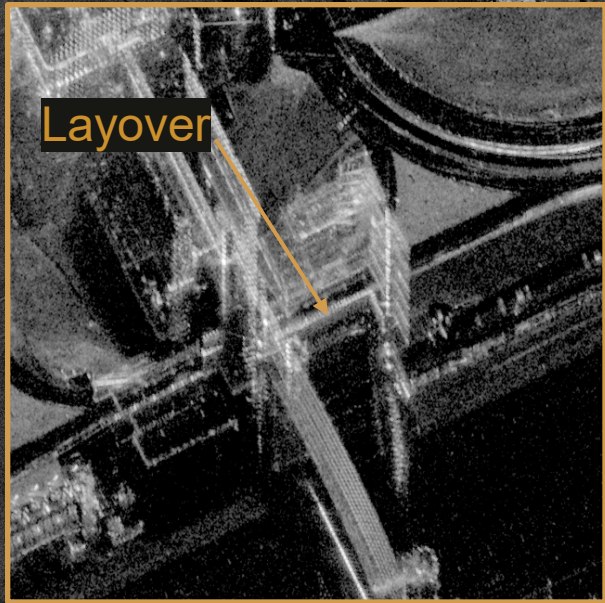




Denver International Airport, Colorado

04.06.2024 / 0607Z / Spotlight





Layover



Specular

Diffuse

Denver International Airport, Colorado

04.06.2024 / 0607Z / Spotlight



EO vs SAR



MAXAR Electro - Optical



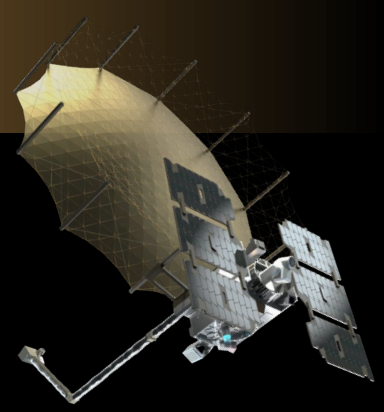
Capella Space Synthetic Aperture Radar



Capella Space – Our Story



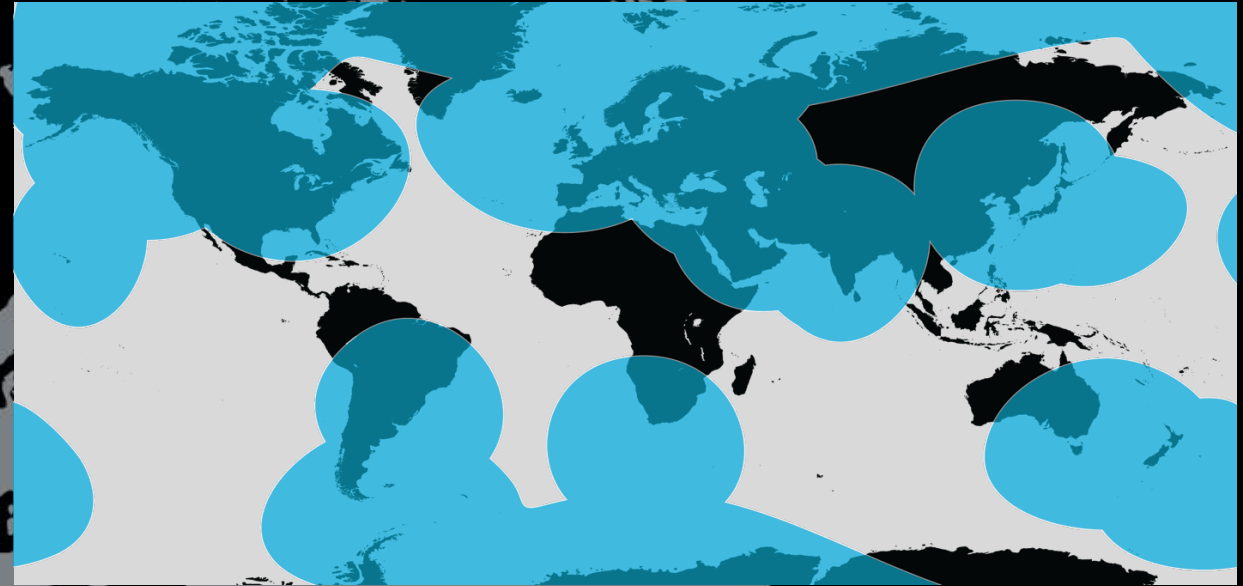
Capella Space



- **Best-in-class:** Capella satellites have industry leading quality and imaging capacity
- **Validated & Proven:** Capella's constellation of satellites is delivering critical intelligence to government and commercial users around the world. TRL 9: actual system flight proven through successful mission operations; Capella is also MRL 10, with full rate production demonstrated and lean production practices in place
- **Fully Integrated:** Capella designs, builds, integrates, and operates direct taskable satellites with customer direct data delivery
- **Extensive IP via R&D:** Capella has built an HW/SW IP portfolio differentiating us from our competitors
- **Constant Evolution of Technology:** Capella evolves its on-orbit (HW) technology every 12-24 months combined with continuous new SW deployment
- **Operational and Experienced Constellation:** Capella currently has six satellites on orbit, and is planning five more for 2025
- In commercial operations since late 2020
- Continuous manufacturing implemented in '23
- Diversified business lines, customers, and pipeline



A Global Network of Ground Stations



REACTIVE TASKING

VHR IMAGING

LOW LATENCY



SAR Data Products

24/7, cloud-free imagery with unparalleled visual clarity

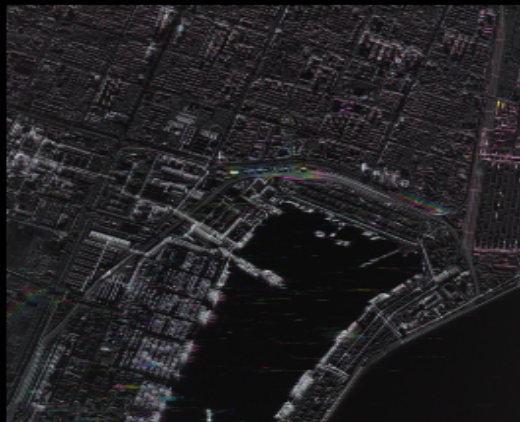


The Capella Advantage

Capella Space's high-quality, high-resolution SAR data offers a continuous view of the world with the power to explore your areas of interest for actionable information and more informed decision-making. Coupled with a fully automated tasking platform, Capella's unique SAR capabilities deliver frequent, timely, and high-quality imagery where and when customers need it most.

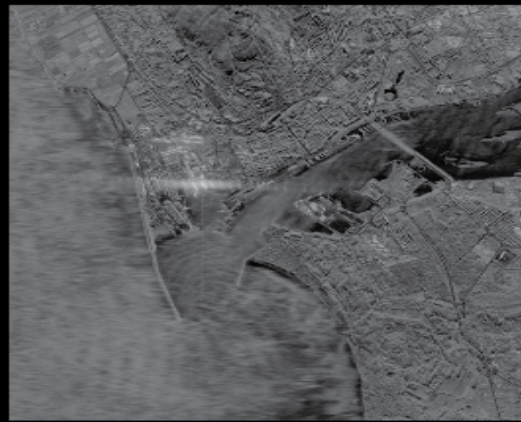
SAR Collection Types

Capella's collection types are carefully curated to meet a variety of mission needs. Each collection type has a predefined set of imaging acquisition parameters to provide the optimal performance of the Capella constellation.



Spotlight Ultra

Extract fine details like motion and obscured manmade objects with additional products like colored sub-aperture imagery (CSI) and dynamic imaging.



Spotlight

Classify objects, detect change and capture more targets than ever with very high-resolution, high-quality imagery optimized for volume and speed.



Spotlight Wide

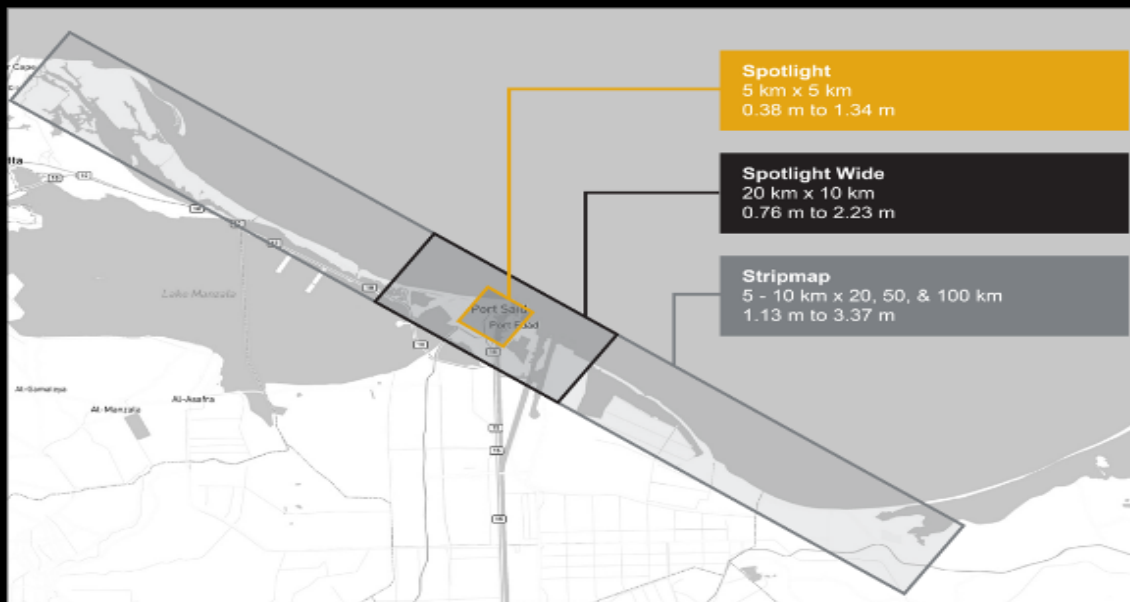
See more than ever with large-area, medium resolution spotlight imagery. Monitor vessel movements, discover illegal mining or track lava flows.



Stripmap

Get the most coverage over your target area of interest for broader land use monitoring and baseline mapping.

Coverage



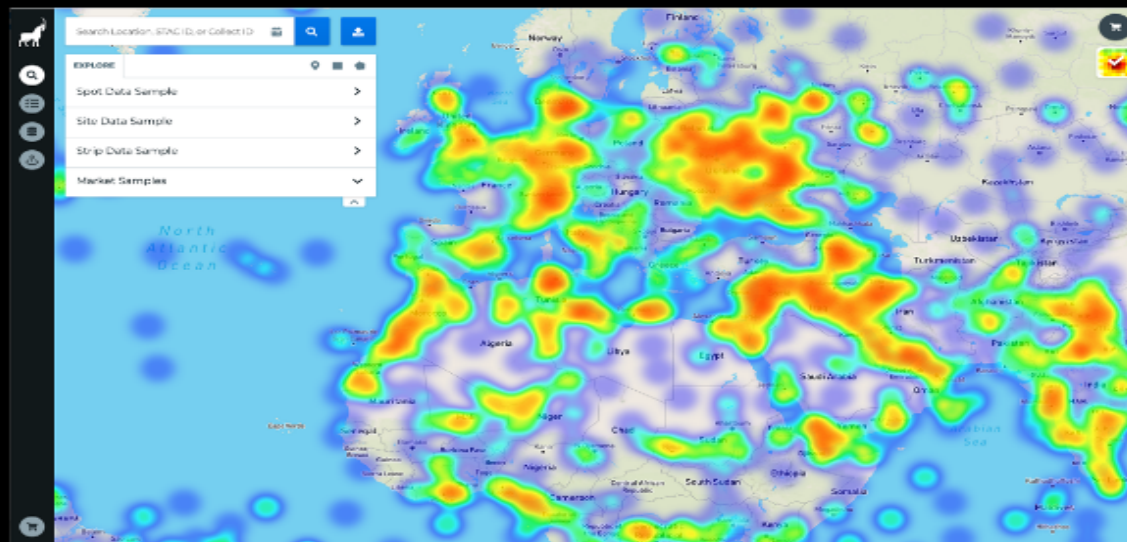
Capella Archive

Search the largest collection of high-quality, high-resolution commercial SAR imagery. Leverage Capella's continuously growing archive for historical context alongside current data at mission-critical locations across the world.

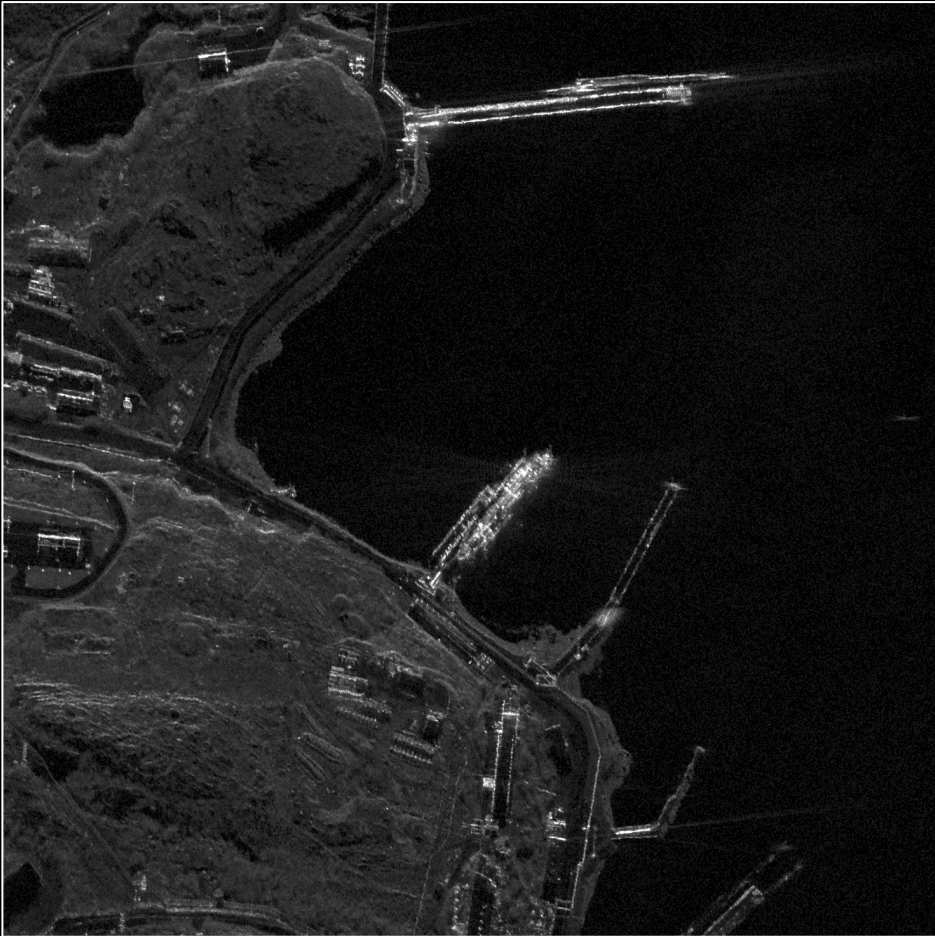
- Access thousands of feature-rich imagery for baseline or time-series analysis
- Apply advanced analytics like Change Detection and Vessel Classification on historical imagery
- Leverage subscription packages for continuous monitoring of specific AOIs and machine learning model development

Collection Types

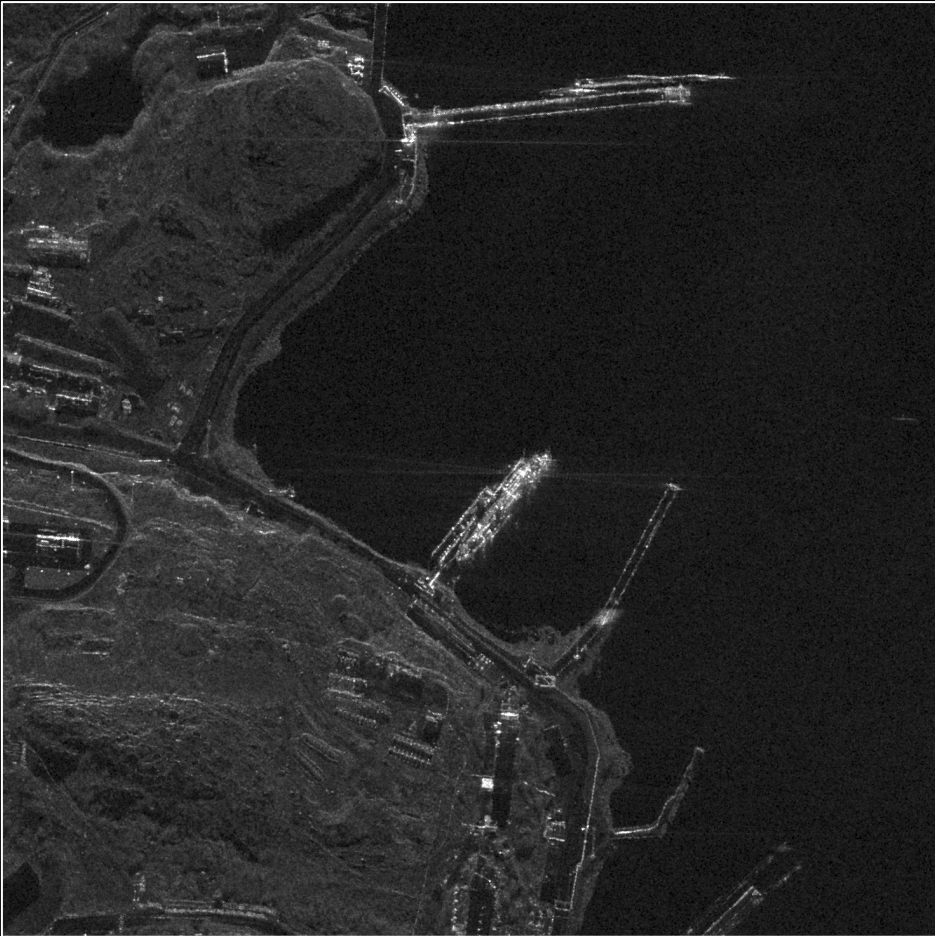
Collection Type	Spotlight Ultra	Spotlight	Spotlight Wide	Stripmap
Look Angle	15° - 50°			
Grazing Angle	73.5° - 33°			
Scene Size (km)	5 x 5		10 x 20	20, 50, 100
Dwell (sec)	28 to 52	8 to 16	15 to 18	4 to 17
Slant Range Resolution (m)	0.25 / 0.3		0.5	0.75
Ground Range Resolution (m)	0.38 to 1.34		0.76 to 2.23	1.13 to 3.37
Azimuth Resolution (m)	0.25	0.5	1.0	1.2
Looks	5	3	3	1
Squint Angle Range	+/- 30°		+/- 0°	



Spotlight Comparison



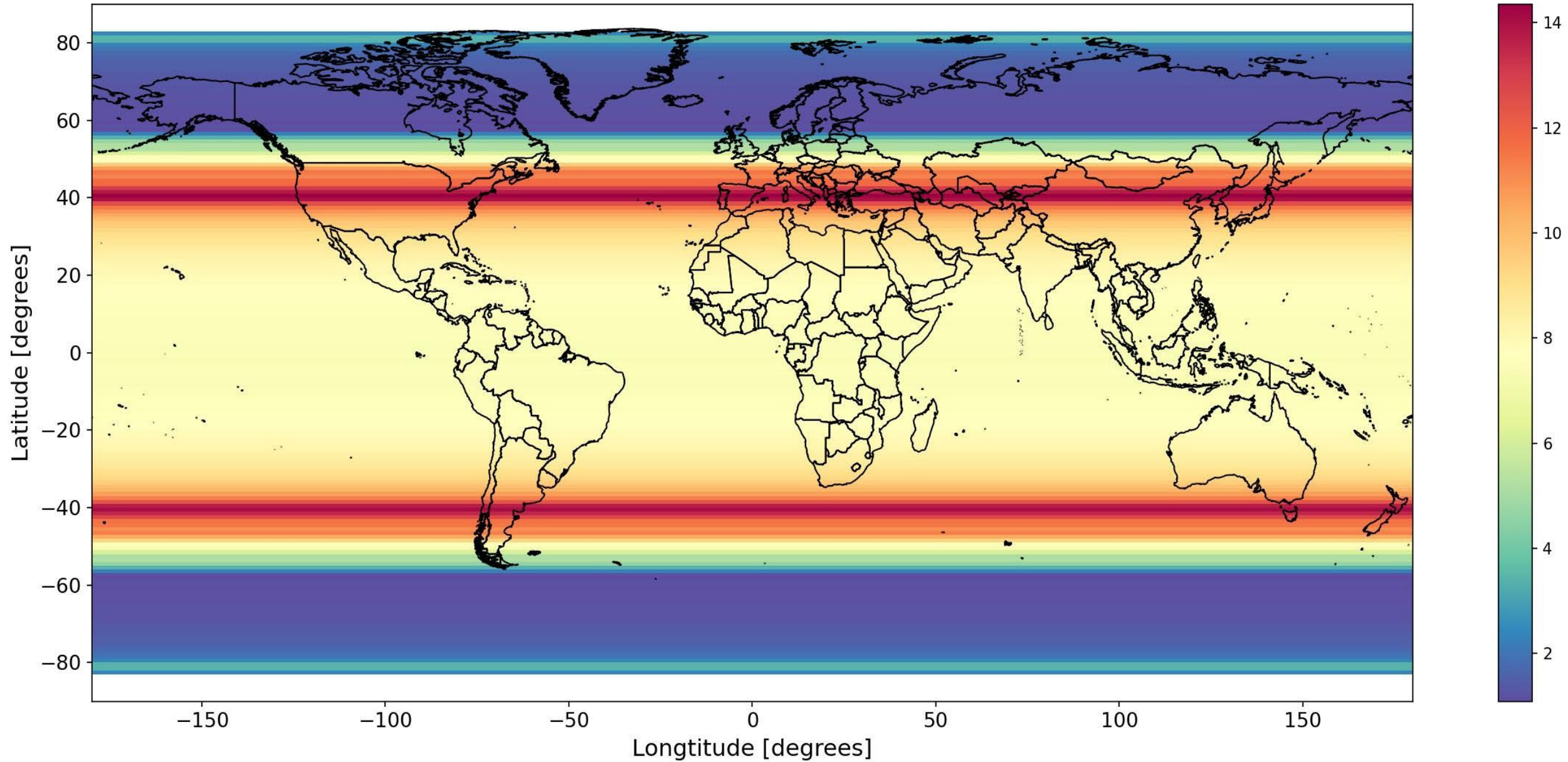
Spotlight Ultra
0.25 m AZR / 5 look



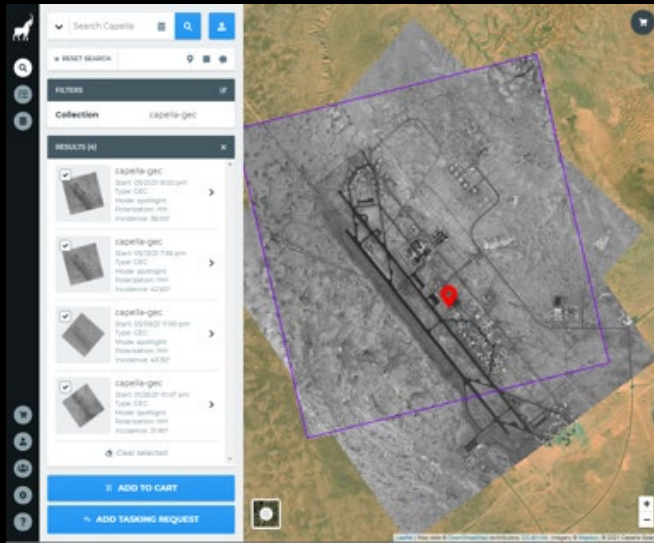
Spotlight
0.5 m AZR / 3 look



**Average number of opportunities per day, averaged by latitude,
Look angle range: 15° to 50°,
Constellation: C9, C10, C11, C14, C13, C15**



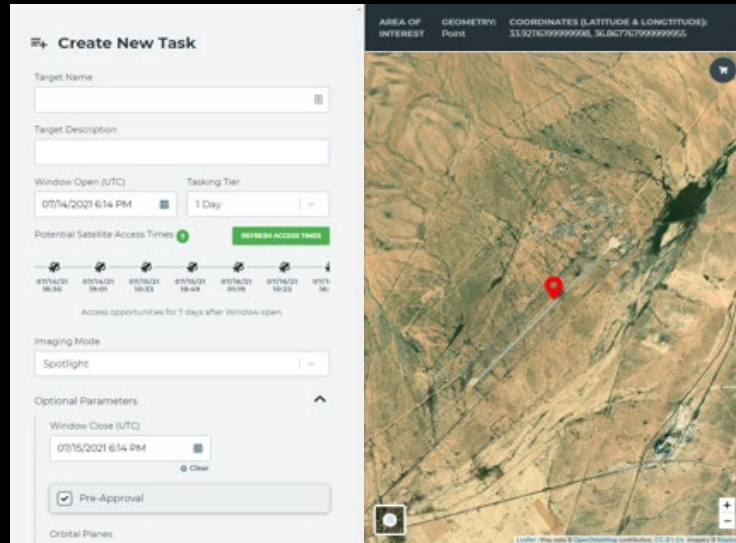
Capella User Console Interface & API



Catalog Browsing & API Integration

Full catalog of historical collection for baseline metrics & pattern of life analysis.

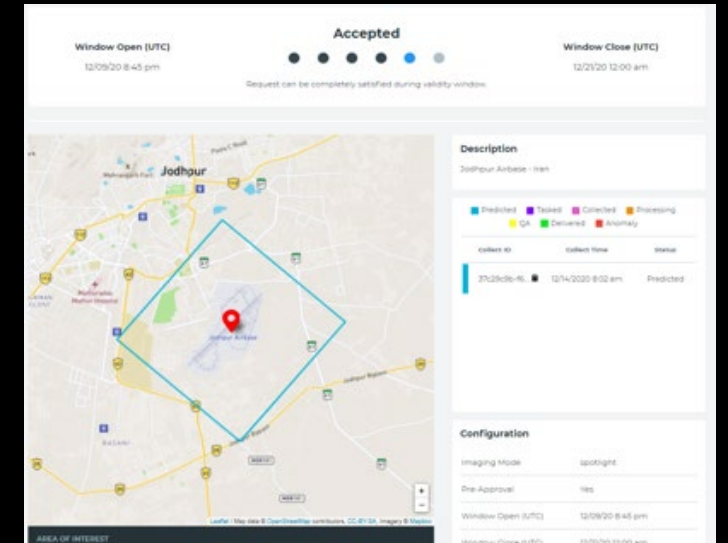
Tip-and-cue scenario for immediate responsiveness via API integration.



Simple-to-Use GUI

Task or purchase archived imagery via coordinates, AOI creation tool or shapefile upload.

Fully automated and secure operations: Satellite ops, SAR processing and data storage are cloud based, fully confidential.



Real-Time Status Updates

New tasking scheduling in ≤ 15 minutes and users are provided real-time status updates.

React to emergencies in real-time.

Deliver to teams on the ground hours after capture.



Disaster Relief, Planetary Sustainability & Environmental Monitoring

UK forest inventory



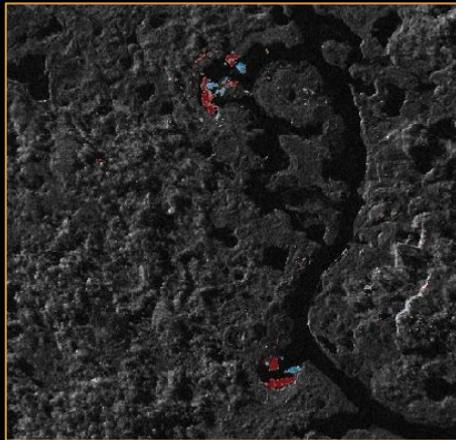
FEMA collection prior to hurricane season



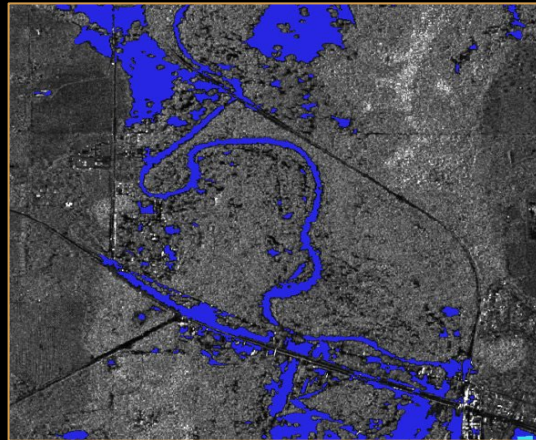
Farmland Monitoring (USA)



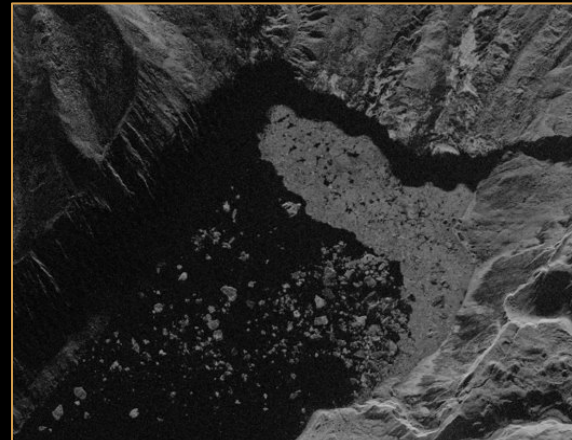
Deforestation monitoring (Indonesia)



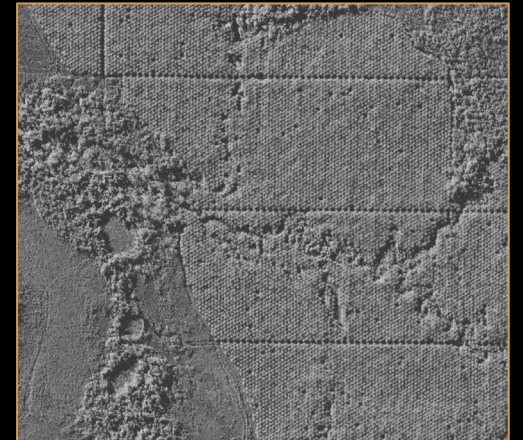
Illegal Mining Detection (Amazon)



Flood Monitoring (Florida)



Glacial Melt Detection



Palm Plantation Monitoring



Coherent Change Detection

Capella continues to refine collection and processing capabilities towards offering Coherent Change Detection

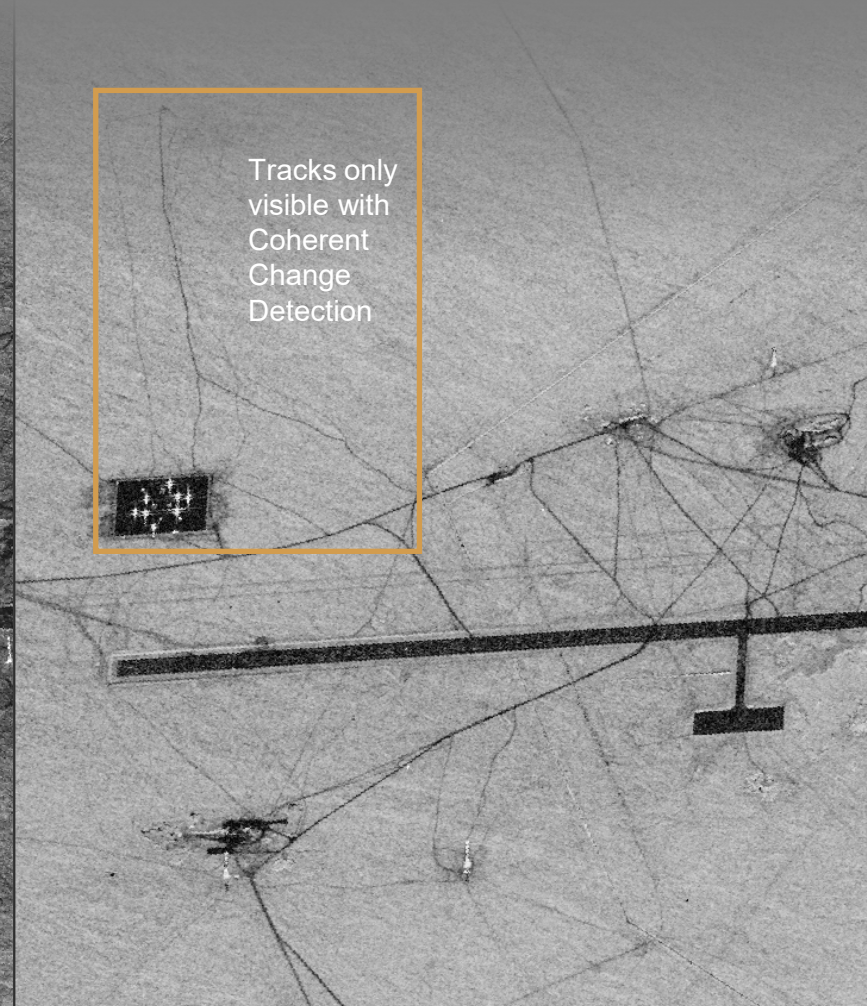
Image 1: 2023-04-23 01:07 Local 🌙
Image 2: 2023-04-28 22:40 Local 🌙



Image 1



Image 2

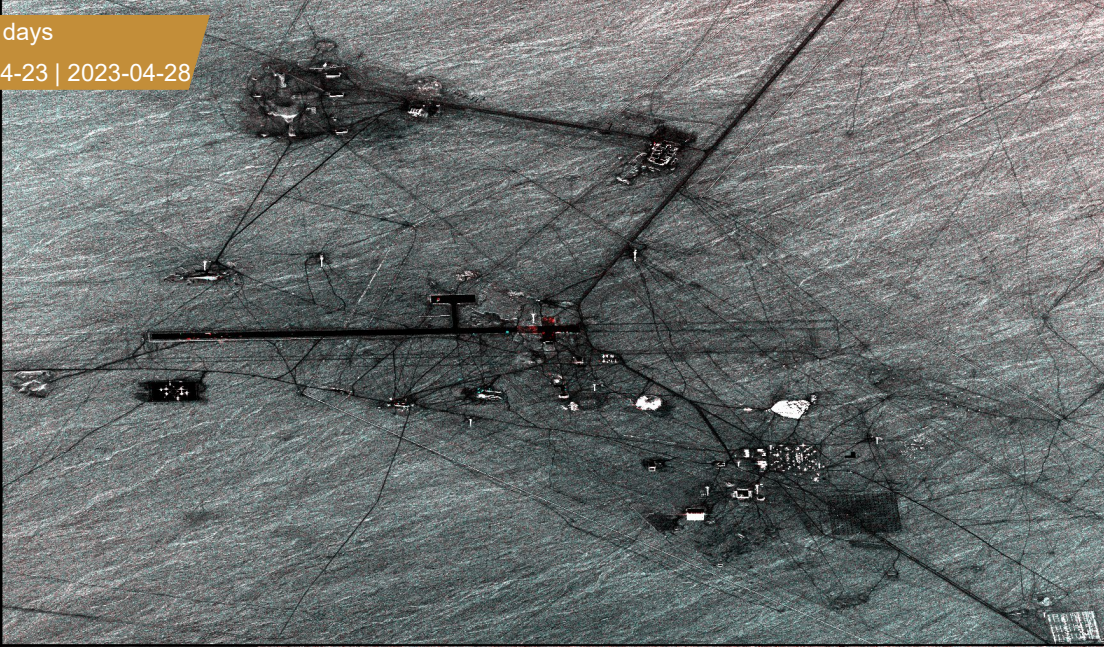


Coherence Map

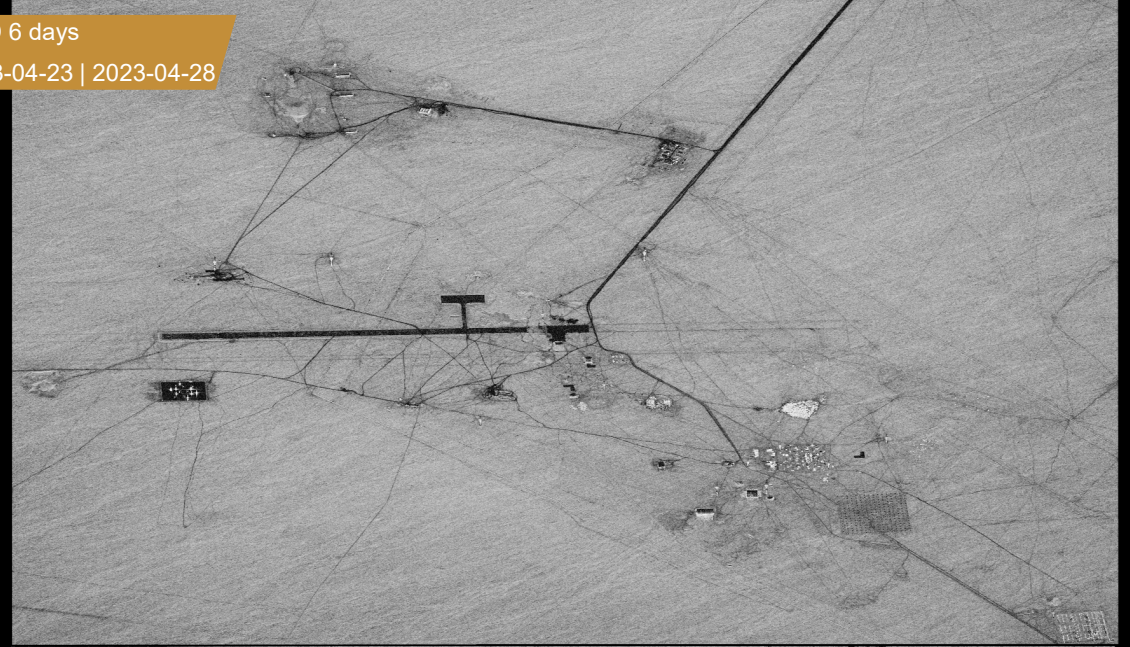
Two Color Multiview & CCD

CCD and ACD
6-day and 270-day delta-t

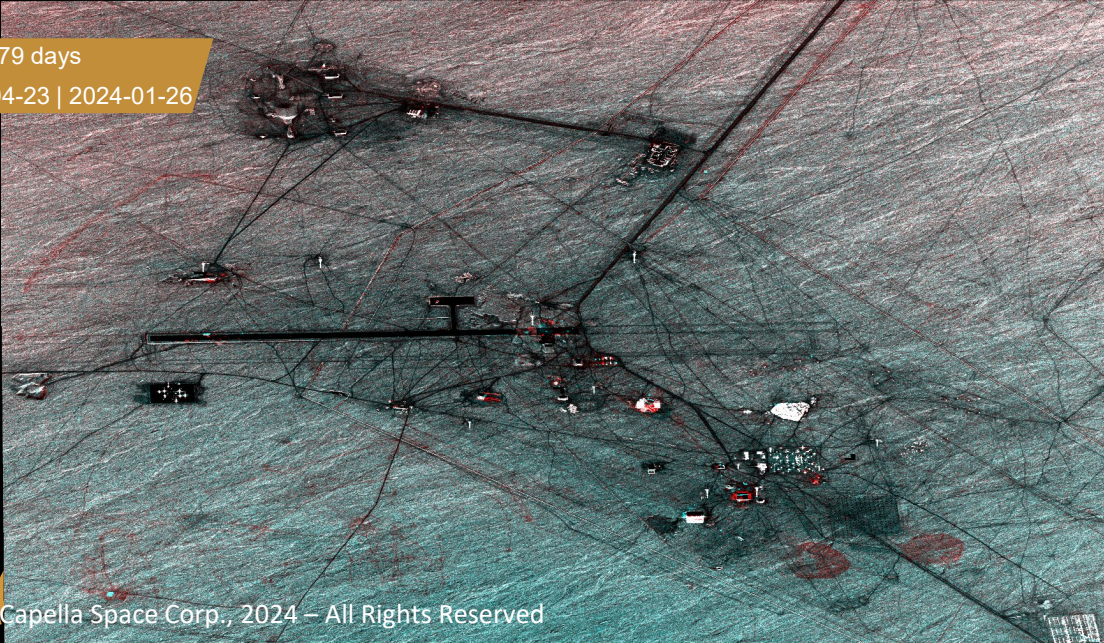
ACD 6 days
2023-04-23 | 2023-04-28



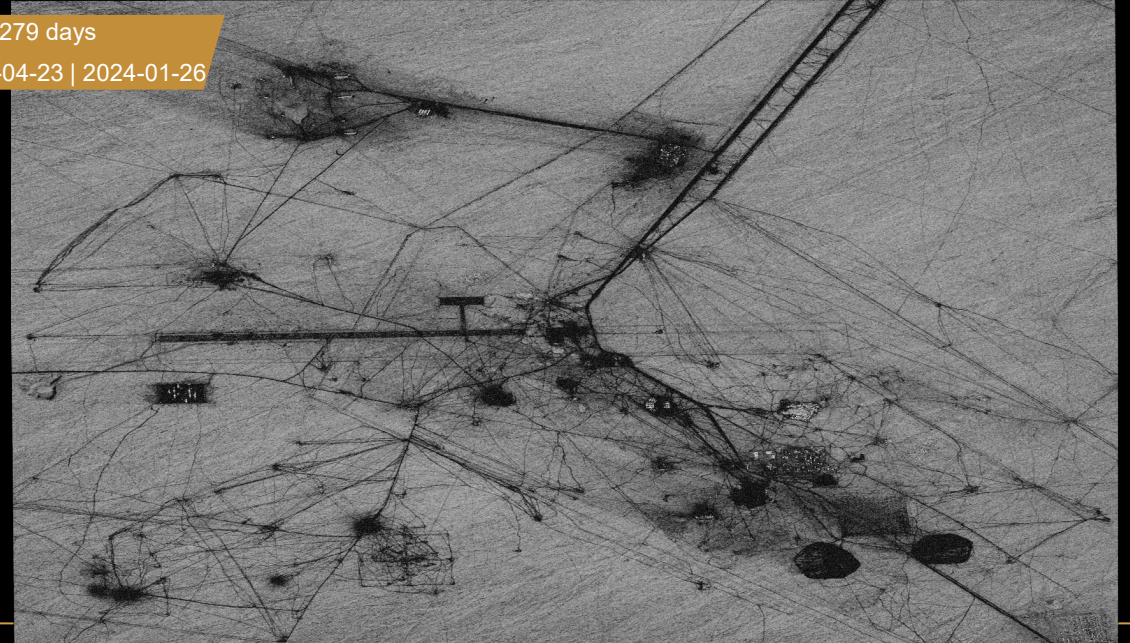
CCD 6 days
2023-04-23 | 2023-04-28



ACD 279 days
2023-04-23 | 2024-01-26



CCD 279 days
2023-04-23 | 2024-01-26

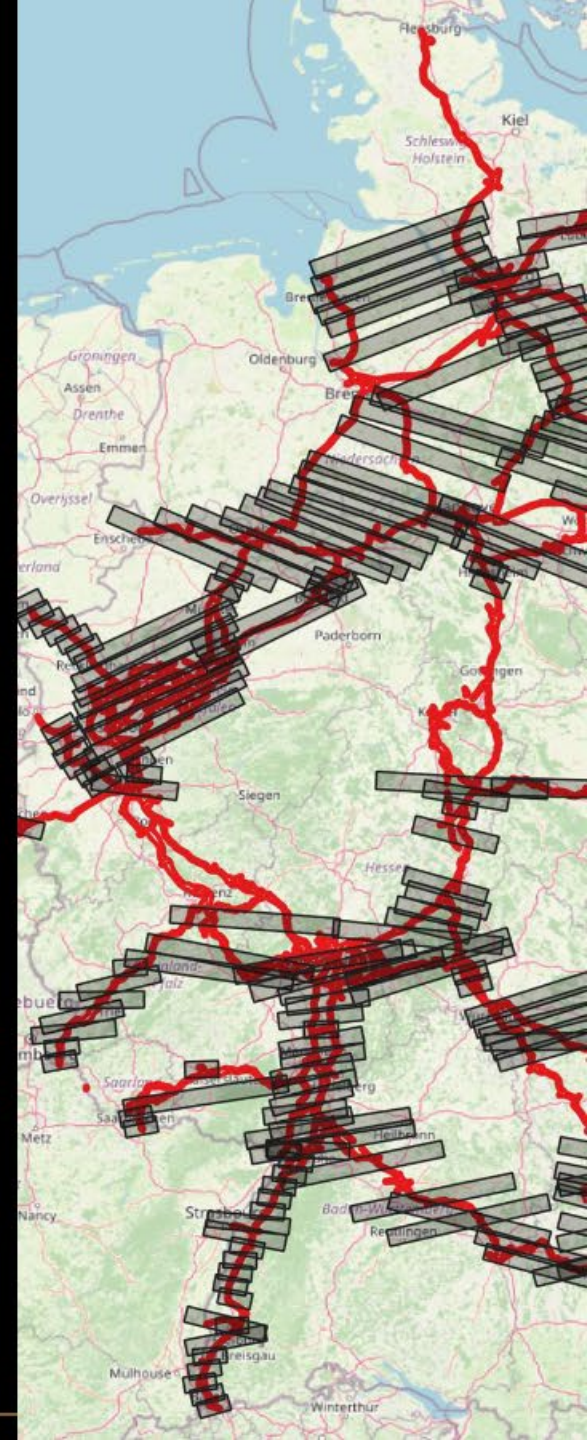


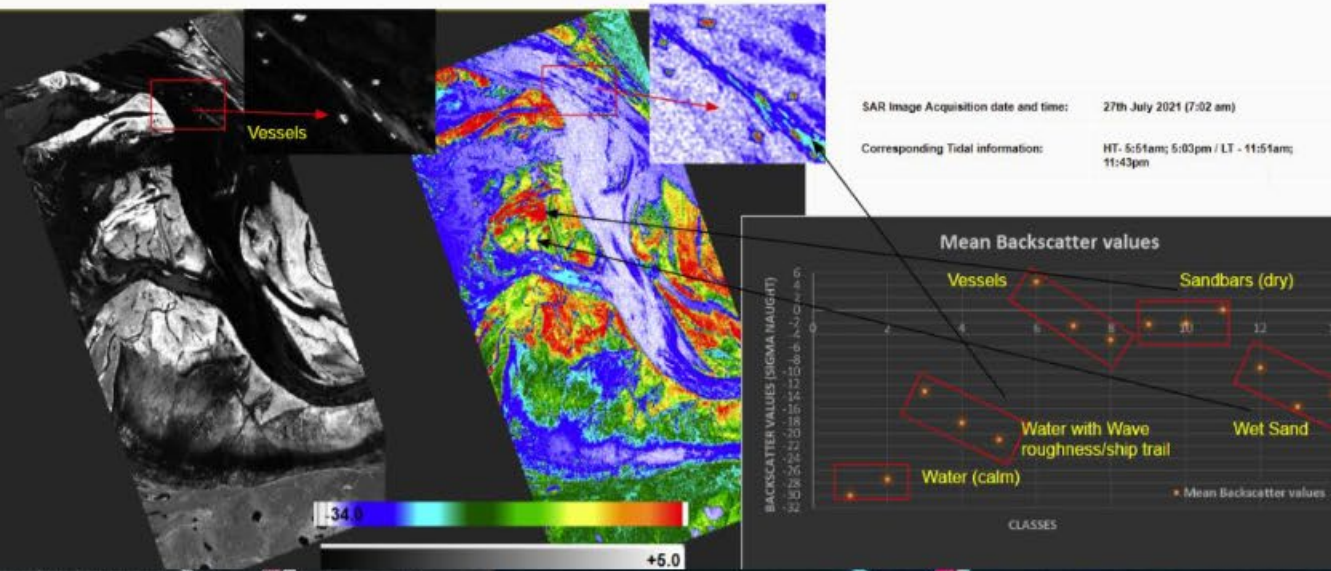


LiveEO

LiveEO and Capella have partnered to offer 24/7, all weather monitoring for over 33,000 km of railway across Germany

Using advanced change detection models on high resolution SAR imagery, LiveEO can identify a wide range of safety hazards that can impact railway operations and threaten public safety.





TCarta and Capella combined capabilities make it possible to measure the effects of climate change on coastal communities and wildlife habitat

Using advanced processing algorithms to analyze backscatter values, TCarta can classify a wide range of surface materials such as water, ice and sand. By precisely synchronizing tidal events with imagery collections, TCarta can extract shoreline extent and map temporal coastal features.

Disaster Response Support

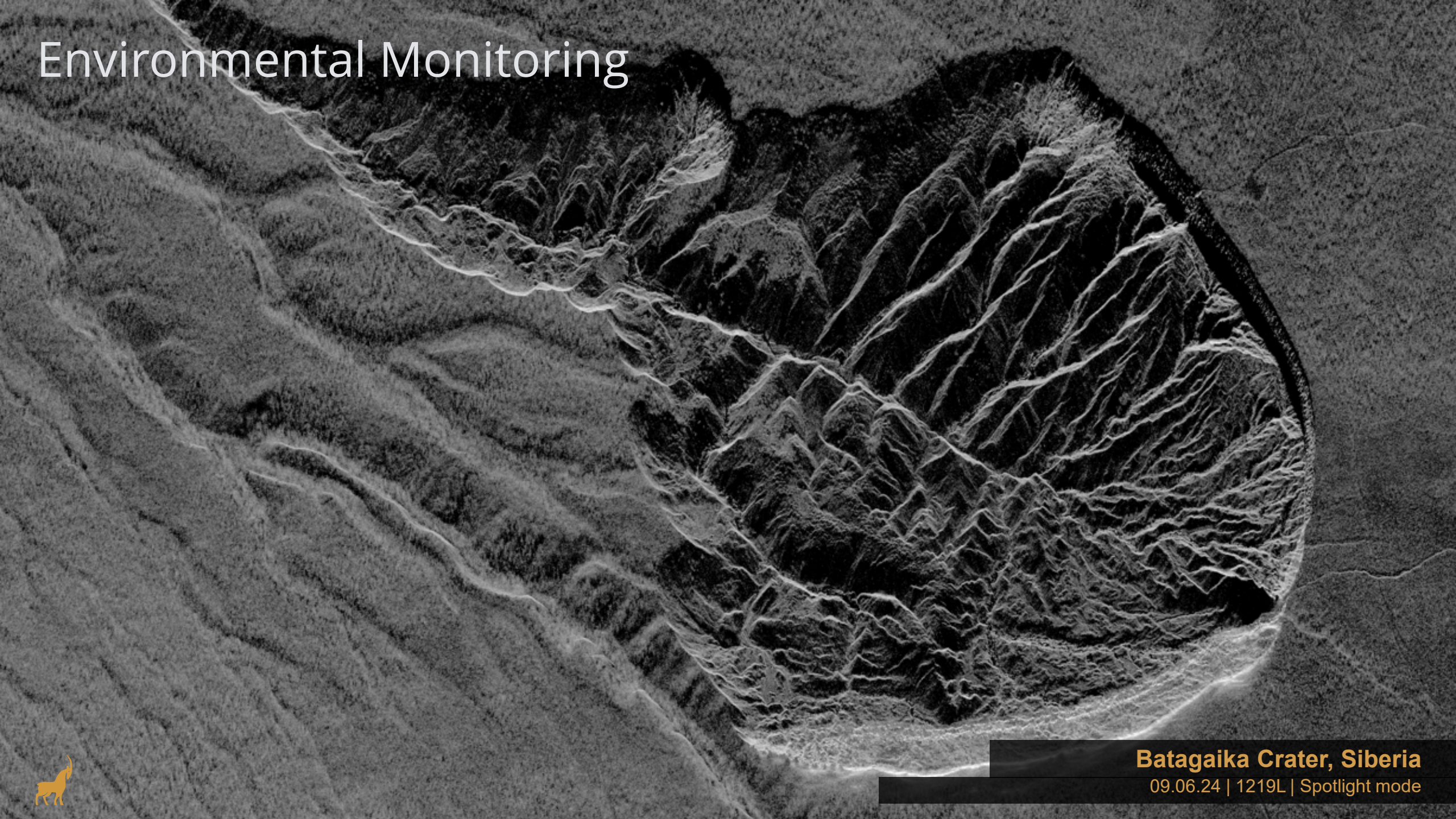


Francis Scott Key Bridge, Baltimore, Maryland

05.18.24 | 0928Z | Spotlight



Environmental Monitoring



Batagaika Crater, Siberia

09.06.24 | 1219L | Spotlight mode



Chinese Carriers in Port

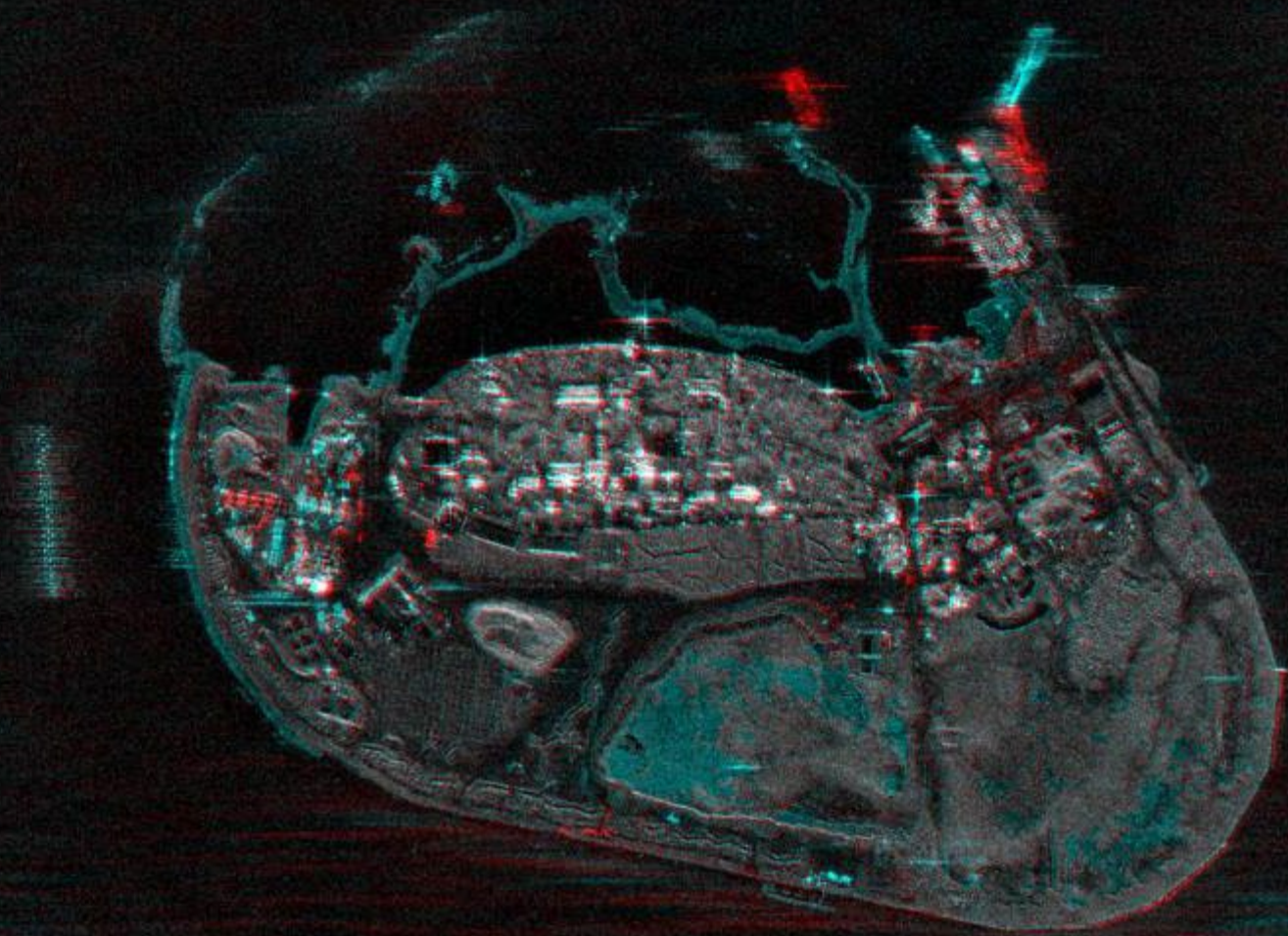


Yulin Naval Base, China

10-10-2024 | 0133Z | Spotlight 5km x 5km



Chinese influence in South China Sea



Sand Cay, Spratly Islands

First image: 17MAR24 Graze: 56 Second Image: 25MAR24 Graze: 55



CSI enhancing analysis

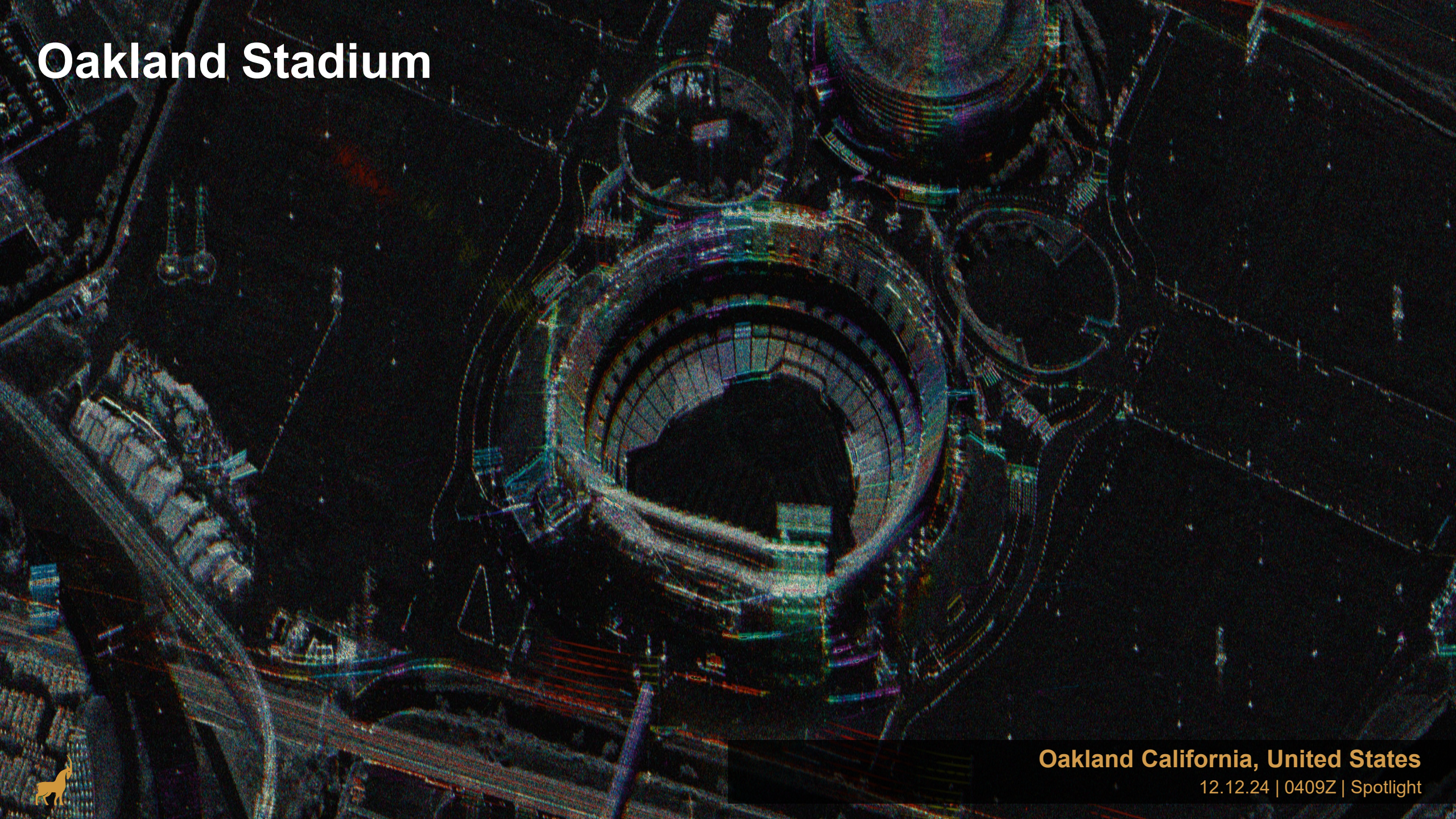


Baranavichy, Belarus

10-02-2024 | 1859Z | Spotlight 5km x 5km CSI



Oakland Stadium

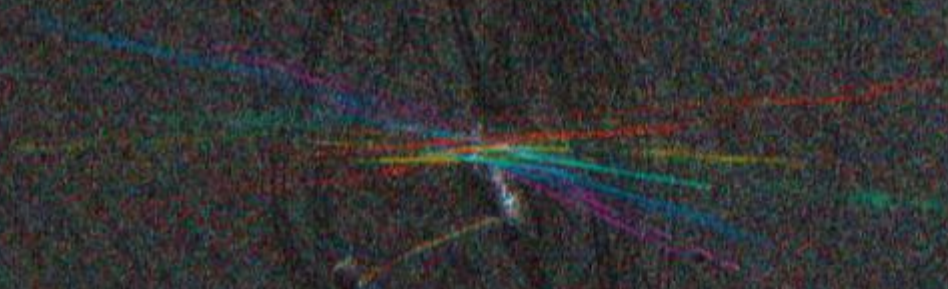


Oakland California, United States

12.12.24 | 0409Z | Spotlight



Possible Rotating Equipment



Kursk, Russia

10.02.2024 | 0835Z | Spotlight 5km x 5km

High-resolution Flood Monitoring

Tasking Spotlight Wide for fast, high-res, broad area coverage

Challenge:

Quickly understanding flood extent across an imperfect AOI – the winding Oder river on the Germany-Poland border

Solution:

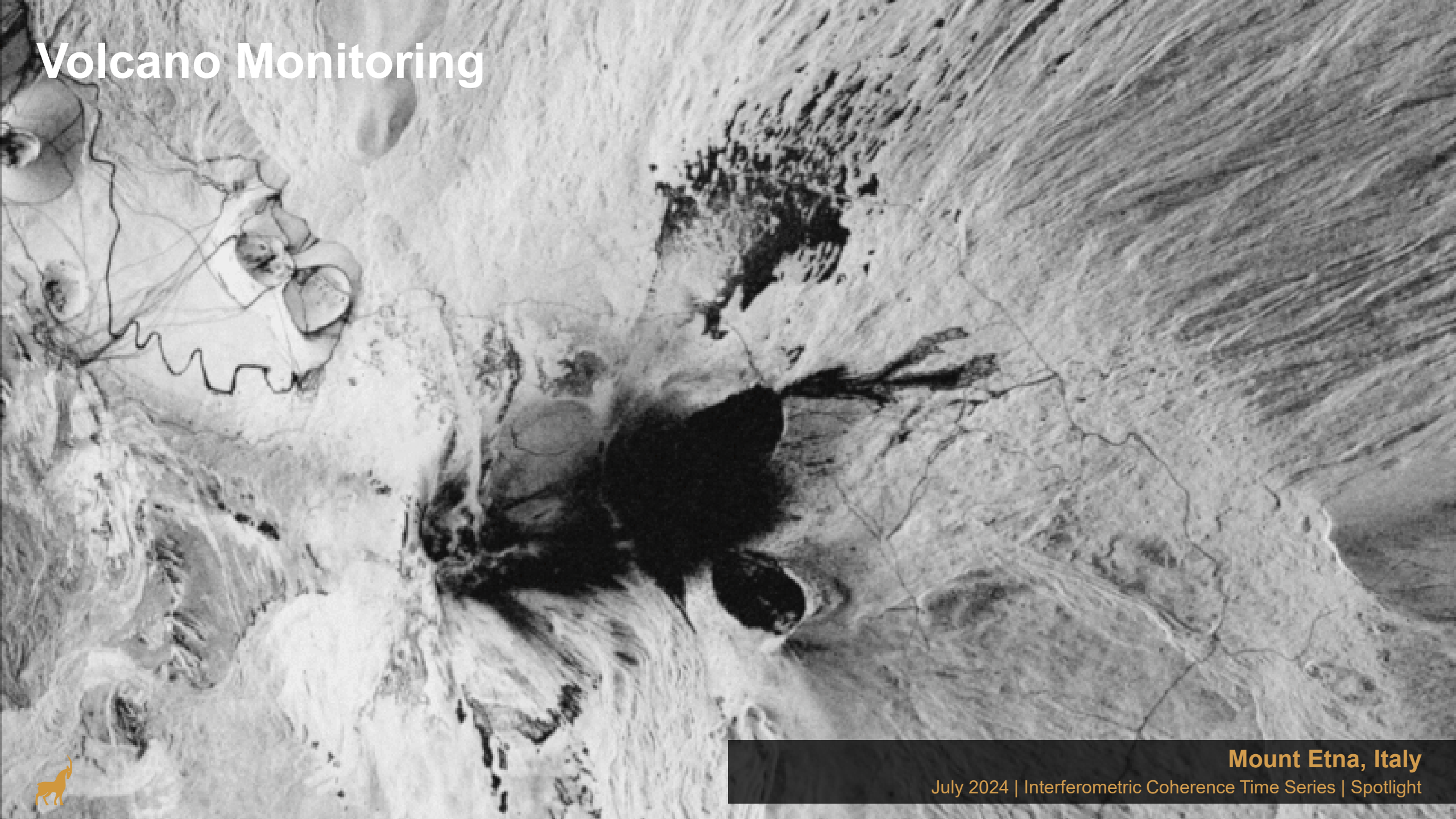
Ordering Spotlight Wide tasks with simple custom parameters to efficiently map the affected areas

Result:

Full coverage of 160 km of river valley only required 10 Spotlight Wide scenes with relevant footprints at the required 1.0 m resolution

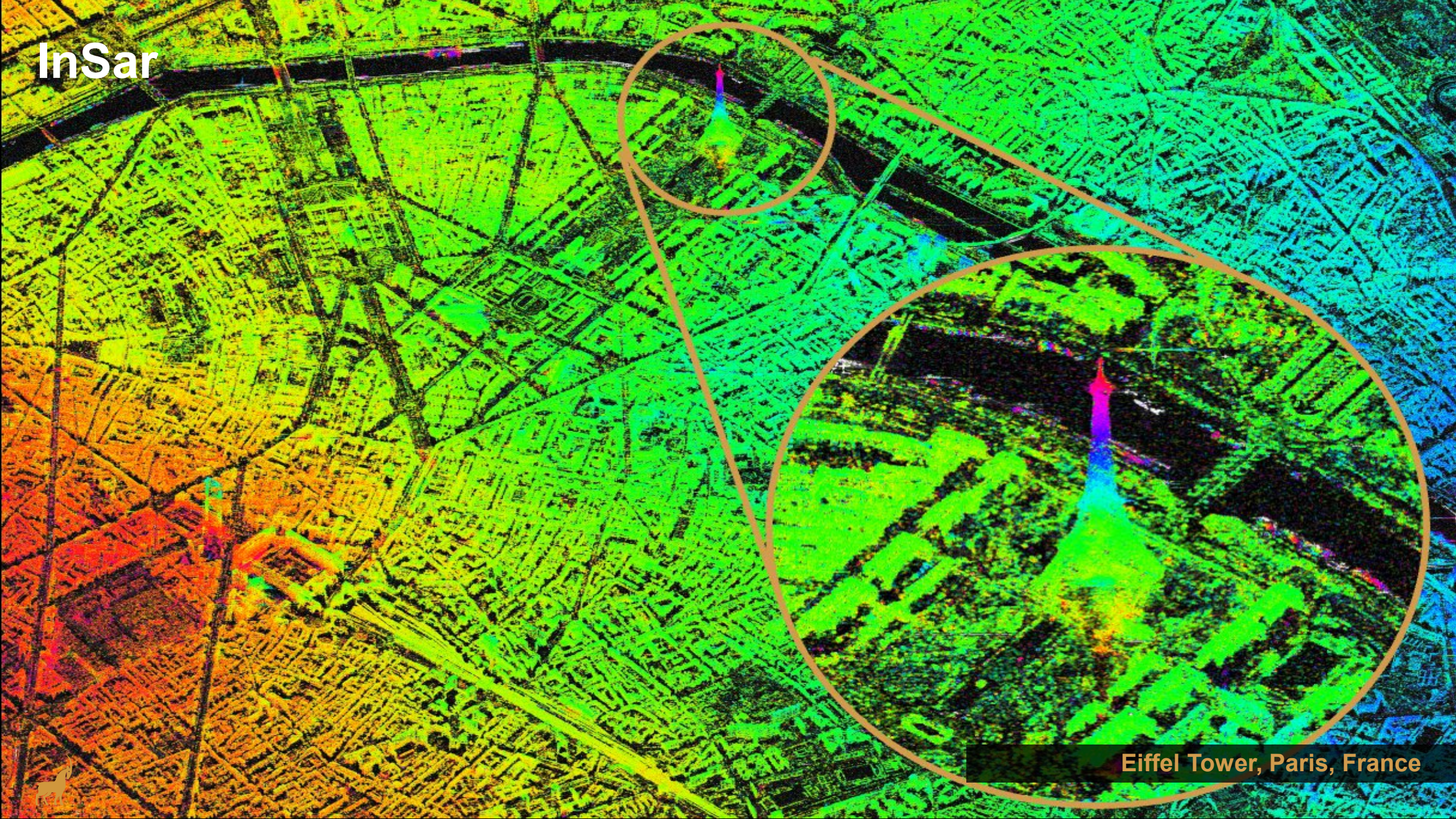


Volcano Monitoring



Mount Etna, Italy
July 2024 | Interferometric Coherence Time Series | Spotlight

InSar



Eiffel Tower, Paris, France

Possible Radar Rotating in scene



Poss Spt Veh

Kursk, Russia

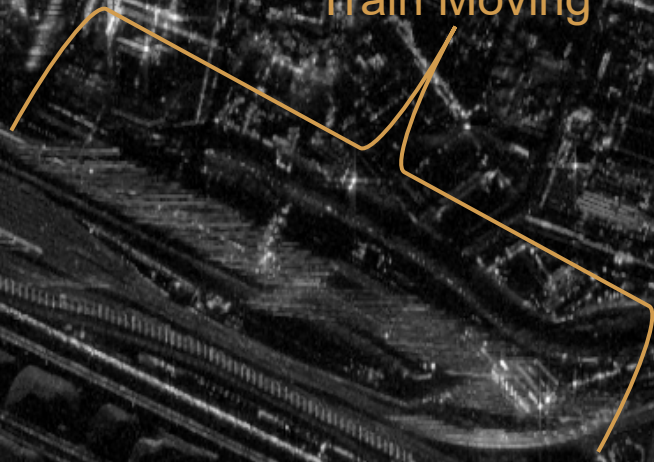
10-2-2024 0835Z Spotlight 5km x 5km



Dynamic Imaging



Train Moving



Rail Yard, China

20 JUN 24 0620Z - 33.8 graze

Scott Clark
Director, Mission Solutions
scott.clark@capellaspace.com

Lori Niemeyer
Director of Business Development, Mission Solutions
Lorelei.Niemeyer@capellaspace.com

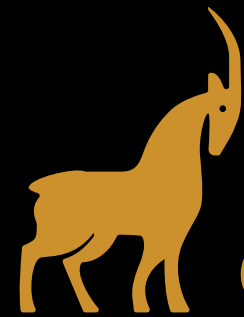
Eric Brooks
Senior Project Manager, Mission Solutions
eric.brooks@capellaspace.com

Stosh Kowalski
Senior Program Manager, Mission Solutions
stosh.kowalski@capellaspace.com

Tom Repetti
Systems Engineer, Mission Solutions
tom.repetti@capellaspace.com

Dave Jones
Engagement Lead, Mission Solutions
david.jones@capellaspace.com

Thank You
capellaspace.com



Capella Space

AMPLIFY INTELLIGENCE™