SPACE FOR CULTURAL HERITAGE

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EUROPEAN NEW SPACE LEADER

ICEYE company, founded in 2015, is building a constellation of microsatellites equipped with SAR onboard for the Earth observation.

ICEYE launched 10 X-band SAR satellites (12 expected satellites in orbit in 2021).

ICEYE is a forerunner in the New Space movement, where the end-to-end development, from the design of satellite and payload, to the building of spaceborne and the data processing, is made in house.

ICEYE

NEW ACTOR IN SPACE

ICEYE

EUROPEAN NEW SPACE LEADER

2018

WORLD'S FIRST SMALL
SAR SATELLITE LAUNCHED

230+

PEOPLE WITH
38+ NATIONALITIES

$152M

SECURED
FINANCING

HEADQUARTERS IN FINLAND,
3 SUBSIDIARIES:
POLAND, US, AND UK

WORLD LEADER
IN SAR MINIATURIZATION
TECHNOLOGY

EXISTING PORTFOLIO OF
INTERNATIONAL
CUSTOMERS

ICEYE

2012	The beginning
2015	Company founded
2016	Initial customers
2017	$13m series A
2018	ICEYE-X1 launch
2018	$34m series B
2018	100 people
2018	ICEYE-X2 launch
2019	3 satellites constellation
2020	$87m series C
2021	10 satellite missions launched to date

PROVEN RESULTS WITH A

NEW SPACE APPROACH

ICEYE

CONSTELLATION

2021 AND FORWARD

12	3	1	0.25
SATELLITES IN ORBIT	**HOUR** AVERAGE REVISIT RATE	**DAY** GLOBAL GROUND TRACK REPEAT	**METER** RESOLUTION

ICEYE

L1 ICEYE PRODUCTS

PARAMETER	SPECIFICATIONS		
IMAGING PARAMETERS			
PARAMETER	**STRIPMAP**	**SPOTLIGHT**	**SPOTLIGHT HIGH**
Nominal swath width	30 km	5 km	5 km
Nominal product length	50 km	5 km	5 km
Incidence angle	15-30	20-35	20-35
NESZ	<-19 dB	<-17 dB	<-17 dB
Slant range resolution	0.5-1.5 m	0.5 m	0.5 m
Ground range resolution	3 m	1 m	1 m
Azimuth resolution	2.5-3 m	0.5 m	0.25 m

CULTURAL HERITAGE NEEDS

The cultural heritage is subjected to risks that could cause damages and major losses:

1. Subsidence and ground motion
2. Indiscriminate urban sprawl
3. Looting
4. Climate change and natural disasters

Satellite data and high technologies can provide useful information to prevent damages and to support the conservation management.

1. This requires a huge amount of high-resolution satellite data with frequent persistent monitoring
2. This needs the synergy between cultural heritage management and space data actors.

HIGH-RES SAR FOR CULTURAL HERITAGE

SAR data are very useful for cultural heritage monitoring, due to its nature.

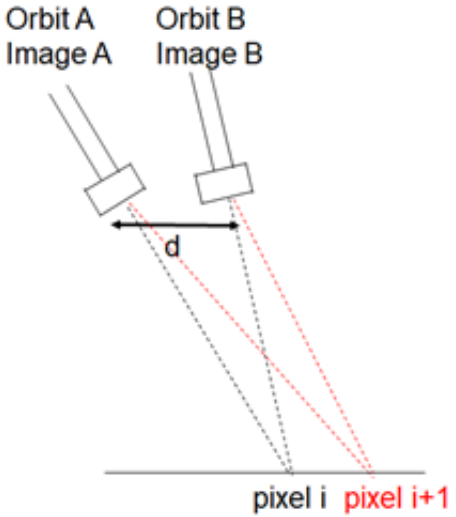
The SAR measures the amplitude and the phase of the backscattered signal from surface :

1. Amplitude is related to the amount of energy that is backscattered toward the sensor
2. The phase is relative to the propagation distance of the signal.

The advantage of the SAR are:

1. Ability to collect high resolution data in all weather conditions and during day or night time, as active microwave sensor;
2. Distance measurement capability, that enables techniques for the deformation monitoring at millimetric scale;
3. Strong interaction with the man-made structure, allowing an accurate land use monitoring.

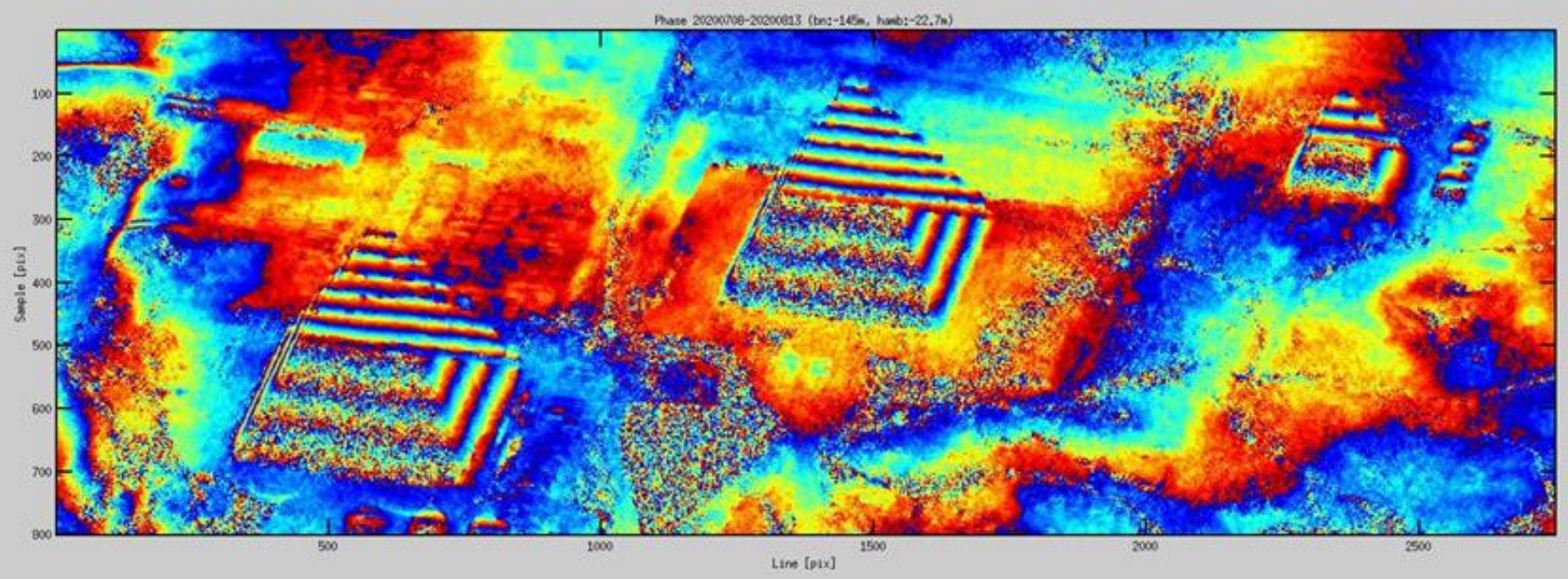
METHODS AND TECHNOLOGIES



More images are acquired in similar geometrical conditions generating interferometric pairs.

Two applications are particularly suitable for cultural heritage monitoring:

1. InSAR (SAR Interferometry), used to generate topographic maps and to monitor ground deformation and surface motion.
2. Change Detection, used to identify changes occurred in the monitored area of interest between the dates of acquisition.
    a. Incoherent change detection: identifies changes in the bean backscatter power using the intensity information;
    b. Coherent change detection identifies changes in both amplitude and phase information, allowed the detection of changes at sub-resolution scale.
3. The synergy between quantity of data and Machine Learning techniques is the best strategy to manage the huge informative content, to optimize the useful information and to enable fast responses to minimize the damages.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Line [pix]
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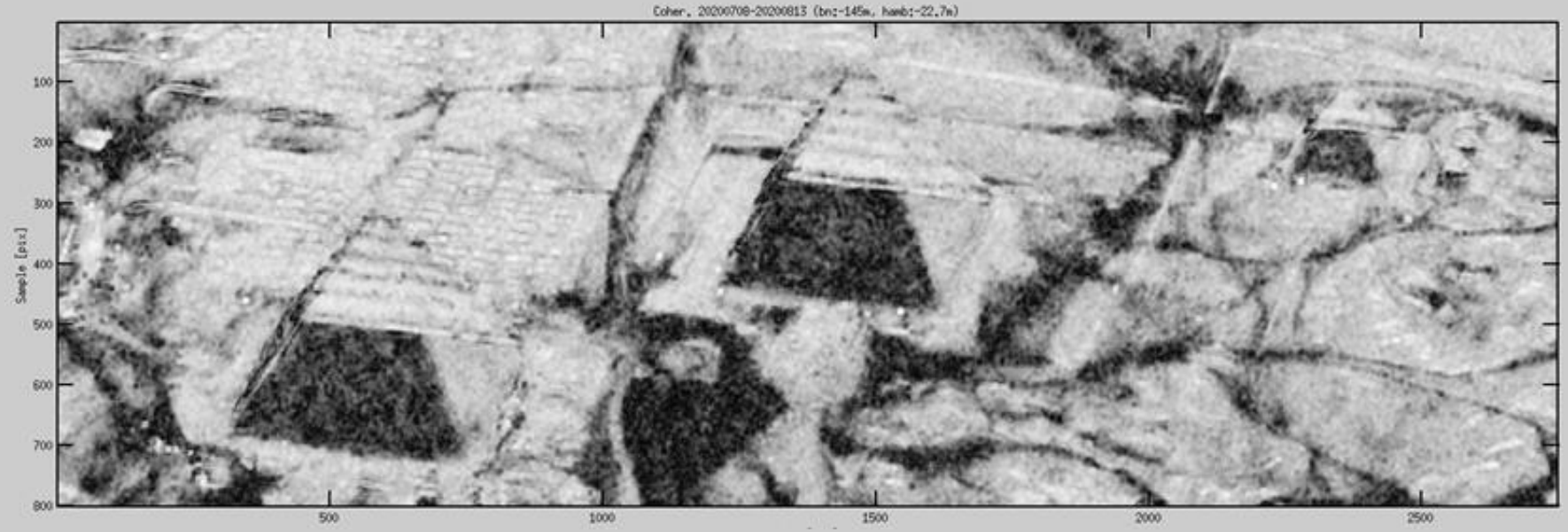
200
300
400
500
600
700
800
500
1000
1500
2000
2500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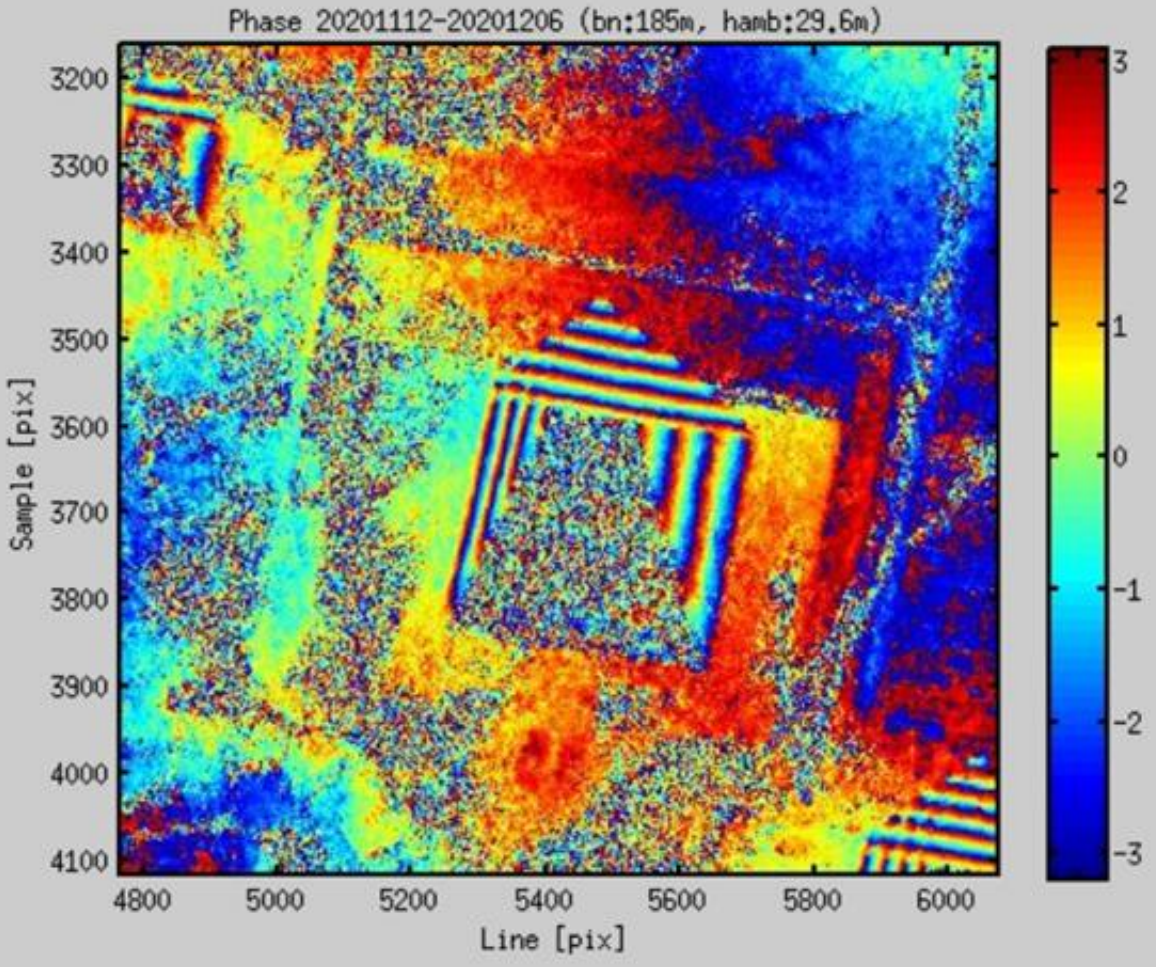
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5800
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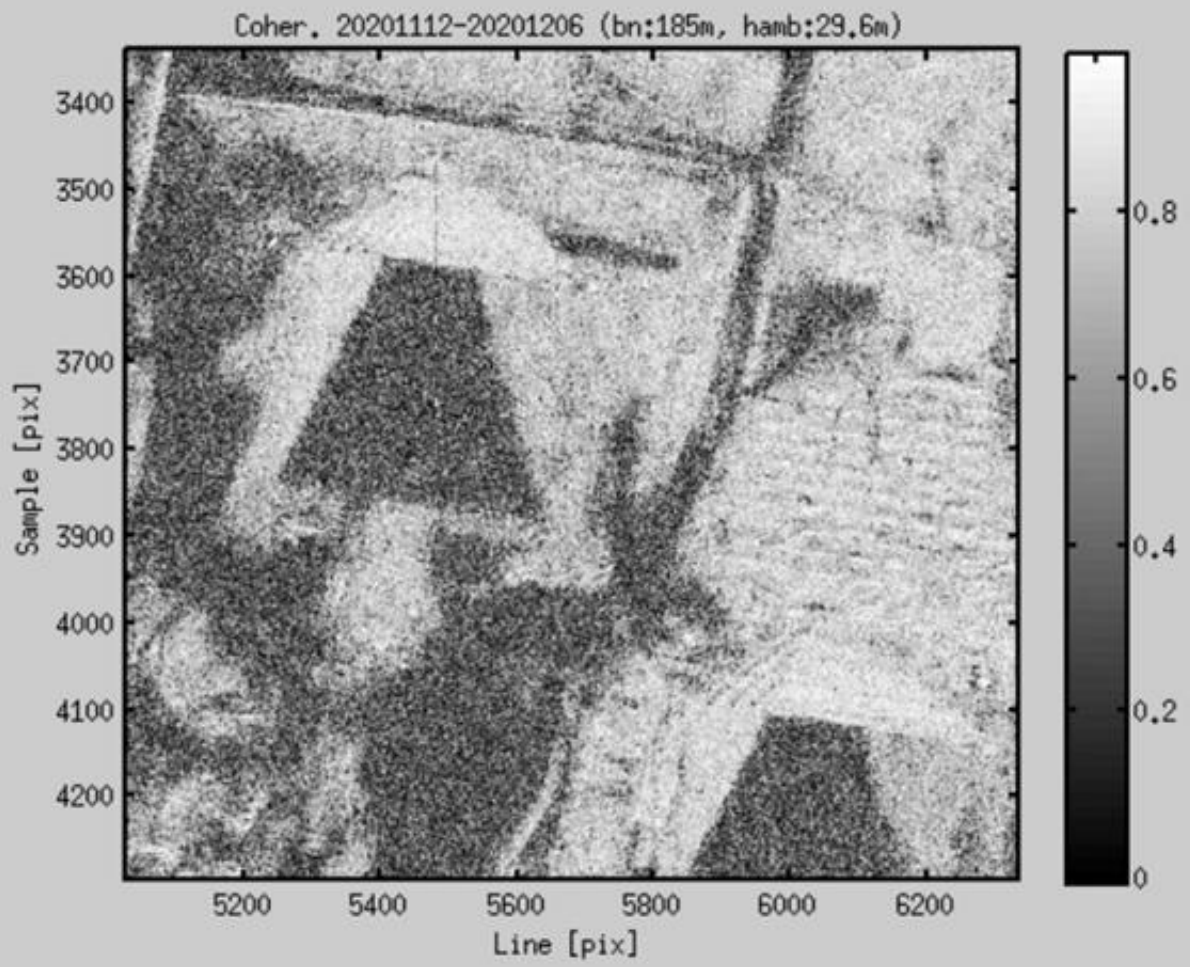
3
2
1
0
-1
-2
-3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3500
3600
3700
3800
3900
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4100
4200
5200
5400
5600
5800
6000
6200
0.8
0.6
0.4
0.2
0

CULTURAL HERITAGE APPLICATIONS

SUBSIDENCE AND GROUND MOTION

DAMAGE ASSESSMENT

SURVEILLANCE

URBAN SPRAWL MONITORING

NATURAL DISASTER MONITORING

DETECTION OF NEW ARCHEOLOGICAL AREAS

SECURITY

?

ICEYE

GIZA, EGYPT

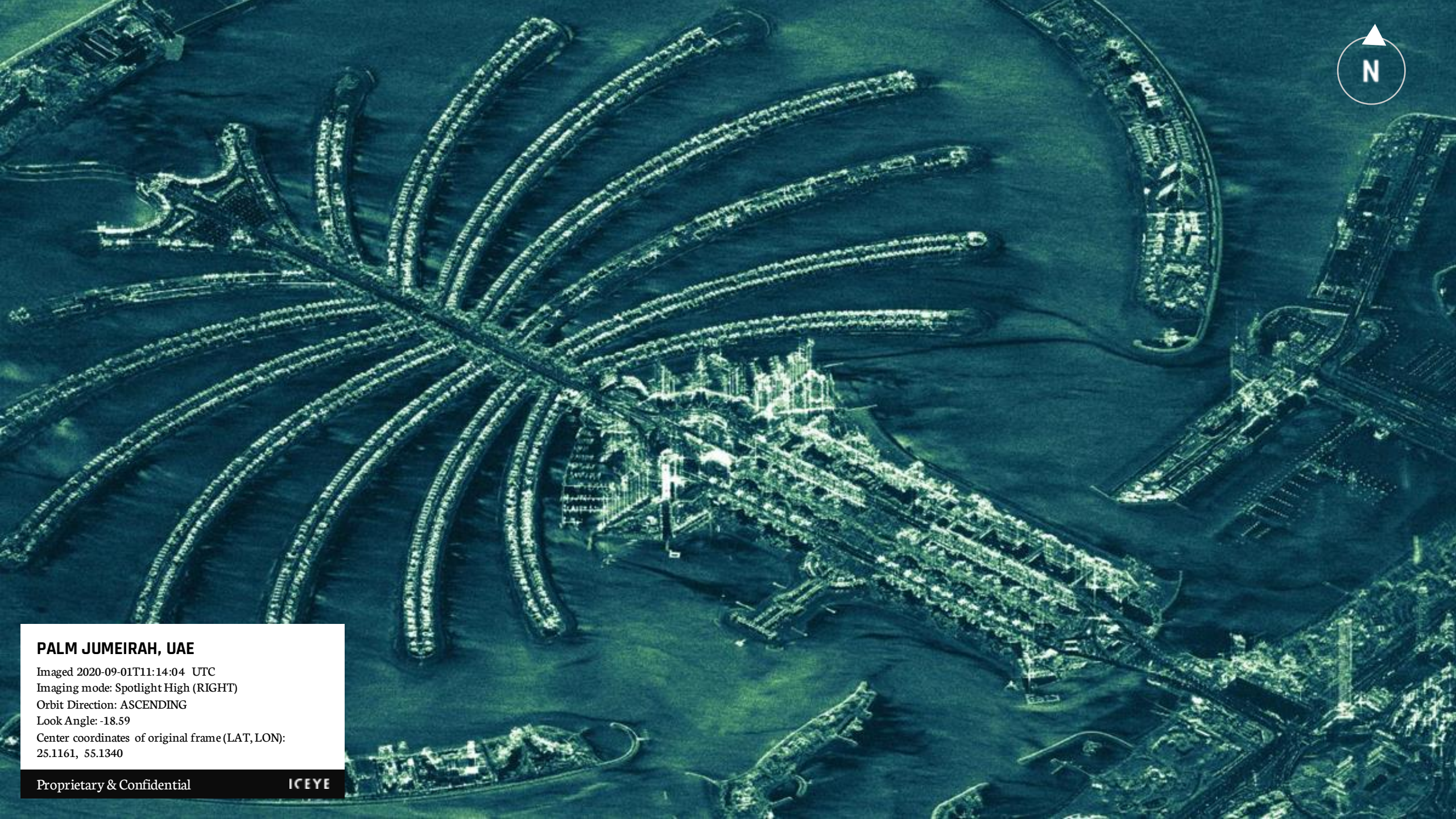
Imaged 12-06-2020 01:26:47 UTC
Imaging mode: Spotlight High (RIGHT)
Orbit Direction: DESCENDING
Look Angle: 23.43
Center coordinates (LAT, LON): 29.9764, 31.1313

NEW ADMINISTRATIVE CAPITAL, EGYPT

Imaged 24-11-2020 01:23:11 UTC
Imaging mode: Spotlight High (LEFT)
Orbit Direction: DESCENDING
Look Angle: 23.52
Center coordinates (LAT, LON): 30.02426,31.7620

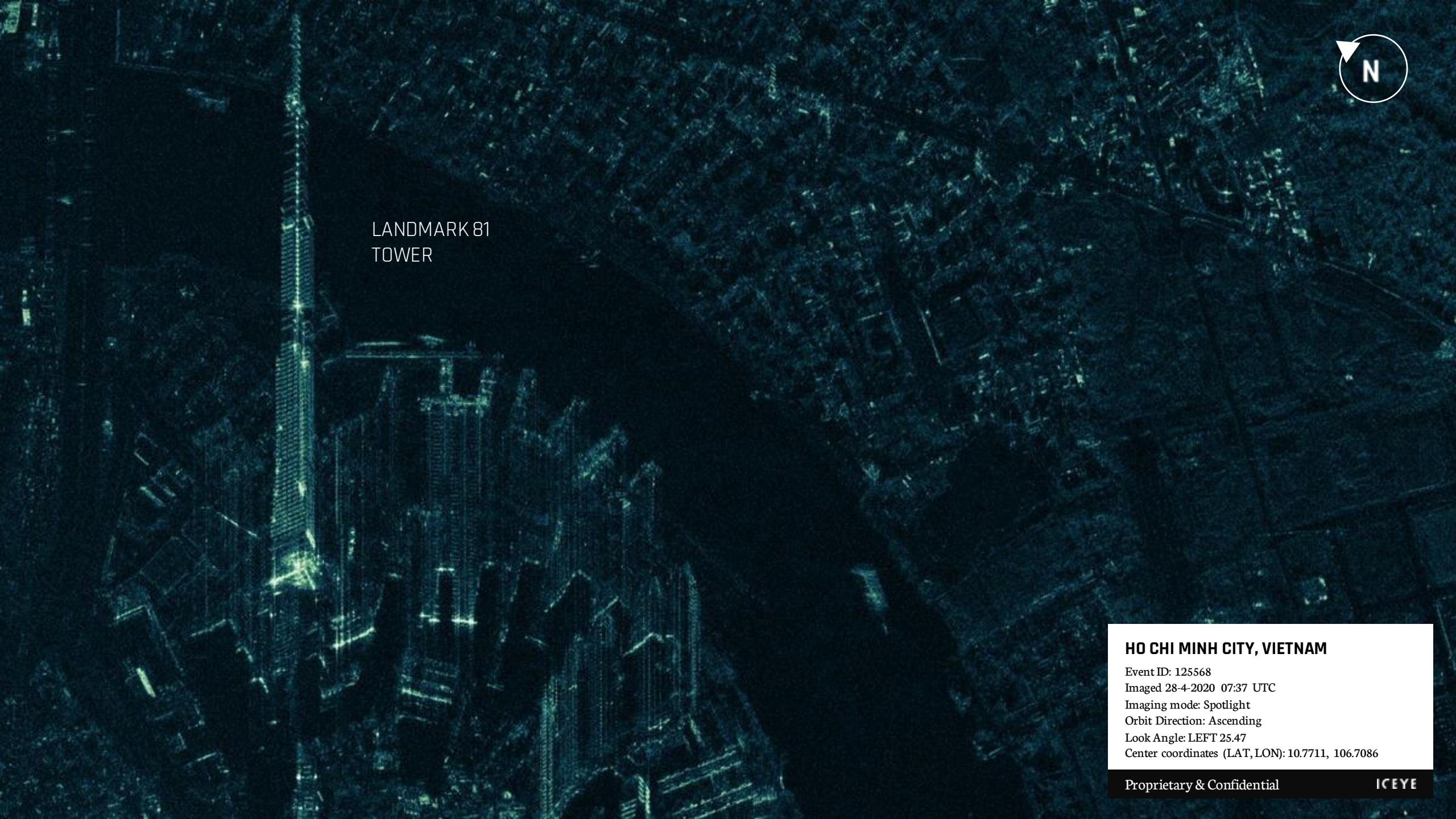
LONDON, ENGLAND

Imaged 03-6-2020 03:56:22 UTC
Imaging mode: Spotlight_high (LEFT)
Orbit Direction: DESCENDING
Look Angle: 25.45
Center coordinates (LAT, LON): 51.4937, -0.13721



PALM JUMEIRAH, UAE

Imaged 2020-09-01T11:14:04 UTC
Imaging mode: Spotlight High (RIGHT)
Orbit Direction: ASCENDING
Look Angle: -18.59
Center coordinates of original frame (LAT, LON):
25.1161, 55.1340



HO CHI MINH CITY, VIETNAM

Event ID: 125568
Imaged 28-4-2020 07:37 UTC
Imaging mode: Spotlight
Orbit Direction: Ascending
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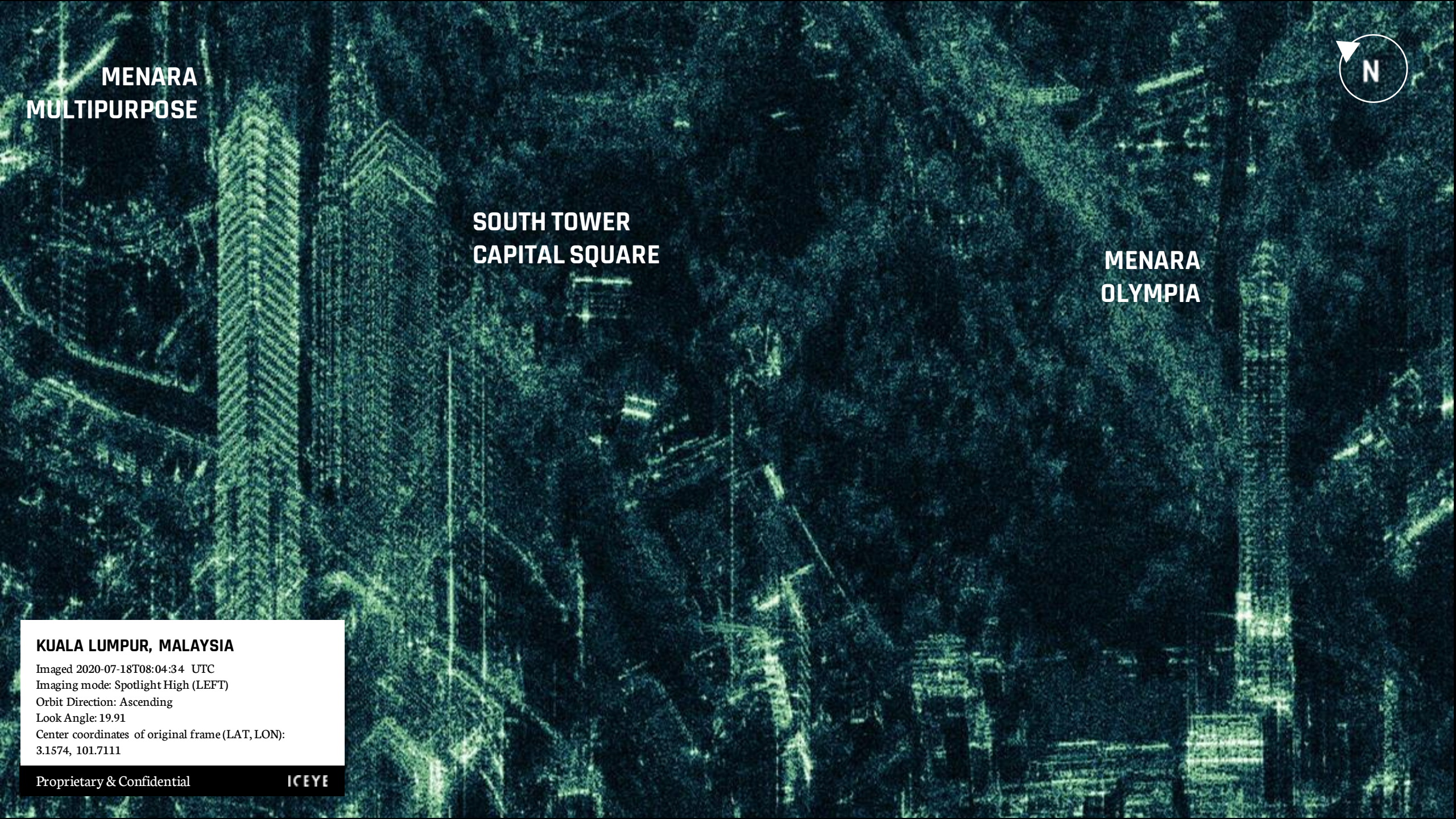
Center coordinates (LAT, LON): 10.7711, 106.7086



KUALA LUMPUR, MALAYSIA

Imaged 2020-07-18T08:04:34 UTC
Imaging mode: Spotlight High (LEFT)
Orbit Direction: Ascending
Look Angle: 19.91
Center coordinates of original frame (LAT, LON):
3.1574, 101.7111