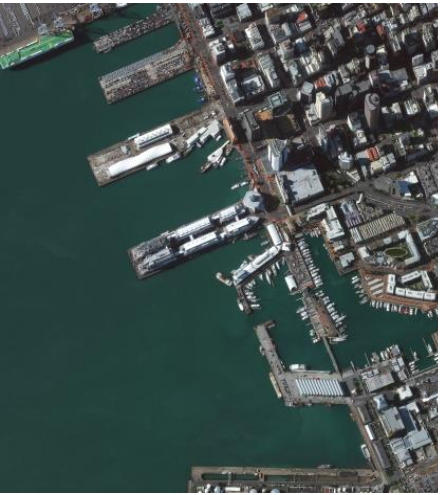
Direct Tasking of VHR Optical Satellites

Operational Image Quality Assurance

George Ellis
Director Operations
EUROPEAN SPACE IMAGING®

European Space Imaging



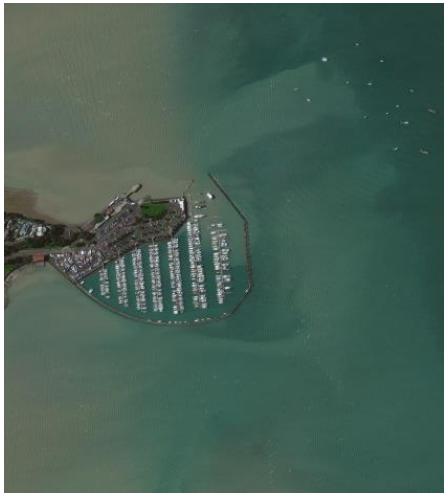
Established in 2002

Based in Munich

Around 40 employees

Local tasking of MAXAR's optical satellite fleet

Largest provider of VHR optical images in Europe



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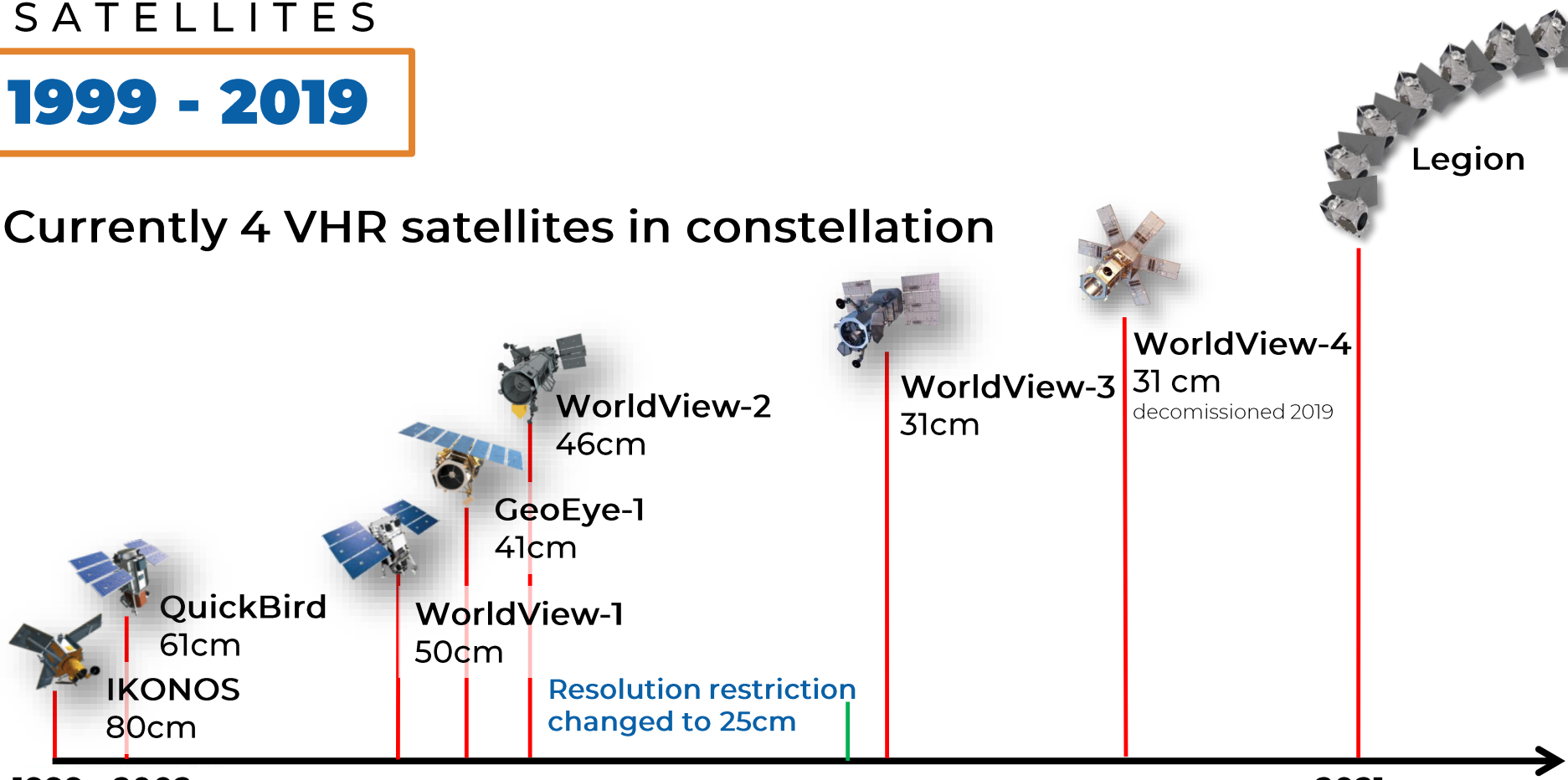
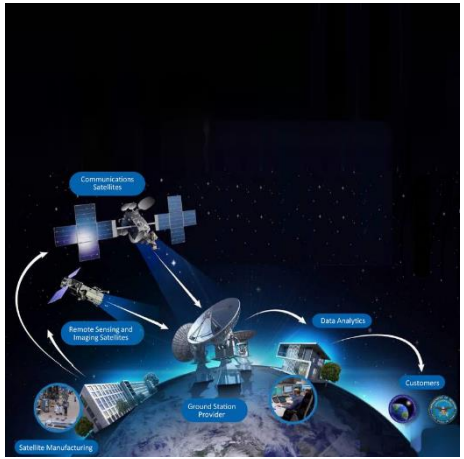
SATELLITES

1999 - 2019

Currently 4 VHR satellites in constellation



Ground Segment

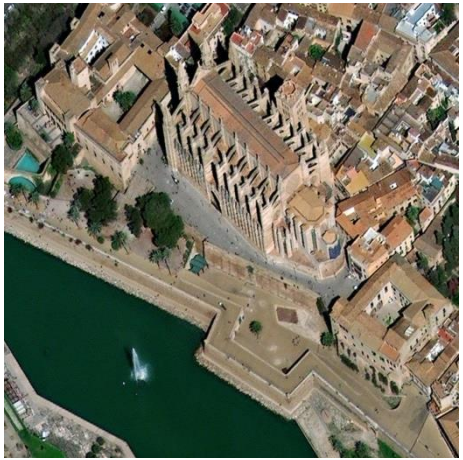


ROBUST MAXAR GROUND SEGMENT

Decades of world-wide operational experience

MULTI-MISSION GROUND STATION

Located in Germany. Direct satellite tasking last minute collection planning, local downlink



NEAR REAL TIME IMAGERY DELIVERY

7 days a week.

LARGEST HISTORICAL LIBRARY

Archive dating back as far as 1999. Growing by more than 3 million km^2 daily

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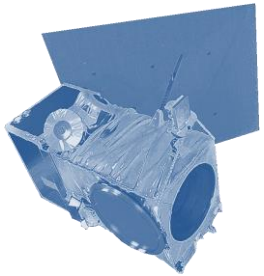
Influences on

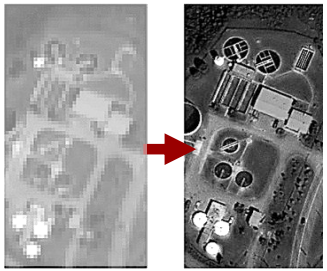
Quality of Optical Images



Sensor Quality
Cal / Val

Atmospheric,
Ground & Light
Conditions

clouds, haze, smoke,
contrails, sunglint etc.



Processing
Post-Processing

Operational
Procedures

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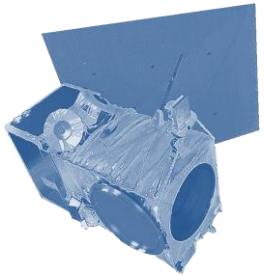
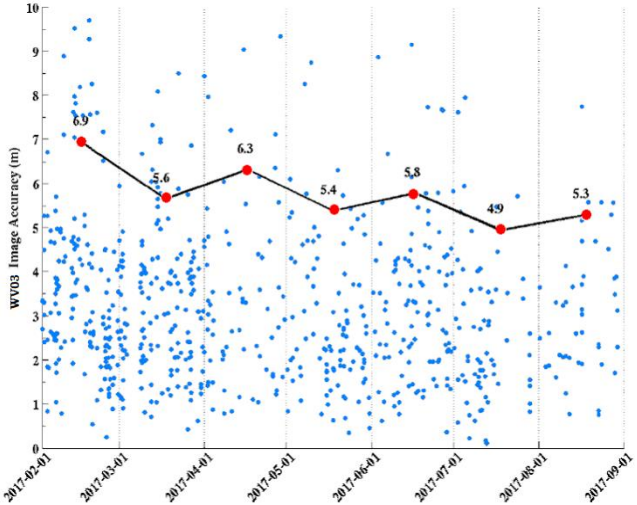
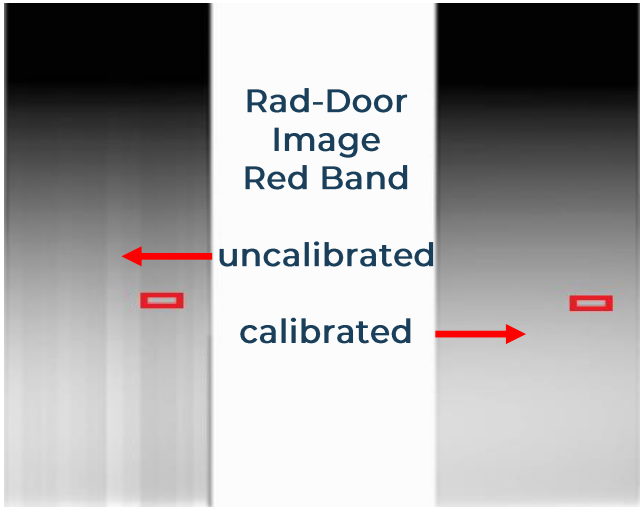
Sensor



Sensor Quality
Cal / Val

Our partner MAXAR ensures high quality of sensor built and on-orbit calibration of radiometry and geometry





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Atmospheric, Ground & Light Conditions

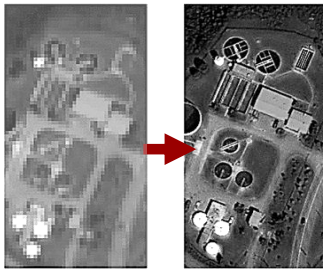
A higher force?

Basically yes, **BUT**

Processing &
Operational Procedures
can help (quite a lot)

Processing

Pan-sharpening
(standard processing technique)



Atmospheric Compensation
AComp (since 2018)

HD processing
(introduced Q4 2019)

AComp

MAXAR proprietary algorithm

Normalizes DN values to a true surface reflectance value

Cuts through haze, giving satellite images crispness, clarity & accurate spectral response

Standard

AComp Enhanced

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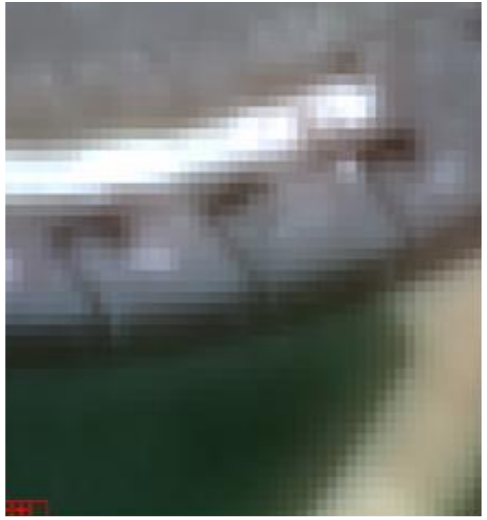
HD

MAXAR proprietary technique to improve visual image clarity

Image is aesthetically refined with precise edges, reconstructed details, less visual clutter & pixelation

Better interpretation by humans or computers. Enables faster & more accurate data extraction from images



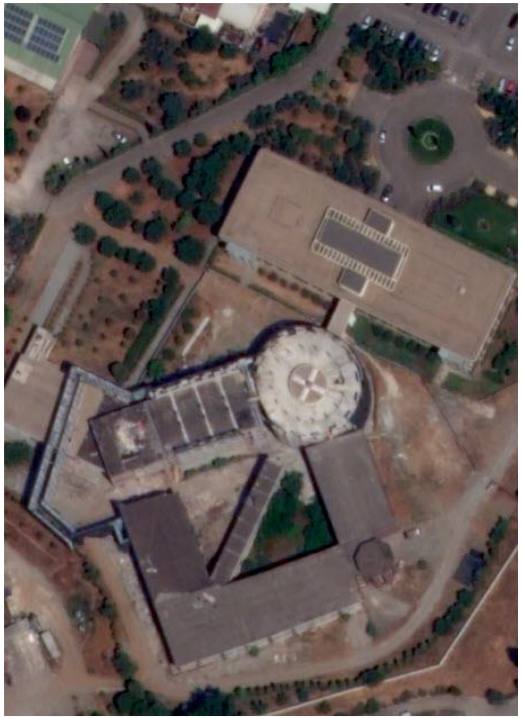
HD

Intelligently increases the # of pixels to maximize useful information & minimize noise & visible pixelation

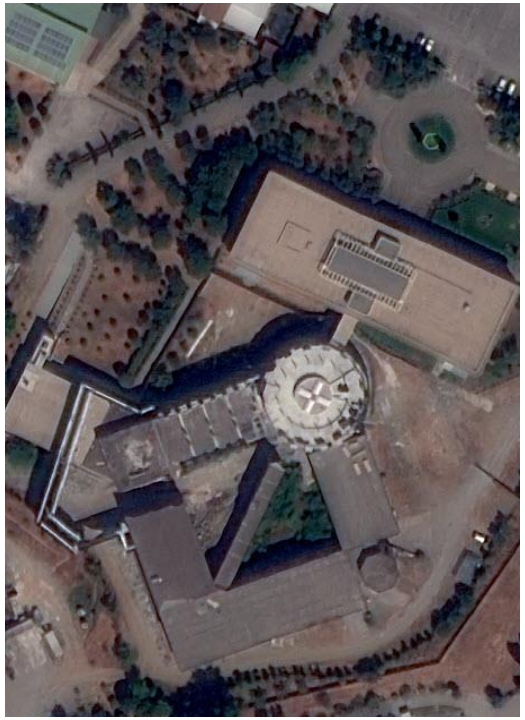
Targets specific information In source image to discern difficult to detect details

Can be used on any MAXAR satellite imagery except Ikonos

WorldView-3
30 cm pixel



GeoEye-1
30 cm pixel



Operational Procedures

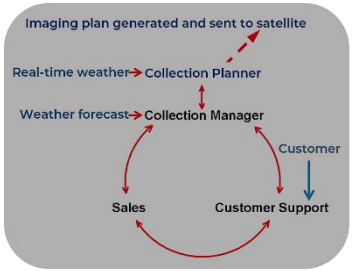
Human-assisted planning and Local Tasking

Increases achievable collection area and number of targets (more images = more **good** images)

“Shoot around clouds”

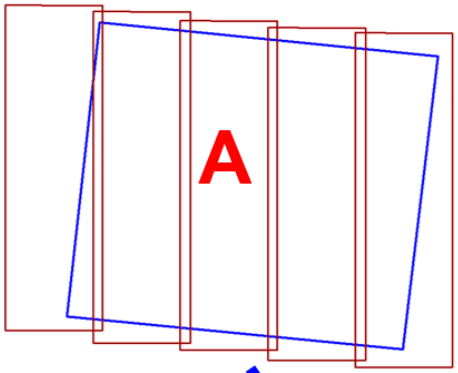
Enables smart cloud recollections

Avoids sun glint etc.



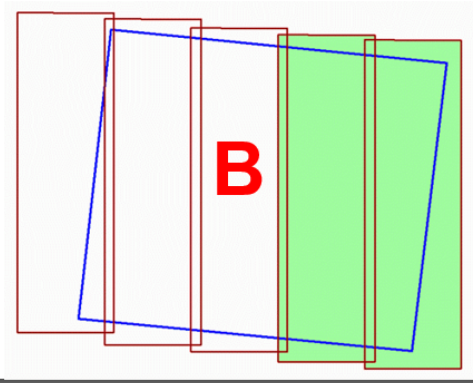
Detailed Collection Planning

Starting scenario

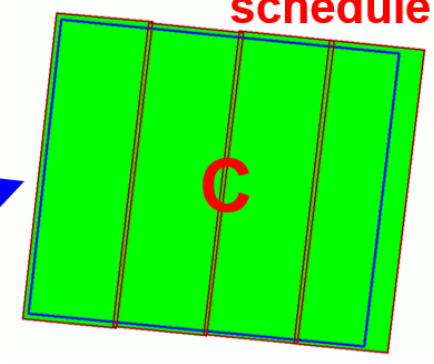


- 10 min editing for a single target
- 7 editing steps, 7 software runs
- Collected area over AOI more than doubled, area gain approx. 1500 km²

Automatically generated schedule



Operator edited schedule



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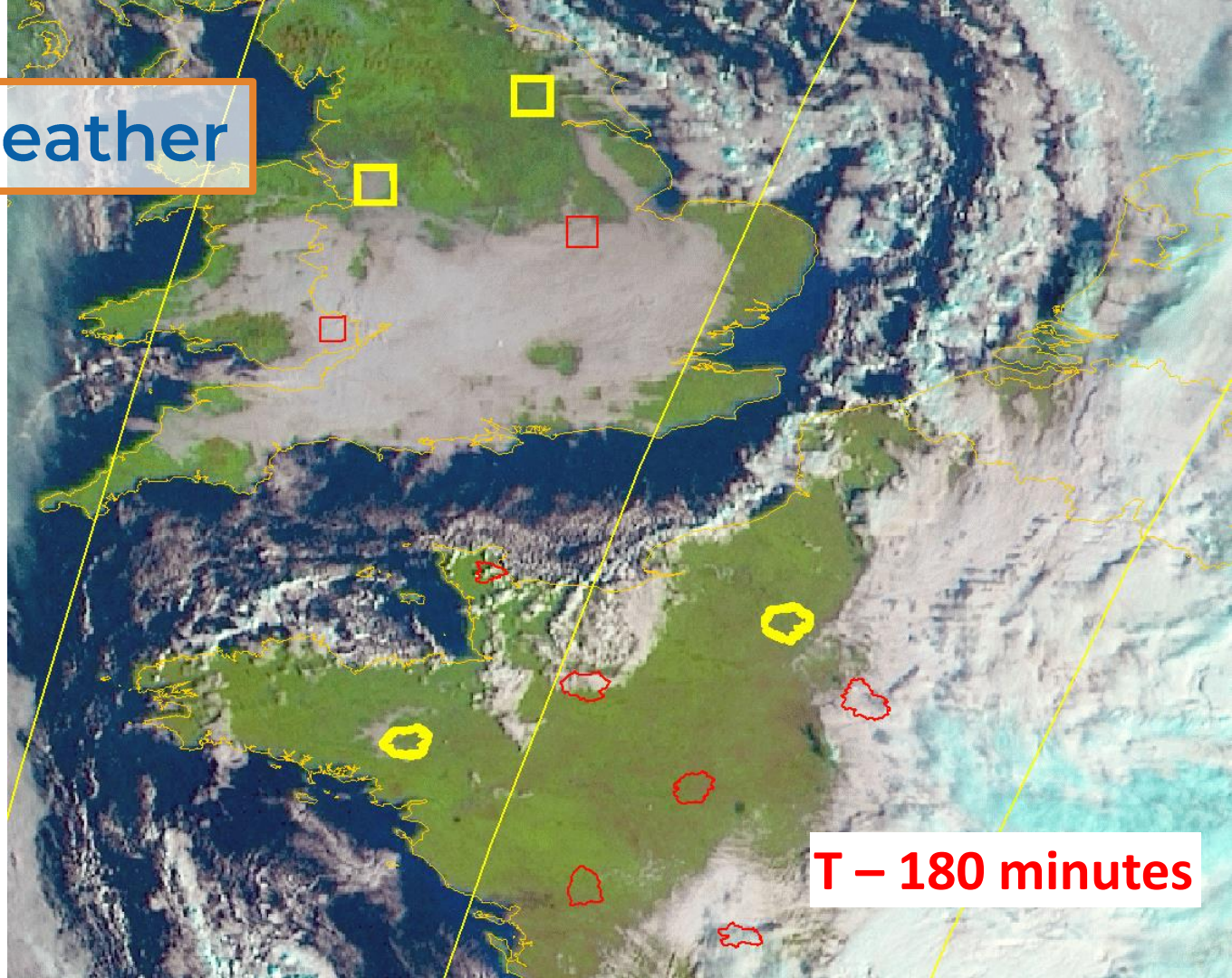
Real-Time Weather

Initial imaging schedule over-laid with real-time weather images

updated every 15 minutes



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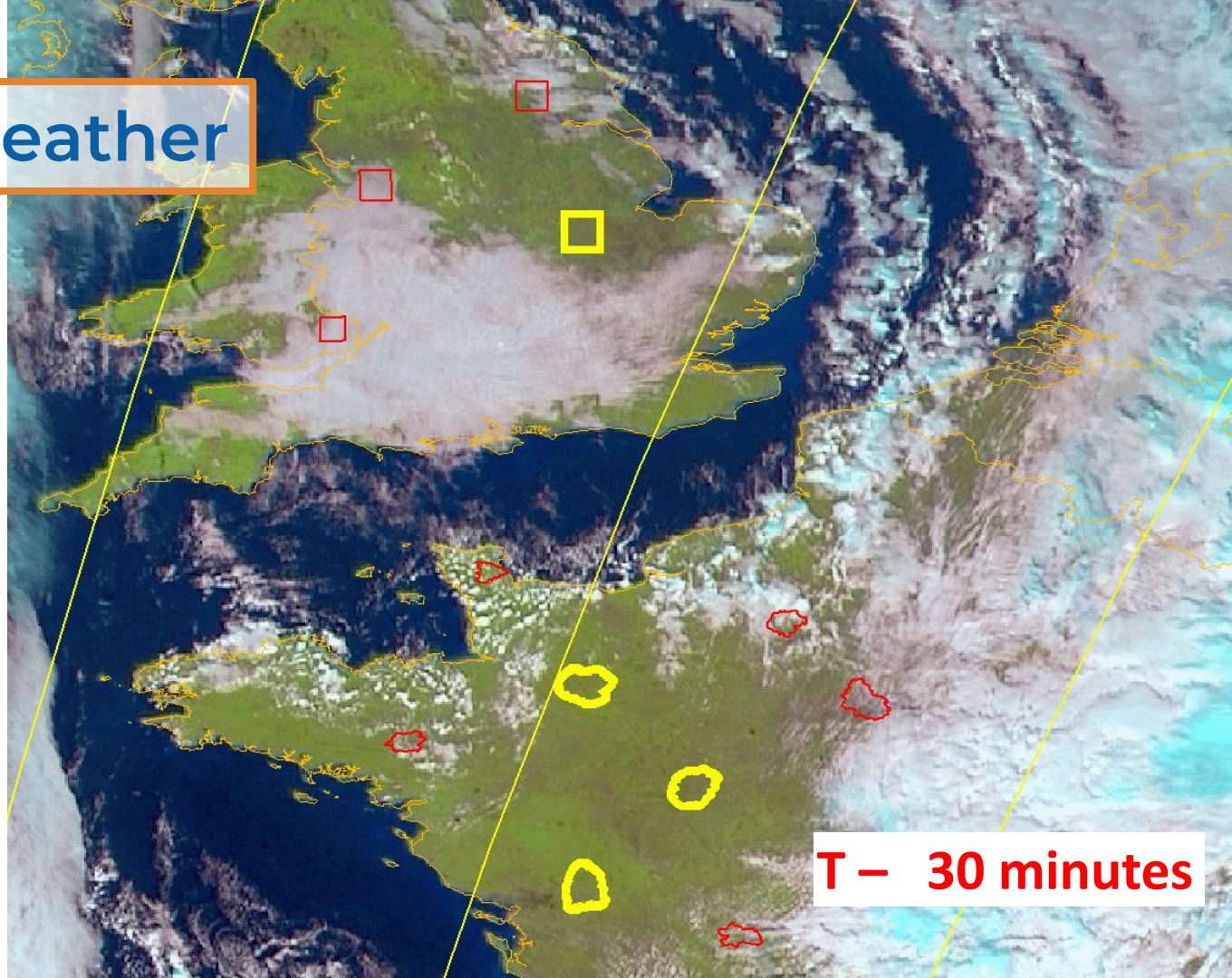
Real-Time Weather

Final schedule:

4 completely different sites scheduled –all cloud-free

All 4 original sites are cloudy now



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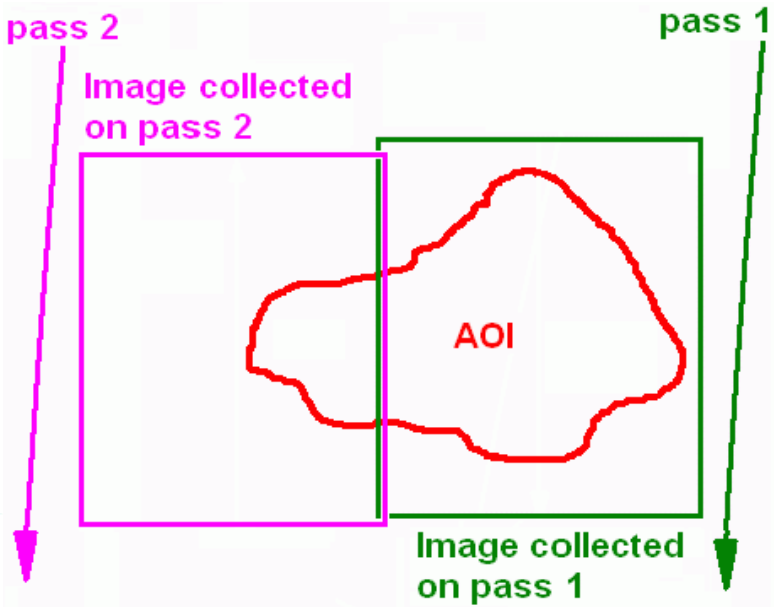
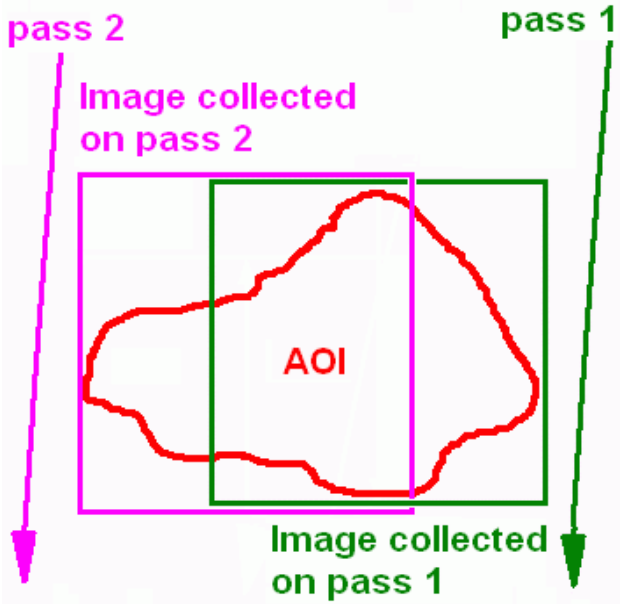
Smart Collecting

maximize **collection area**
minimize imaging overlap



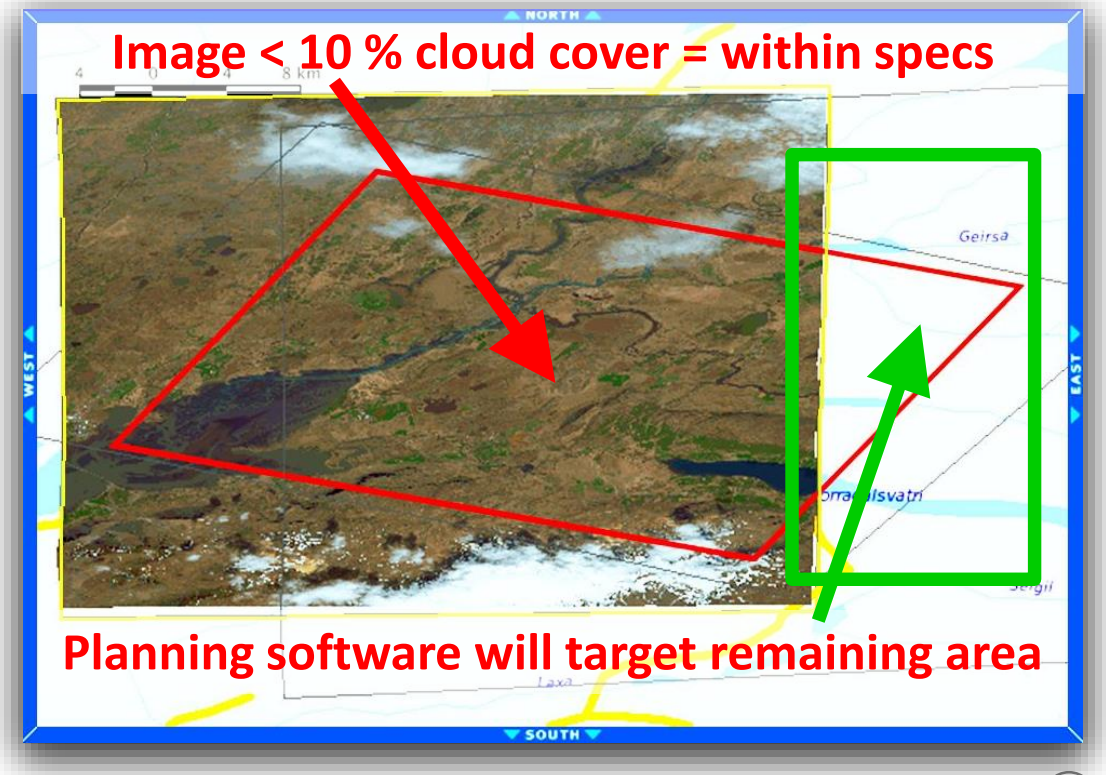
or
minimize **cloud cover**
maximize imaging overlap



Smart Collecting

AOI in Iceland

Partly imaged 15 June



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Smart Collecting

AOI in Iceland

2nd image 21 June

Automatic planning

No operator input

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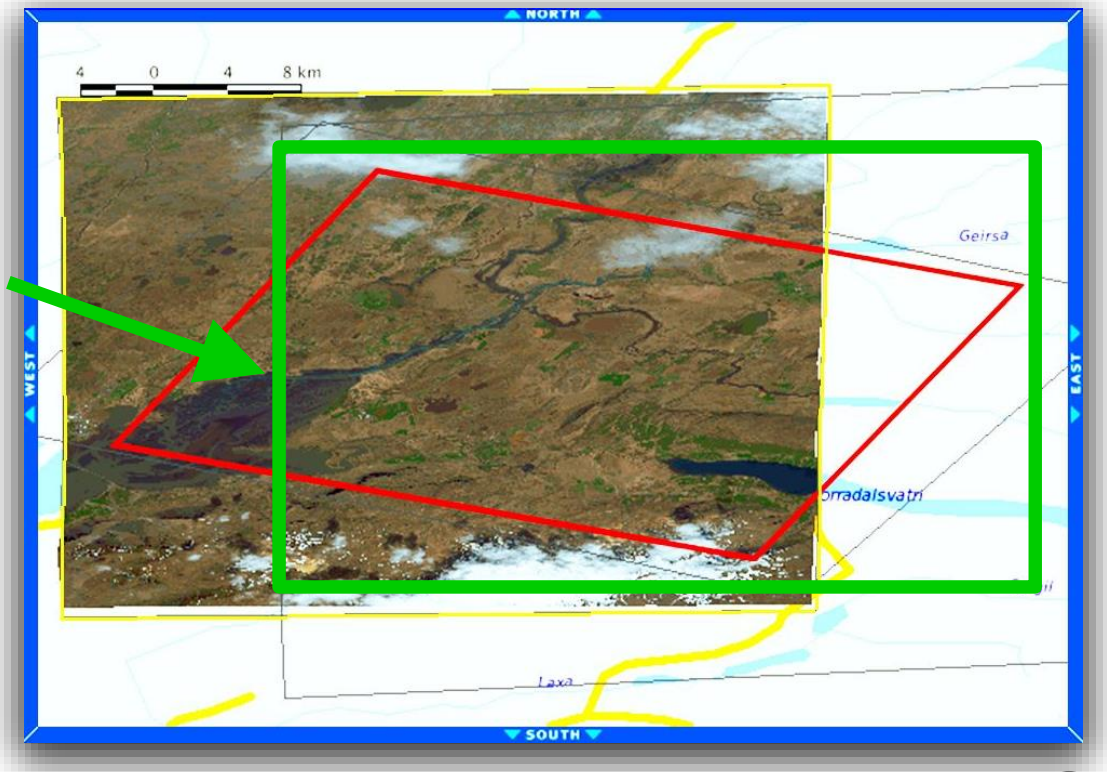
Smart Collecting

AOI in Iceland

Operator decides to collect 2nd image with significant overlap



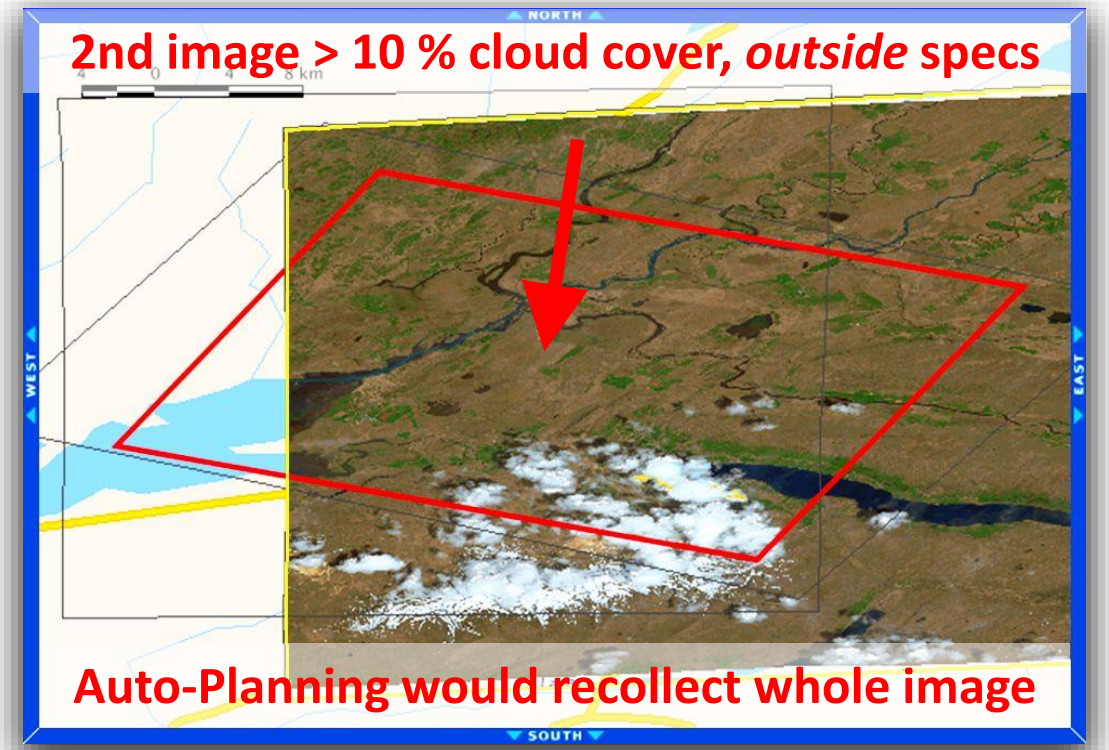
EUROPEAN SPACE IMAGING

Smart Collecting

AOI in Iceland

2nd image 21 June

Manually edited plan



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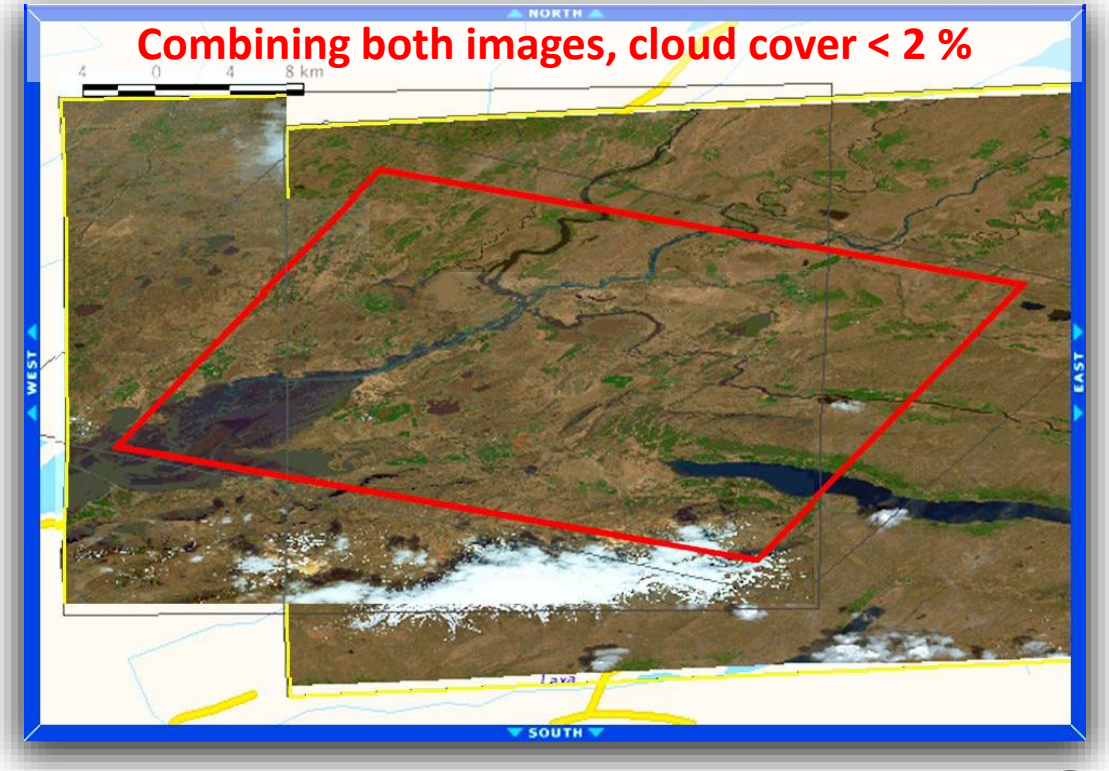
Smart Collecting

AOI in Iceland

Operator-assisted planning results in lower cloud-cover

2 images collected
same 2 days
same time
same satellite



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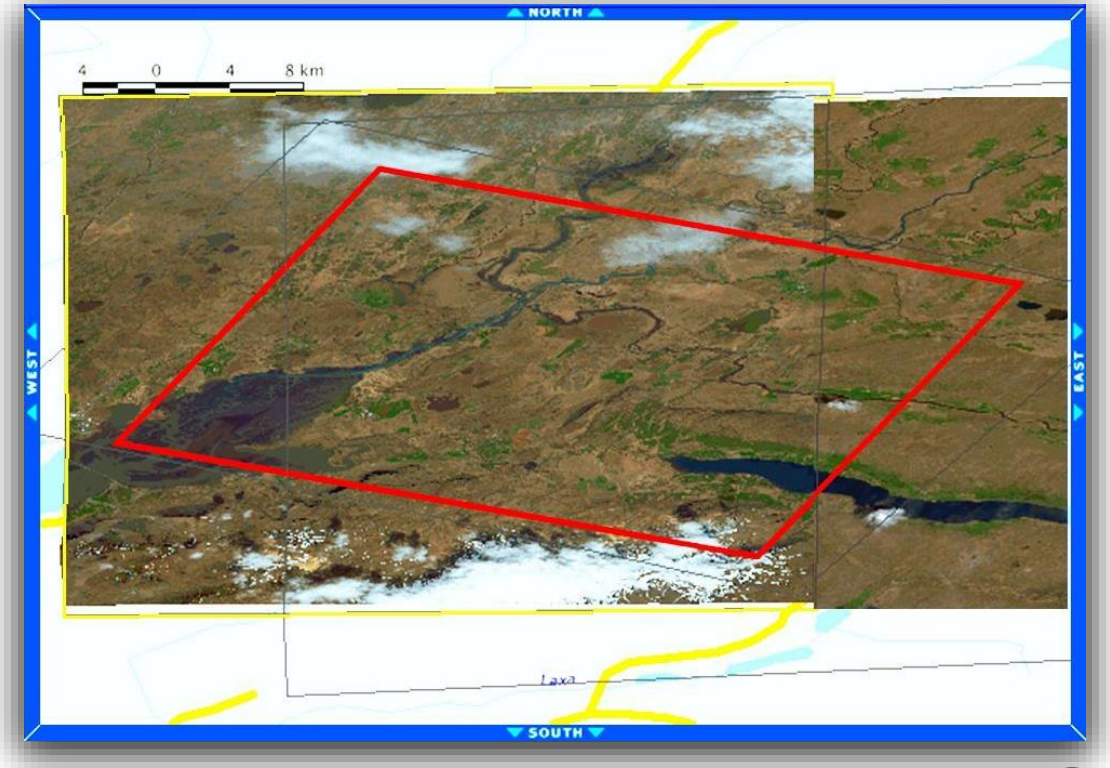
Smart Collecting

AOI in Iceland

Result of automatic planning with no operator input



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Smart Collecting

AOI in Iceland

Result of operator-assisted semi-automatic planning

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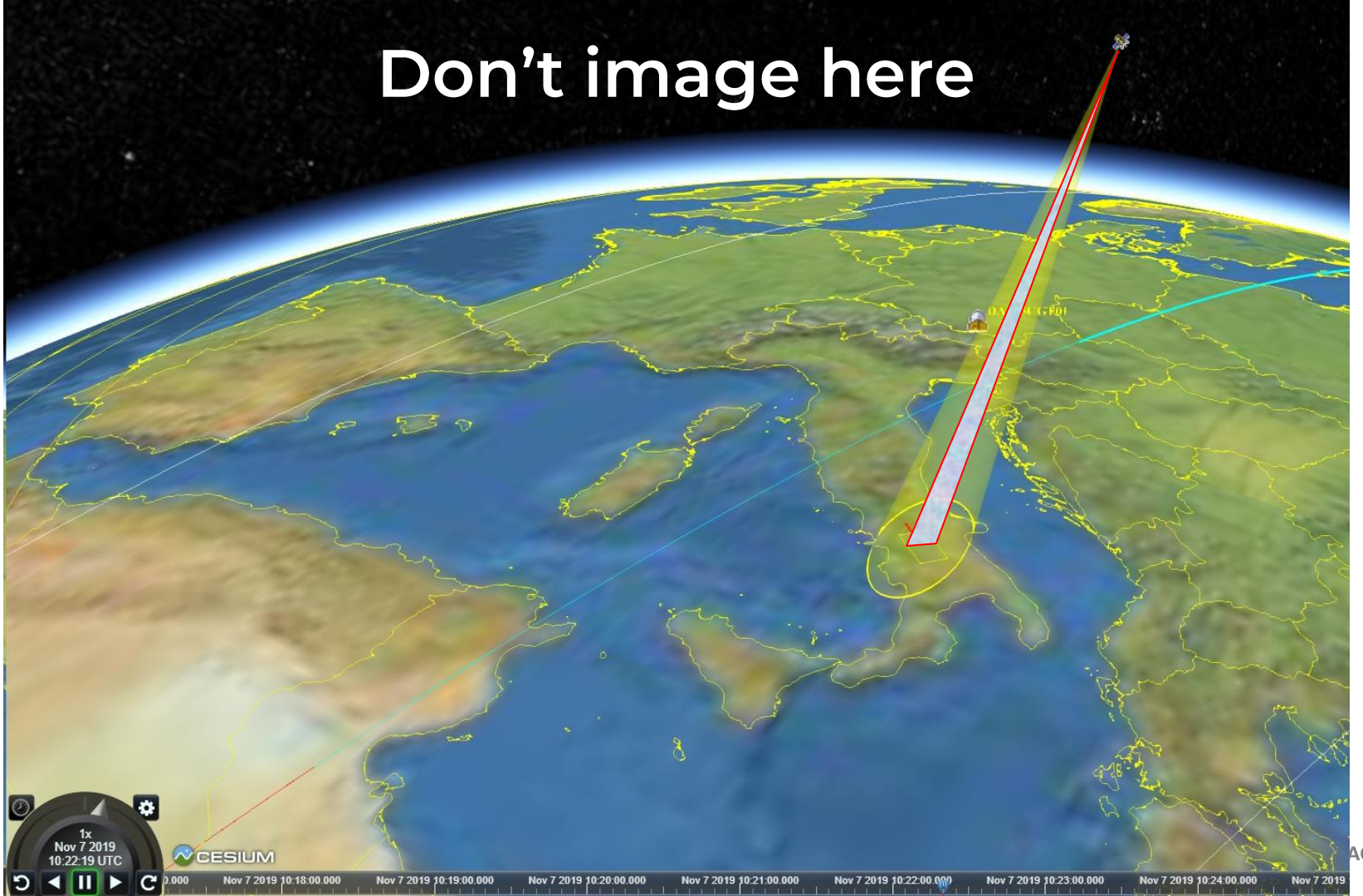
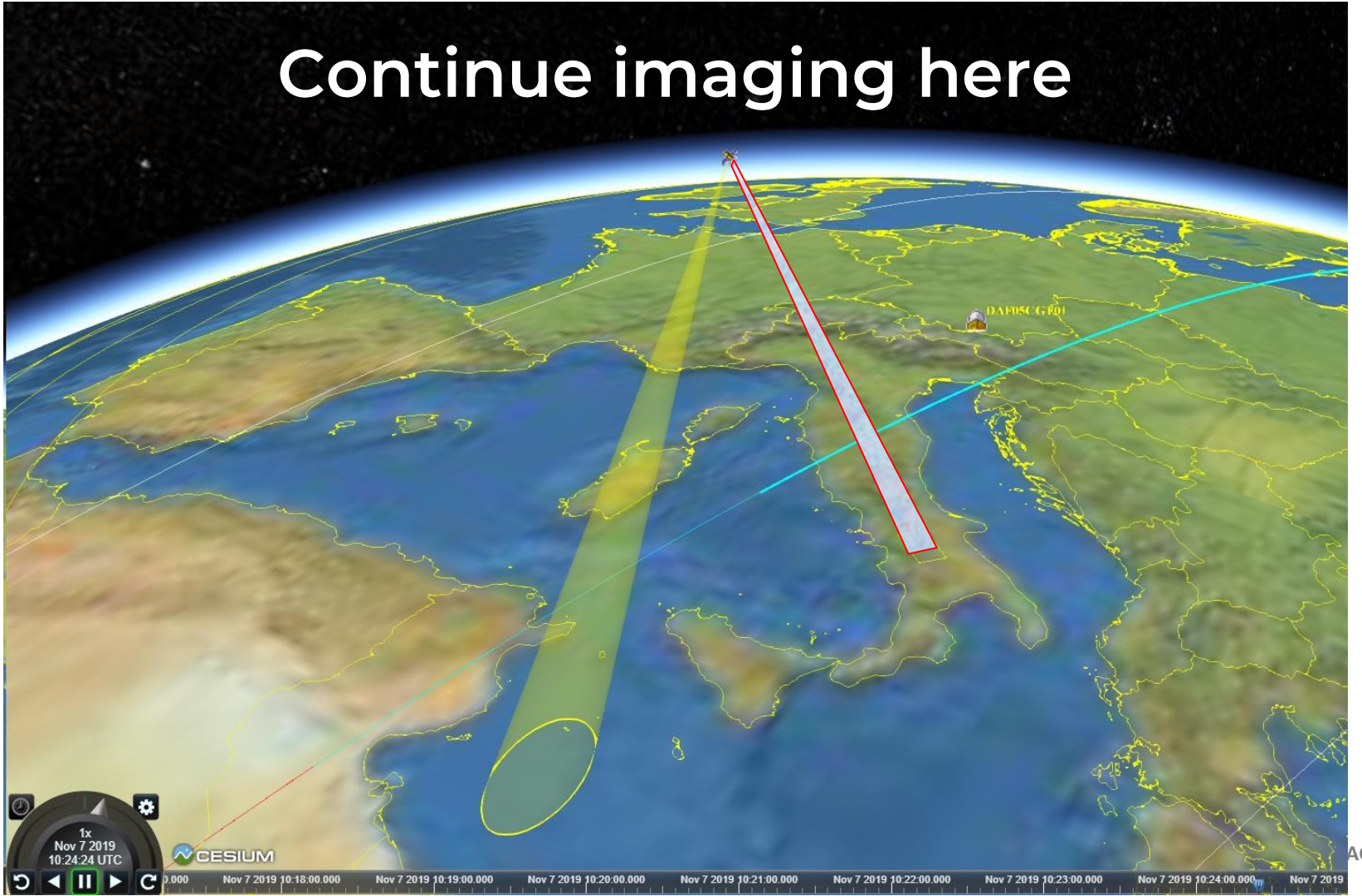
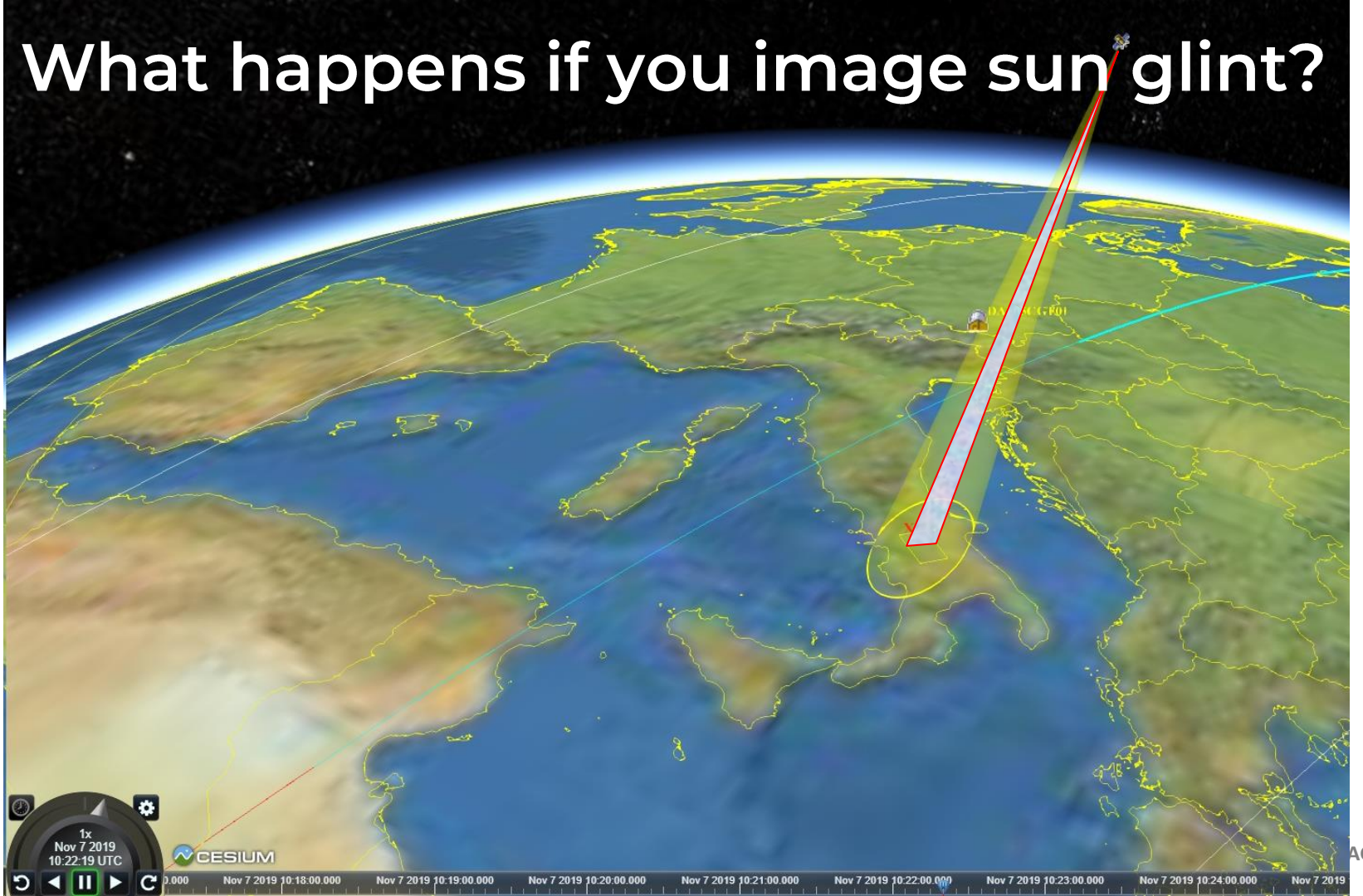
How to avoid sun glint


Don’t image here
1x
Nov 7 2019
10:22:19 UTC
CESIUM
Nov 7 2019 10:18:00.000
Nov 7 2019 10:19:00.000
Nov 7 2019 10:20:00.000
Nov 7 2019 10:21:00.000
Nov 7 2019 10:22:00.000
Nov 7 2019 10:23:00.000
Nov 7 2019 10:24:00.000
Nov 7 2019

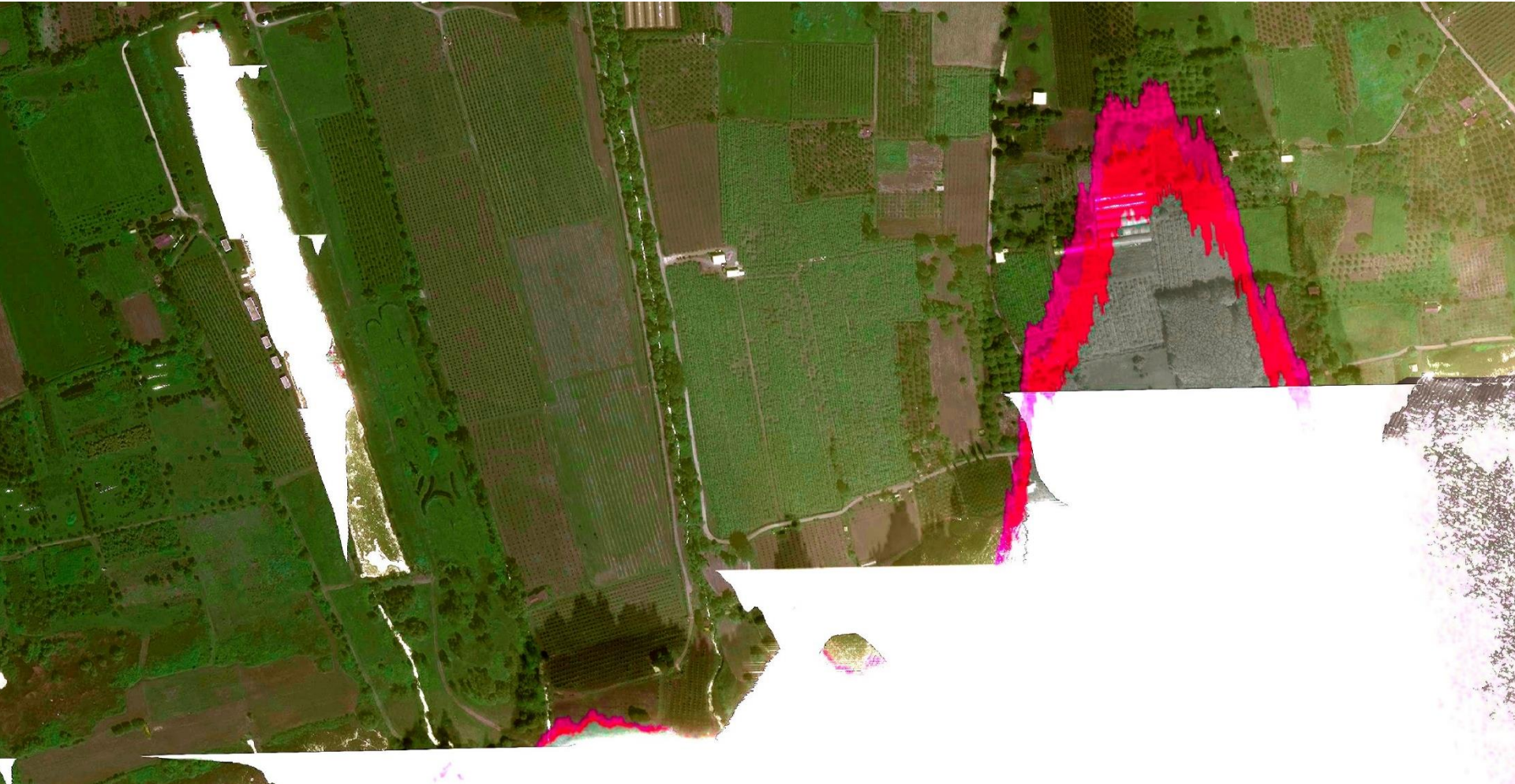
Continue imaging here



What happens if you image sun glint?



This happens: No Christmas Gratification for the Operator!



Optical Image Quality depends on

Sensor quality

Cal/Val efforts during mission

Natural factors

Improved processing methods

Satellite capabilities & capacity

Optical Image Quality depends on

Last not least: Smart use of satellite systems to

increase efficiency

mitigate natural effects

→**Keep the humans in the loop**

(for now)

The EUSI Team 2019

Management IT Customer Support Marketing Sales Operations


Thank you

Issues that hinder an order to process & deliver automatically

- Browse image cataloguing fails because of **Curved Blackfill** -> manual workaround
- Browse image cataloguing fails because of **image issues**, e.g. data drop outs
  -> System Engineer needs to solve the issue
- **Too high reflectance** values in one or more image bands (clouds…)
  -> production of a pan-sharpened product not possible
- **Too complex polygons** or polygon vertices issues, e.g. 9900000 or crossed vertices
- AOI is covered by 2 or more images and requires **manual Tie-Point-Marking** / Bundle Adjust. Avoid by entering order with ‘systematic correction’
- **Incorrectly entered orders**, e.g. wrong DEM, “view input” enabled etc.
- Acquired **images are out of spec**, e.g. too high ONA, GSD
- **FTP server full** during peak season. We just greatly increased speed and disk space