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Very High Resolution Satellite Imagery, status and future capabilities

The new WorldView-3 Satellite and its 16 Bands

Pascal Schichor, Sales Manager EUSI

Geo Spatial World Forum 2015

Presentation Overview

- Introduction European Space Imaging (EUSI)
- Local Tasking at EUSI
- Digital Globe Constellation
- WorldView-3 Highlights
- Conclusion

European Space Imaging

- Established 2002 in Munich, Germany
- Commercial partnerships with leading US satellite operators
  - 2002-2009: Regional Affiliate of **Space Imaging/GeoEye**
  - Since 2010: WorldView Global Alliance Partner of **DigitalGlobe**

- **Constellation of DigitalGlobe through EUSI**
  IKONOS, QuickBird, GeoEye-1, WorldView-1, WorldView-2, WorldView-3

Users & Projects

- Direct and indirect data supply to national, European and international customers
- Direct involvement in key European programmes & projects
- Reseller Network all across Europe and North Africa

Advantages of Local Tasking

Dedicated local ground stations

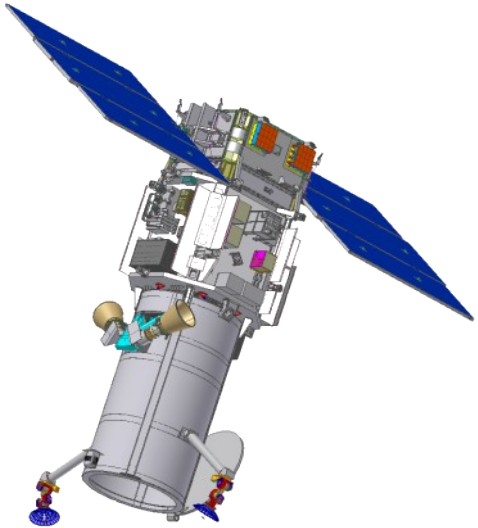
- Operated jointly with DLR (German Aerospace Center) located at Oberpfaffenhofen
- Direct satellite access, tasking and data downlink
- Programming of local and global data collections

Advantages of Local Tasking

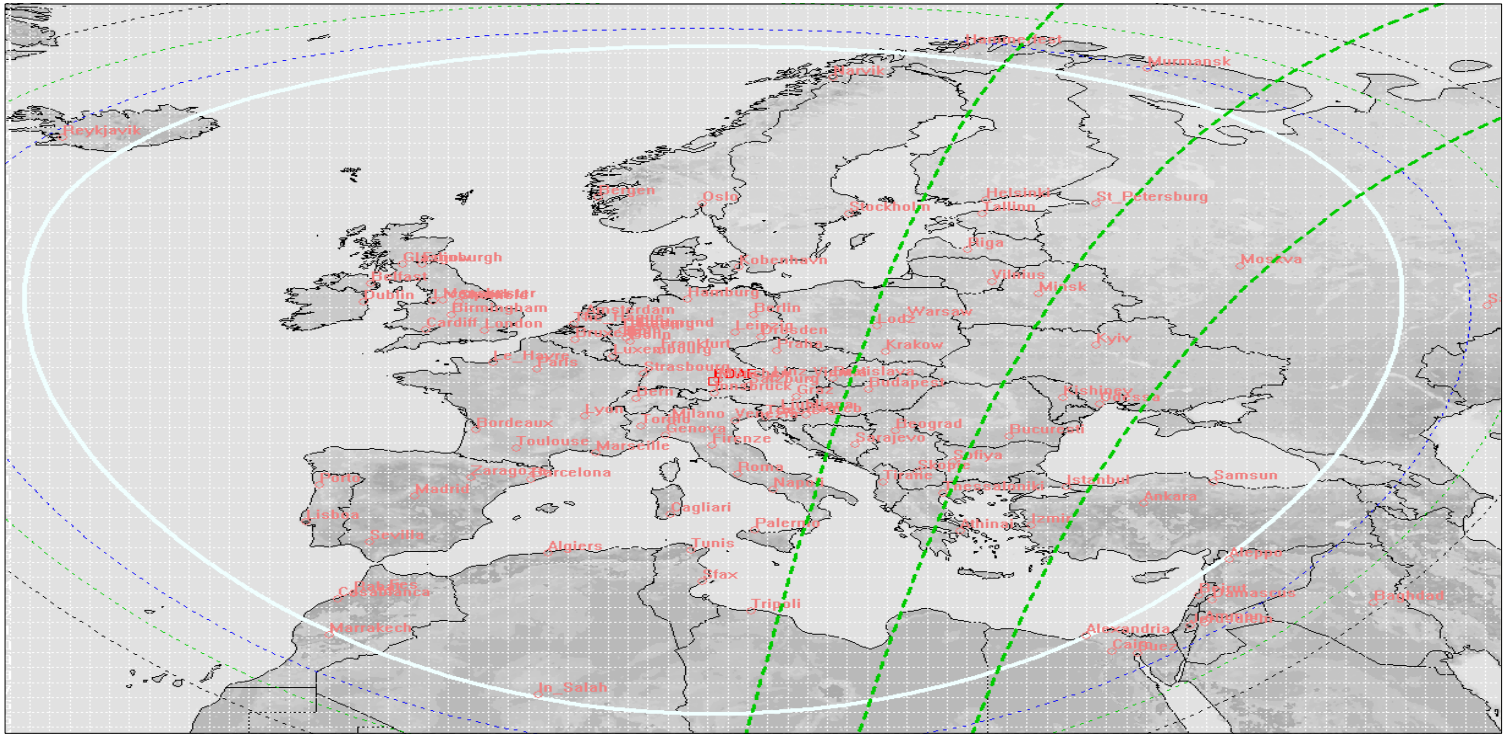
1. **Feedback during imaging planning**
   last minute information incorporated into collection plan

2. **Real-time weather information**
   used up to minutes prior to pass

3. **Very detailed imaging planning possible**
   up to 4 hrs spent per pass to optimize collection plan



EUSI reception Cone



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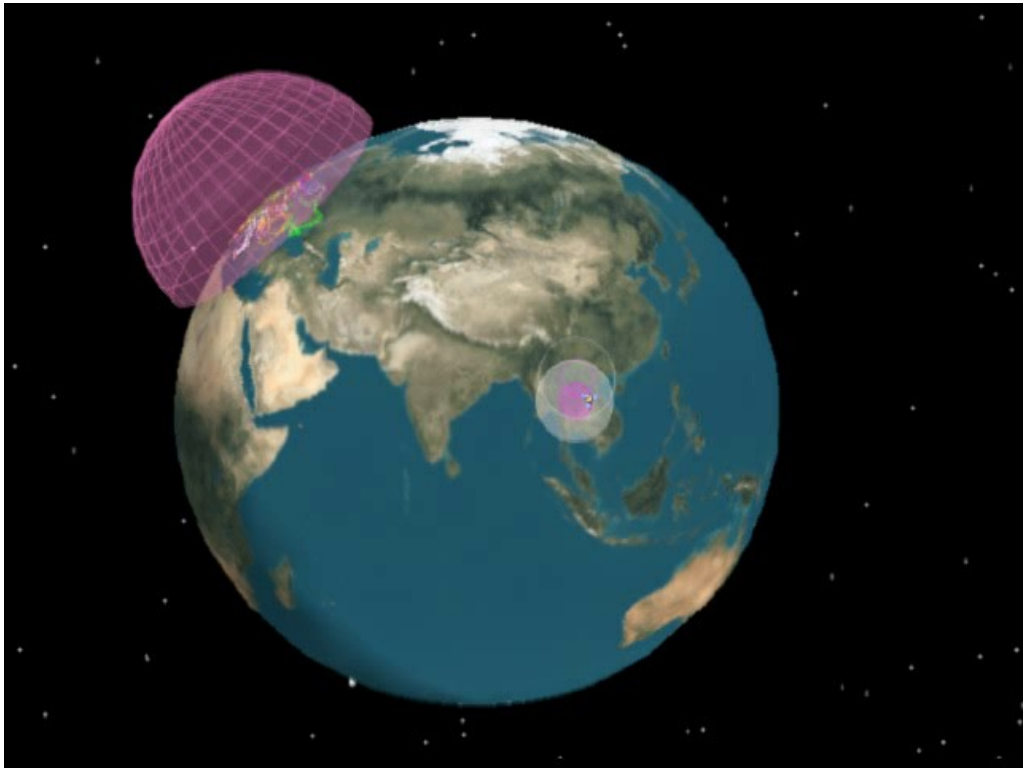


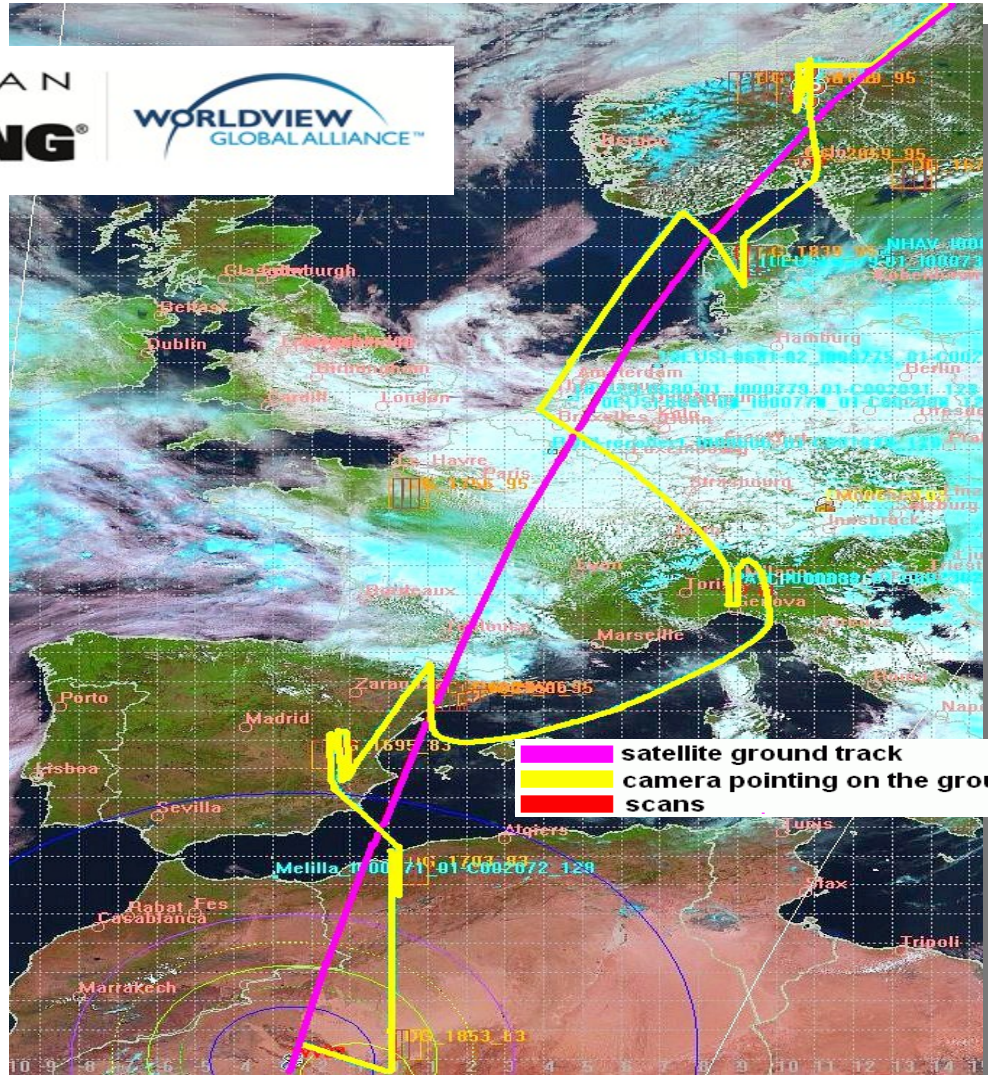
Local tasking example

Shooting between the Clouds

Live weather information to

optimize the pass planning

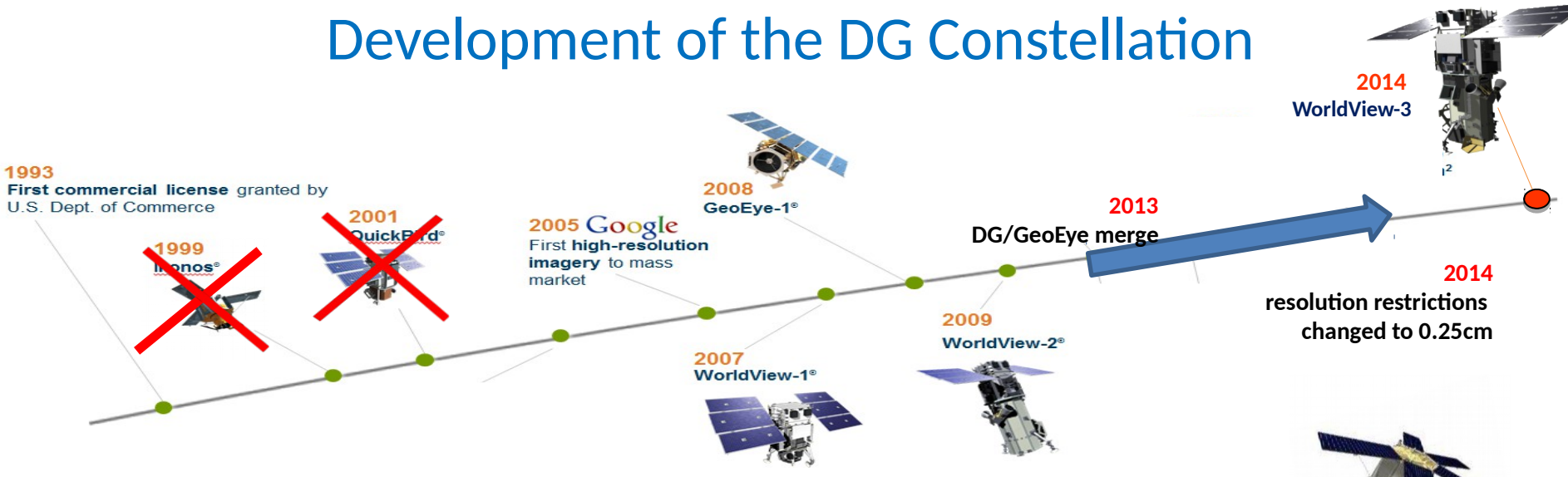
- Updated 15 minutes Weather Information (MeteoSat) to Check the Cloud Situation for the Collections
- Optimizing the Scan Direction



Average collection results over Europe using different levels of weather information:

- No weather forecast → 30 % good 70 % bad images
- Weather forecast files → 50 % good 50 % bad images
- Real-time weather → 80 % good 20 % bad images

Development of the DG Constellation



WorldView-4

Planned launch 2016

1 band Pan, 4 band multispectral

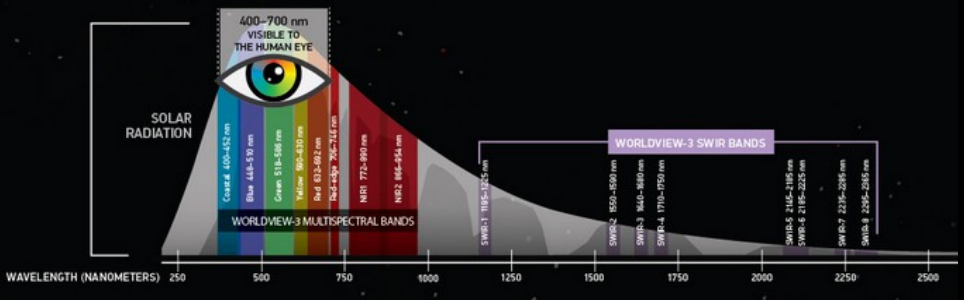
25cm or 30 cm resolution(1)

Introducing the first multi-payload, super-spectral, high-resolution commercial satellite ever to be launched.

WorldView-3

DigitalGlobe

- Panchromatic
- Daily revisit
- 8-Band multispectral
- Rapid retarget CMGs
- 8-Band short wave infrared



	Accuracy w/o GCP	Pan resolution	Multispectral resolution	SWIR resolution	Spectral characteristics	Swath width (nadir)	Operational altitude	Average revisit	Capacity km²/day	Onboard storage
IKONOS	15 m CE90	1.0 m	4.0 m	NA	Panchromatic 4-Band Multispectral	11.3 km	681 km	3 days	150,000	64 Gb
QuickBird	23 m CE90	65 cm	2.62 m	NA	Panchromatic 4-Band Multispectral	18 km	482 km	2.7 days	210,000	128 Gb
WorldView-1	< 3 m CE90	50 cm	NA	NA	Panchromatic	17.7 km	496 km	1.7 days	1.3 million	2199 Gb
GeoEye-1	5 m CE90	50 cm	2.0 m	NA	Panchromatic 4-Band Multispectral	15.2 km	681 km	< 3 days	1 million	1 Tb
WorldView-2	< 3 m CE90	46 cm	1.85 m	NA	Panchromatic 8-Band Multispectral	16.4 km	770 km	1.1 days	1.1 million	2199 Gb
WorldView-3 2014 expected launch	< 3 m CE90	31 cm	1.24 m	3.7 m	Panchromatic 8-Band Multispectral 8 SWIR Bands	13.2 km	617 km	< 1 day	680,000	2199 Gb

Get the best imagery and information available from the most advanced constellation.

Discover more at digitalglobe.com/WorldView3

WorldView-3

Dubai imaged by WorldView-3

WV-3 Launch seen from Space (WV-1)

Aug. 13	Atlas 5 • WorldView 3

Launch: 13.08.2014
Launch time: 18:29 GMT (11:29 a.m. PDT)
Launch site: SLC-3E, Vandenberg Air Force Base, California

- **Improved Resolution**

  Higher resolution means you can see more detail in WV3 imagery.

  Data collected at nadir will have 31-centimeter (cm) panchromatic, 1.24-meter (m) visible and near infrared, 3.7-m short-wave infrared and 30-m CAVIS bands.

  At 20 degrees off-nadir, the resolution is 34-cm panchromatic, 1.38-m visible and near infrared and 4.1-m short-wave infrared.

  With the easing of US government regulations, we will be able to provide WV3 imagery at a maximum of 30-cm.

- **Additional Spectral Bands**

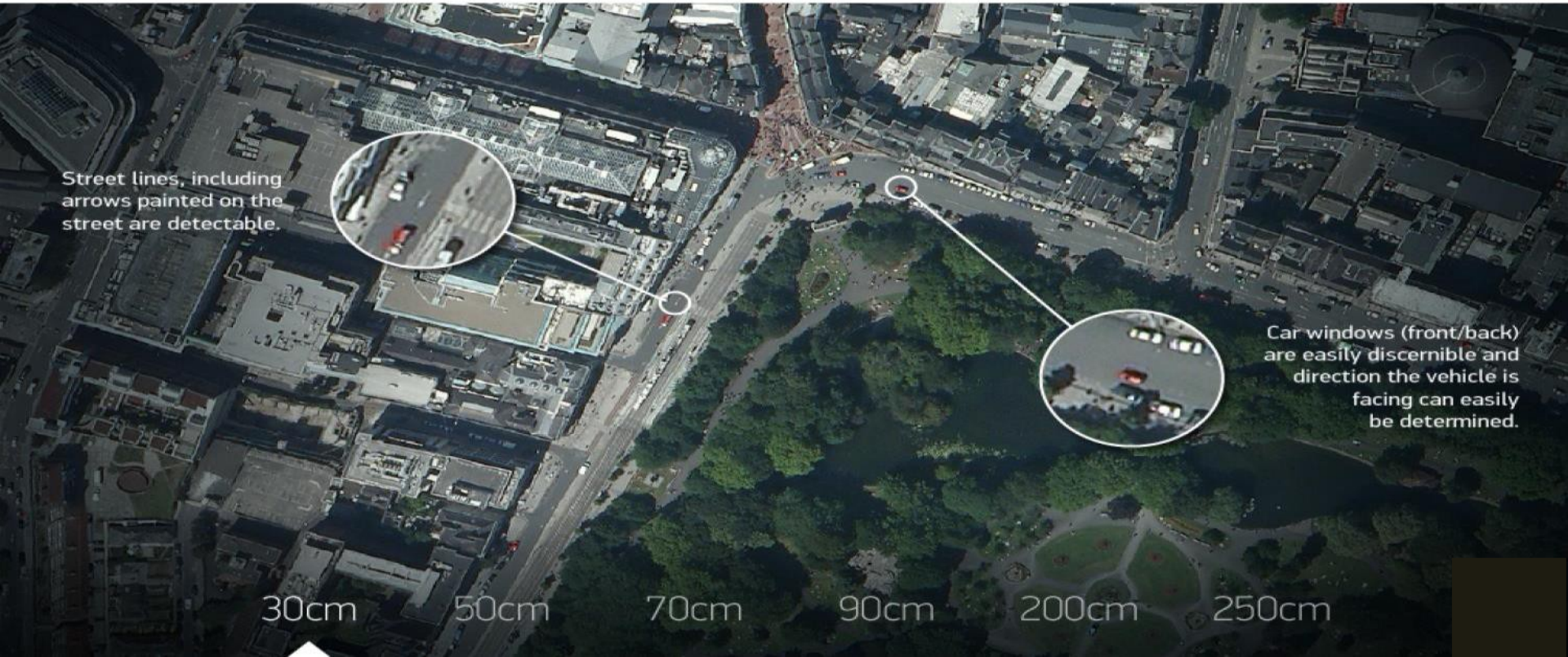
  If spectral analysis is part of your project, then no other satellite can match WV3 with its: 8 bands of visible and near-infrared data; 8 shortwave infrared bands which are crucial for geological studies; and 12 CAVIS bands to detect water vapor, dissolved aerosols, snow, clouds and more.

- **Better Positional Accuracy**

  With accuracies of 3.5-m CE90% or better (without ground control even!), WV3 has no rivals for its enhanced positional accuracy.

Detail and resolution

We use the NIIRS scale to describe the level of detail discernible in imagery acquired from various imaging platforms. Effectively, the higher resolution an image is, the higher a level of NIIRS detail you can achieve, and the more information and insight you can extract from the imagery.



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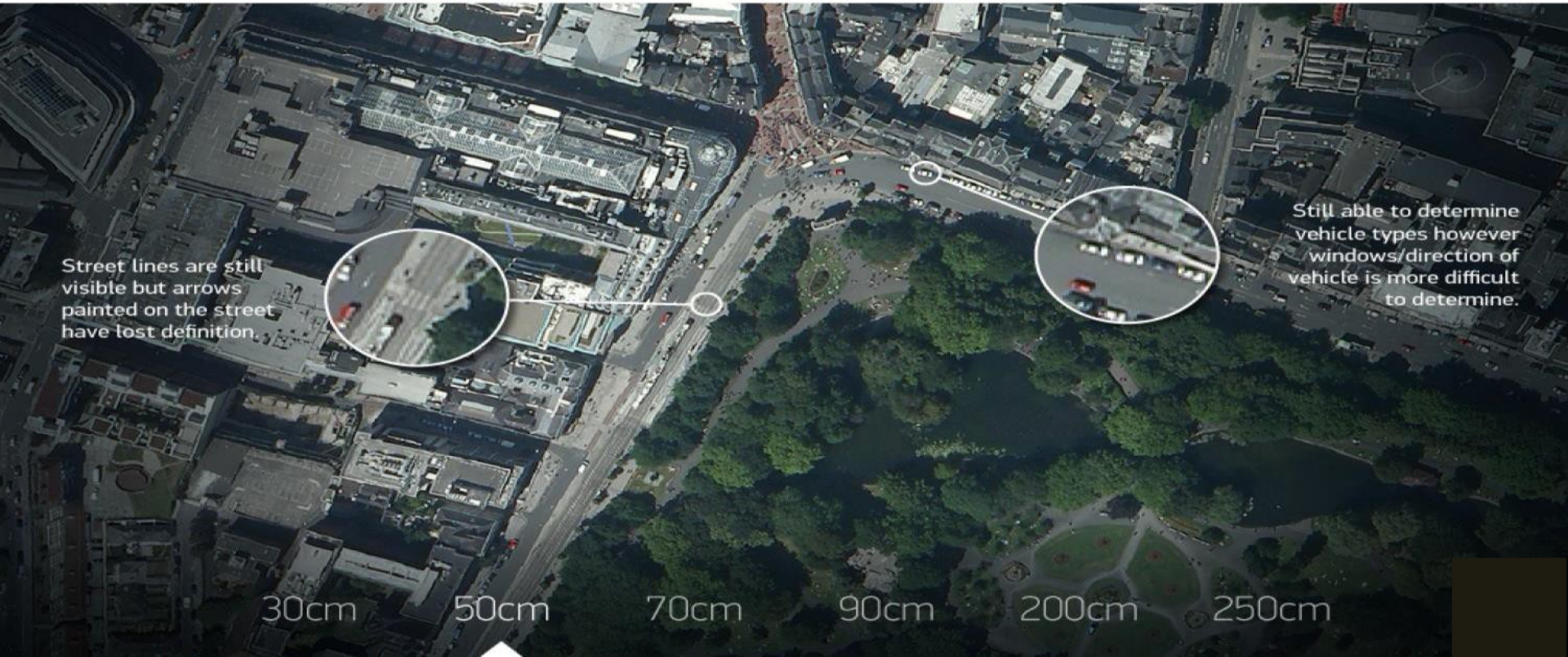

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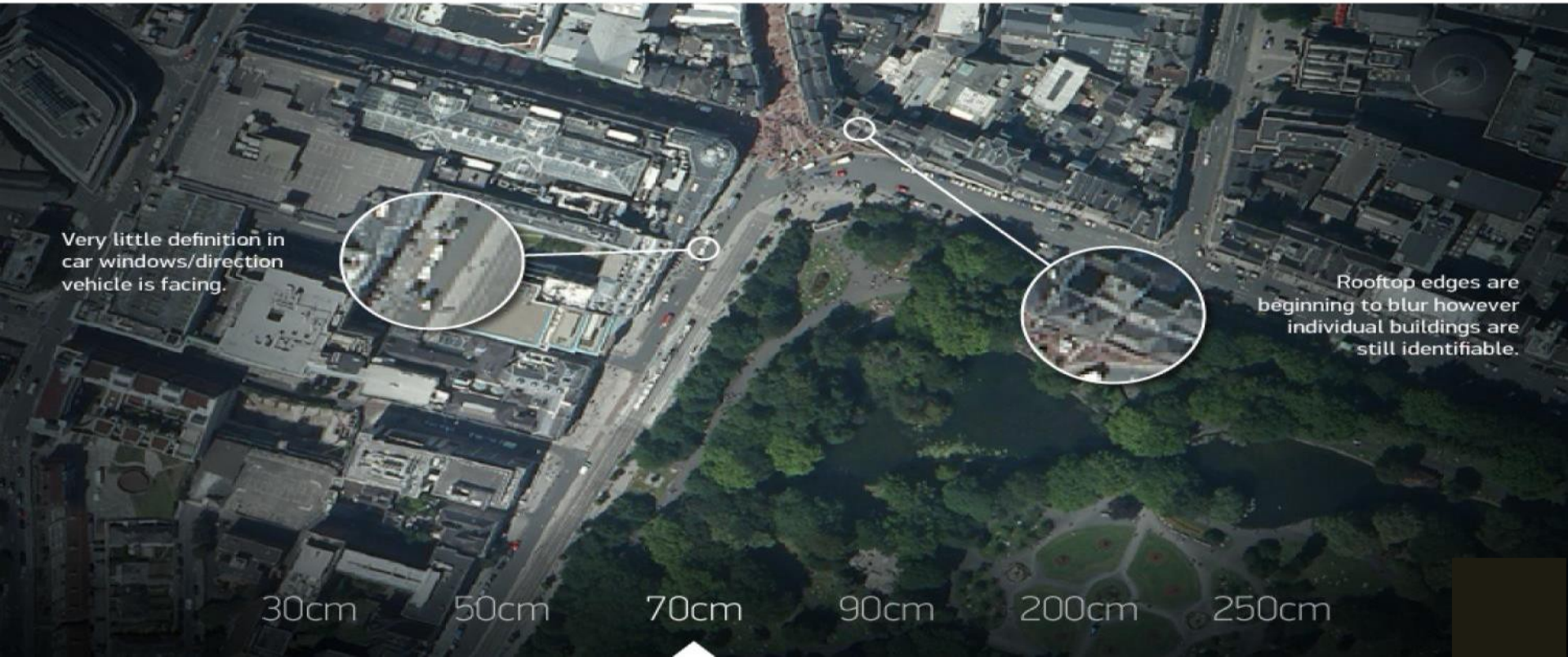
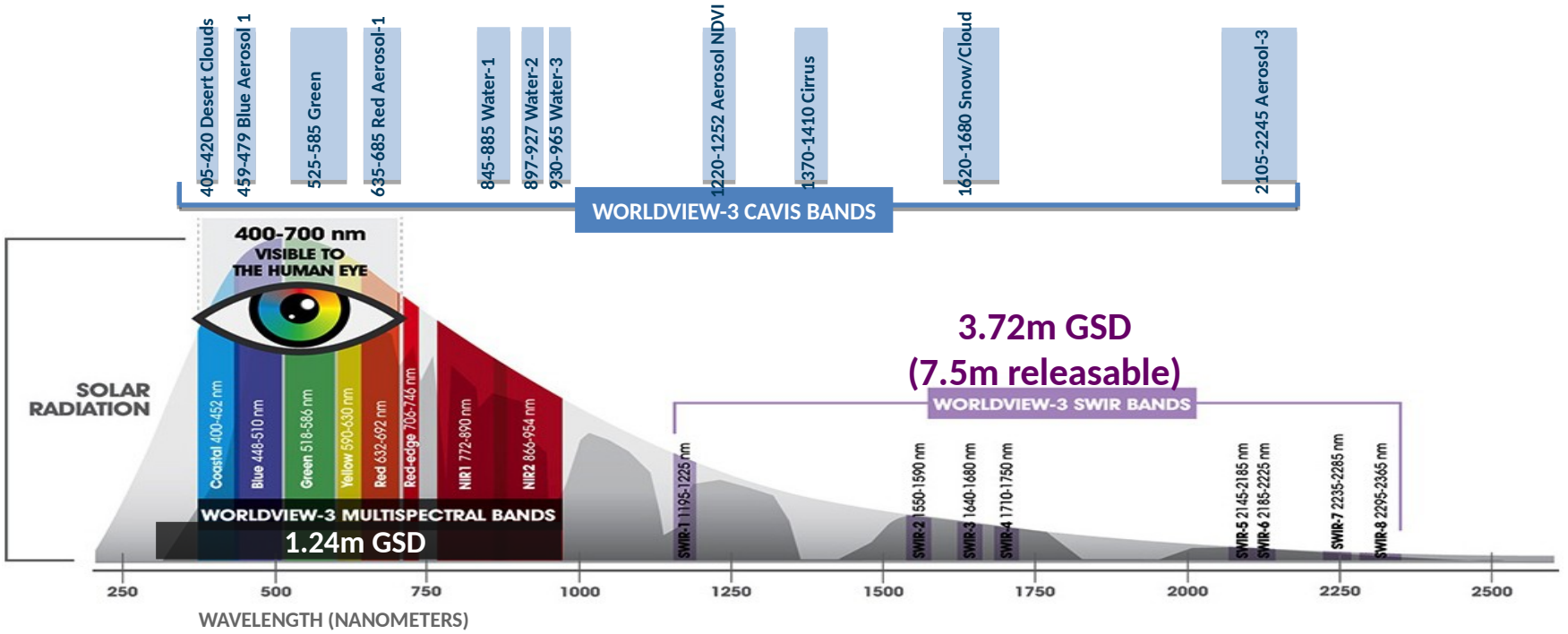


WorldView-3 is the first high-resolution “super spectral” (> 10 bands) satellite in the industry



Pan: 0.31m GSD

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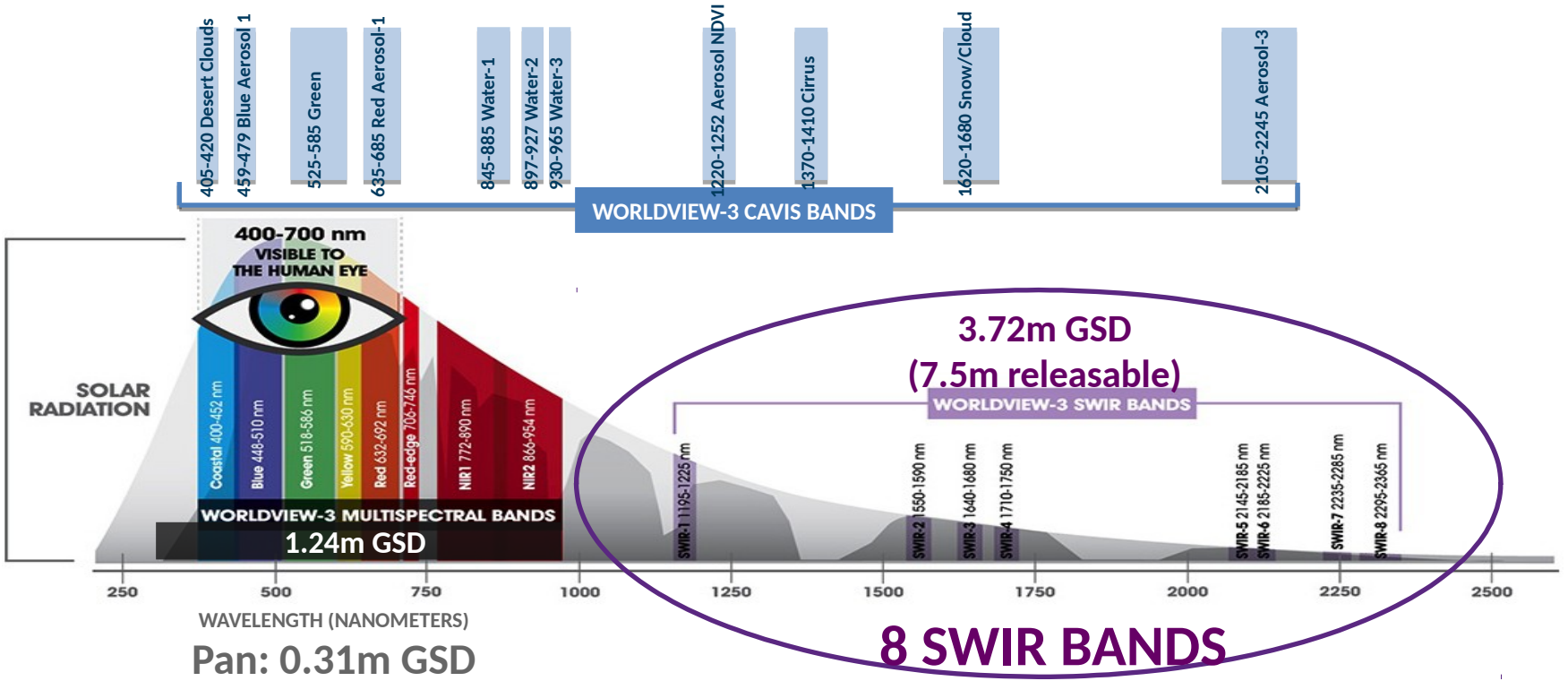


WV-3 SWIR Bands - Smoke Penetration and Thermal Response

Happy Camp, California, 28 AUG 2014:

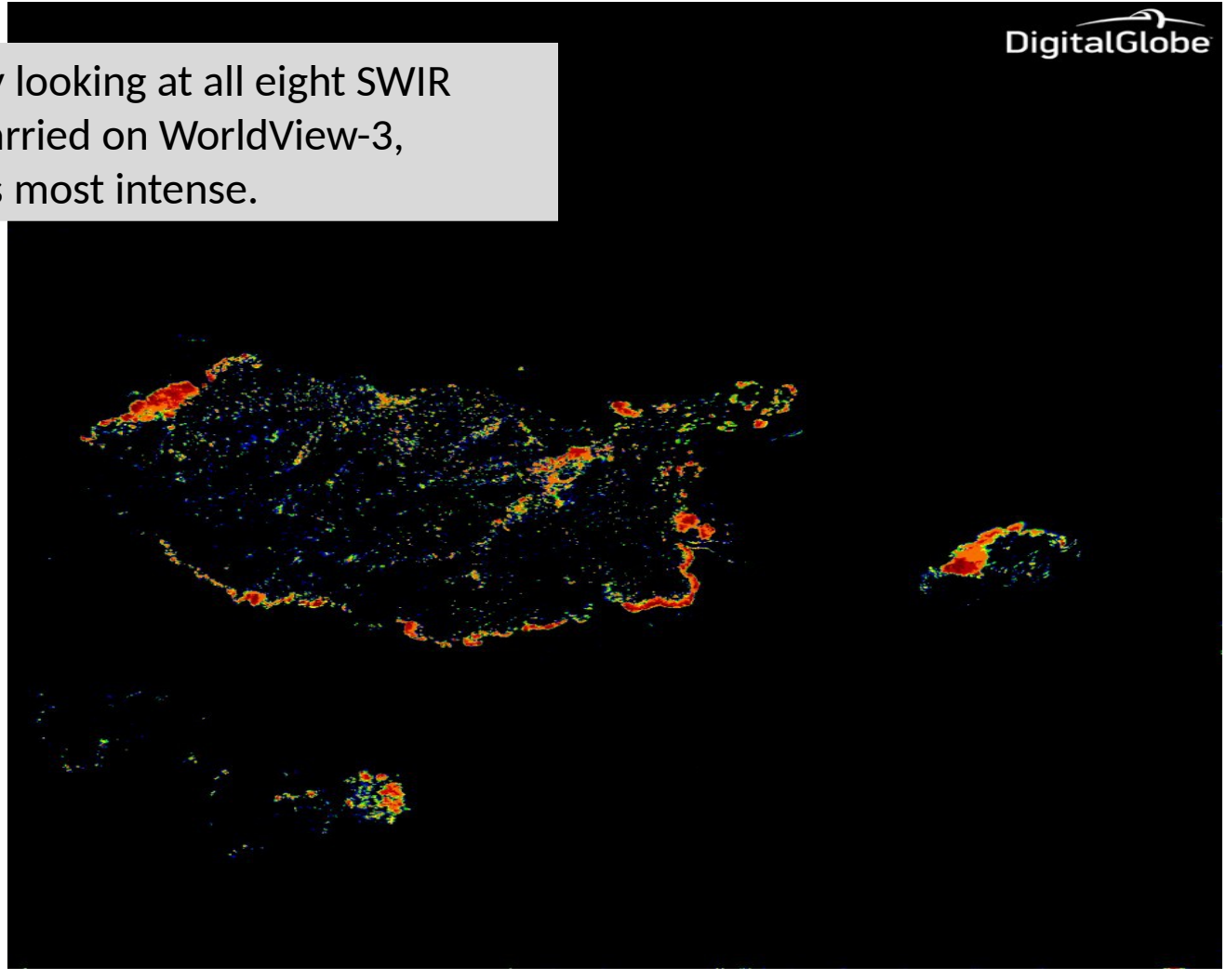
- Worldview-3 visible image, VNIR bands 5, 3, 2.
- Worldview-3 SWIR composite image, SWIR bands 6, 3, 1.
- Heat map relative intensity.

Image source: http://bit.ly/hccphotos


DigitalGlobe

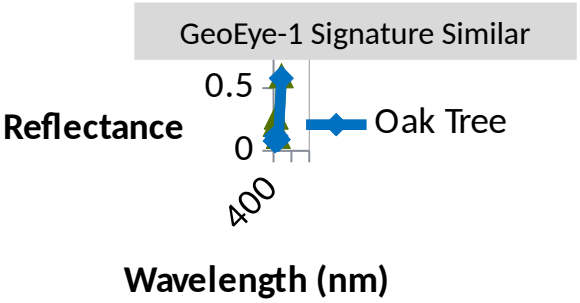
Worldview-3 SWIR composite image, SWIR bands 6, 3, 1

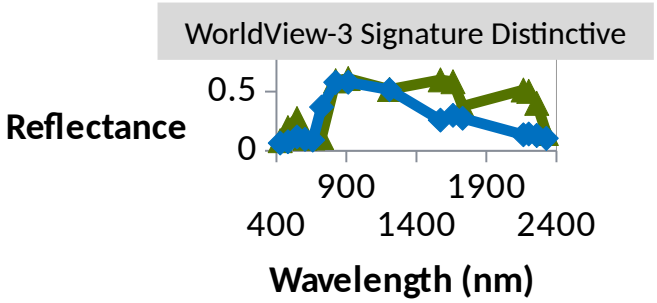
“heat map” calculated by looking at all eight SWIR spectral bands (colors) carried on WorldView-3, showing where the fire is most intense.



WorldView-3 material identification

- Monitoring of oil and chemical spills
- Mining
  - Can see signature of industrially-useful minerals
  - Can see signature of minerals associated with precious metals and rare earths
- Detection of man-made materials
  - metal, tarps, paint, asphalt, etc.





SWIR + Knowledge = Materials

- Solar Panel
- Steel
- Rubber + Fiberglass, White
- EPDM, White
- Ceramic, Red
- Tile, Red
- Paint on Metal
- Concrete

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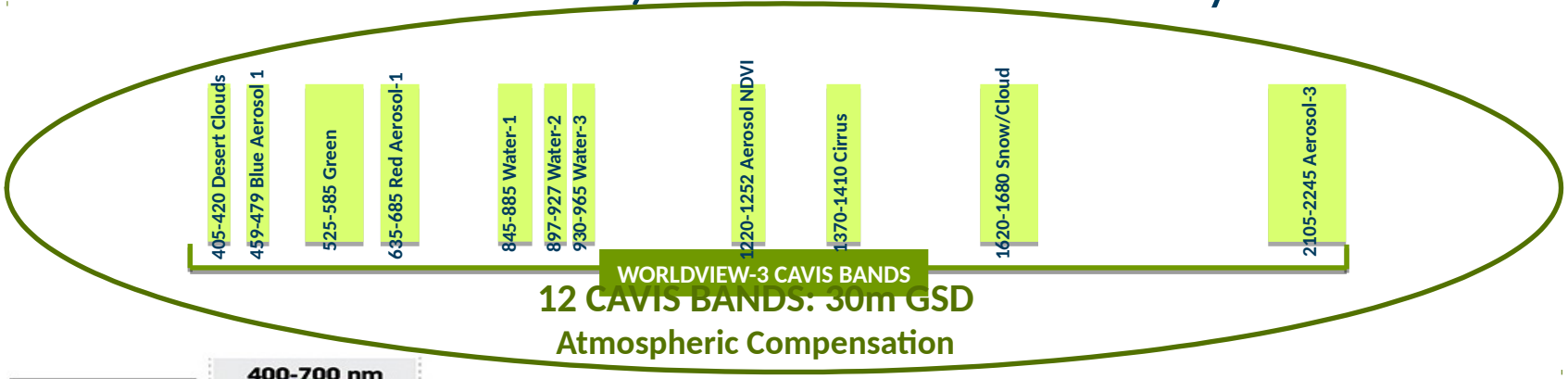
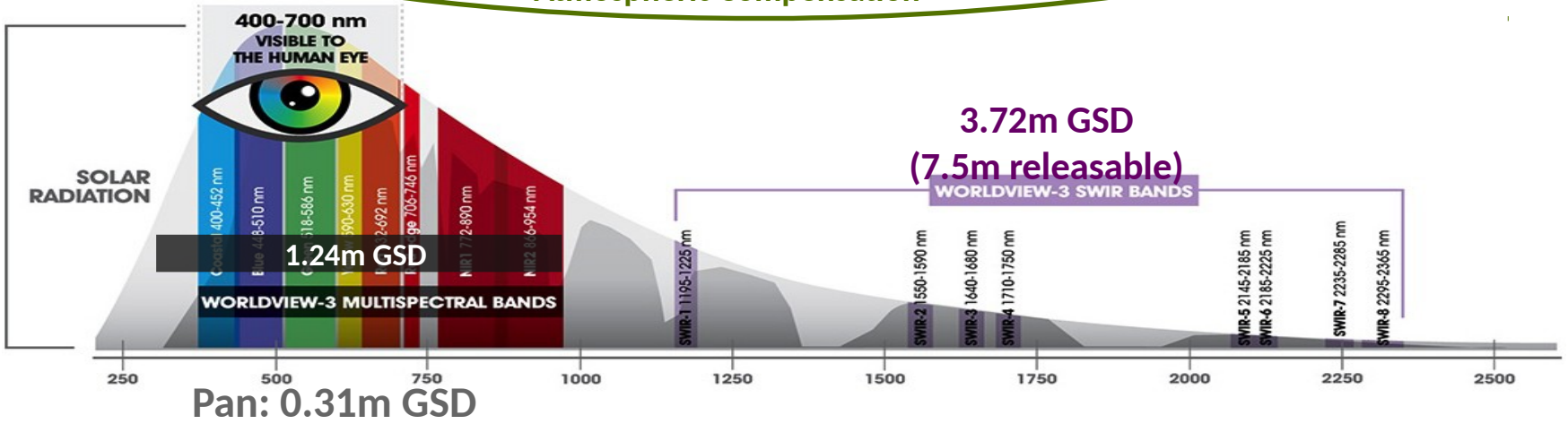




WorldView-3 CAVIS improves efficiency: haze correction

Before and After Haze Correction using CAVIS

CAVIS enables surface reflectance which facilitates more accurate, consistent change detection

TOA reflectance

Conversion to surface reflectance allows for consistent mapping and monitoring

Surface reflectance (after atmospheric compensation)

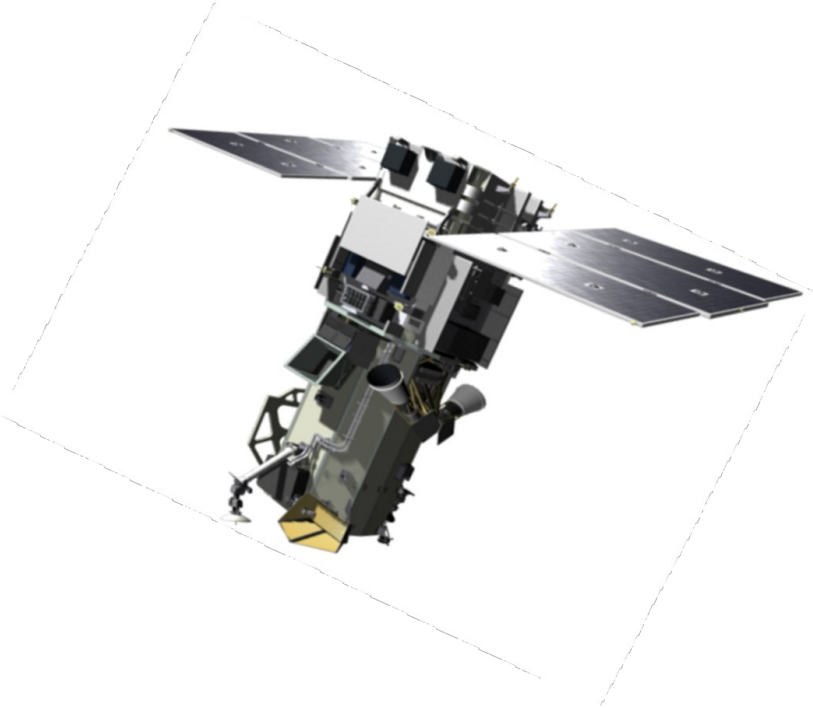
DigitalGlobe's Reflectance Algorithm Results

Beijing - uncorrected

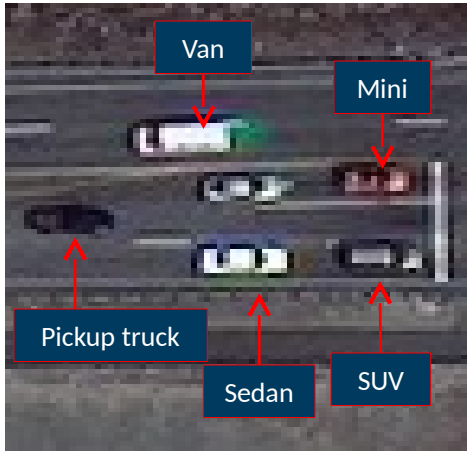
Beijing – surface reflectance

Applications & First Images

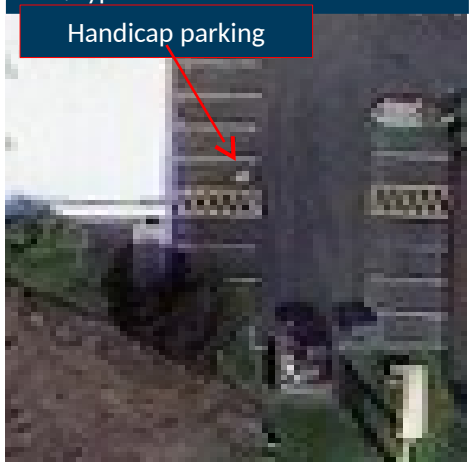
WorldView-3



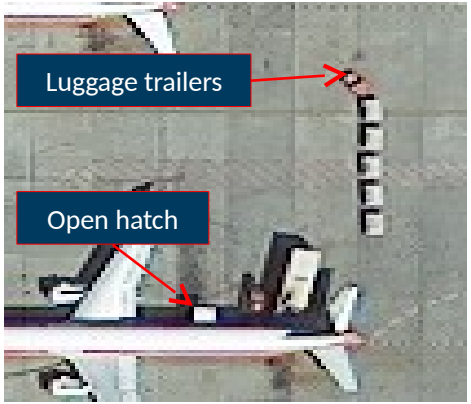

WV-3 2014-08-21
WV-3 Improved Resolution
IKONOS 2011-10-9
WV-2 2014-09-04



Vehicles can be identified by size/type.



Kennewick, Washington| August 20, 2014| WorldView-3



Additional activity is identifiable such as aircraft loading/unloading activity.

Refueling and maintenance activity is observable

Madrid, Spain| August 21, 2014| WorldView-3

D&I APPLICATIONS

Monitoring:
Damage assessments

DigitalGlobe


Buildings destroyed
Heavy Equipment Transporter (HET)
Ordnance impact points (approximately 3.5 meter diameter holes)
Roof collapsed (ordnance impact point)

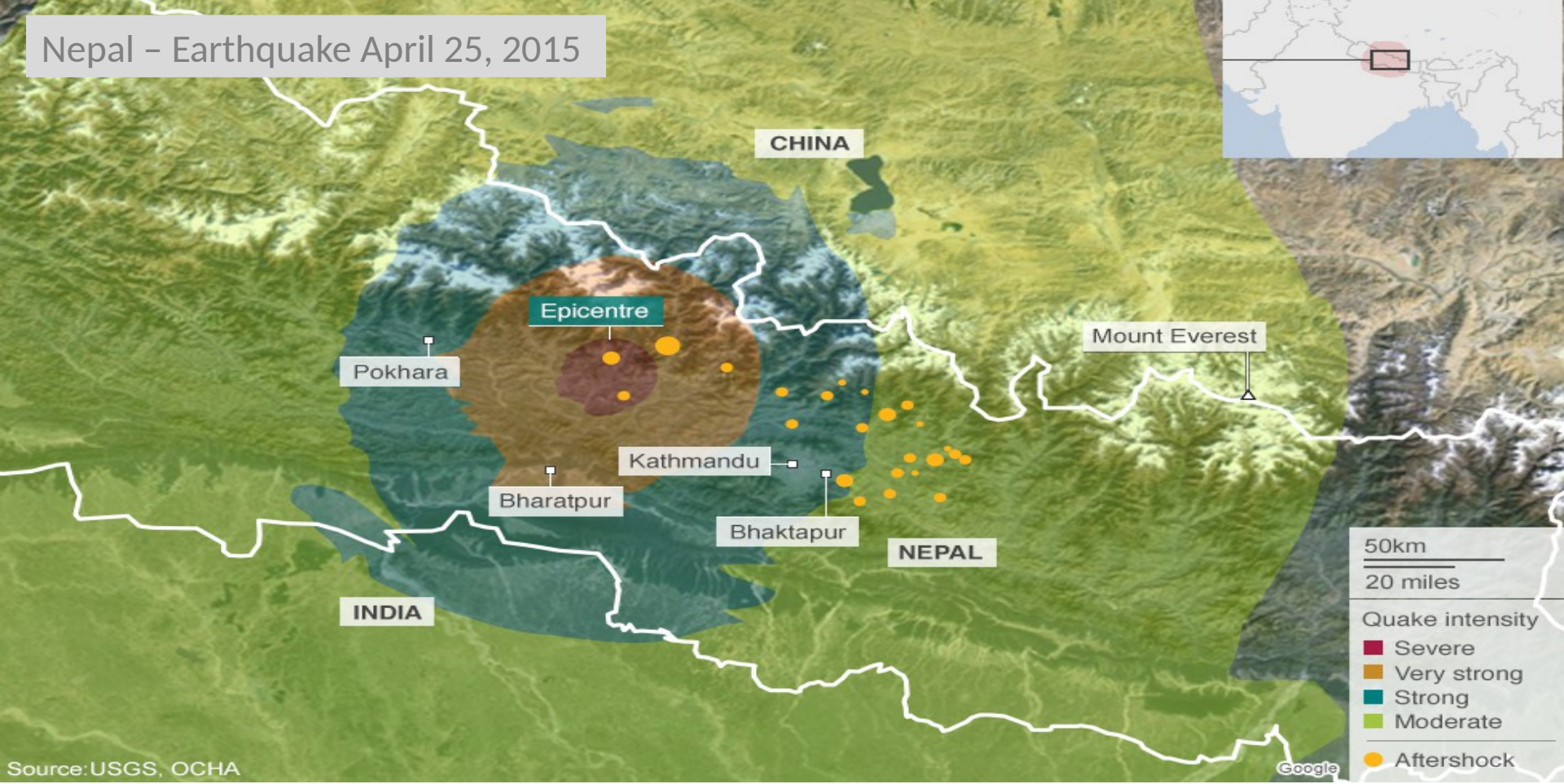

Catastrophic structural damage to roof of terminal

Humanitarian Issues

DigitalGlobe


Syrian refugees attempting to leave Syria for Turkey
Turkish armored patrol car

Nepal – Earthquake April 25, 2015




DigitalGlobe


DigitalGlobe

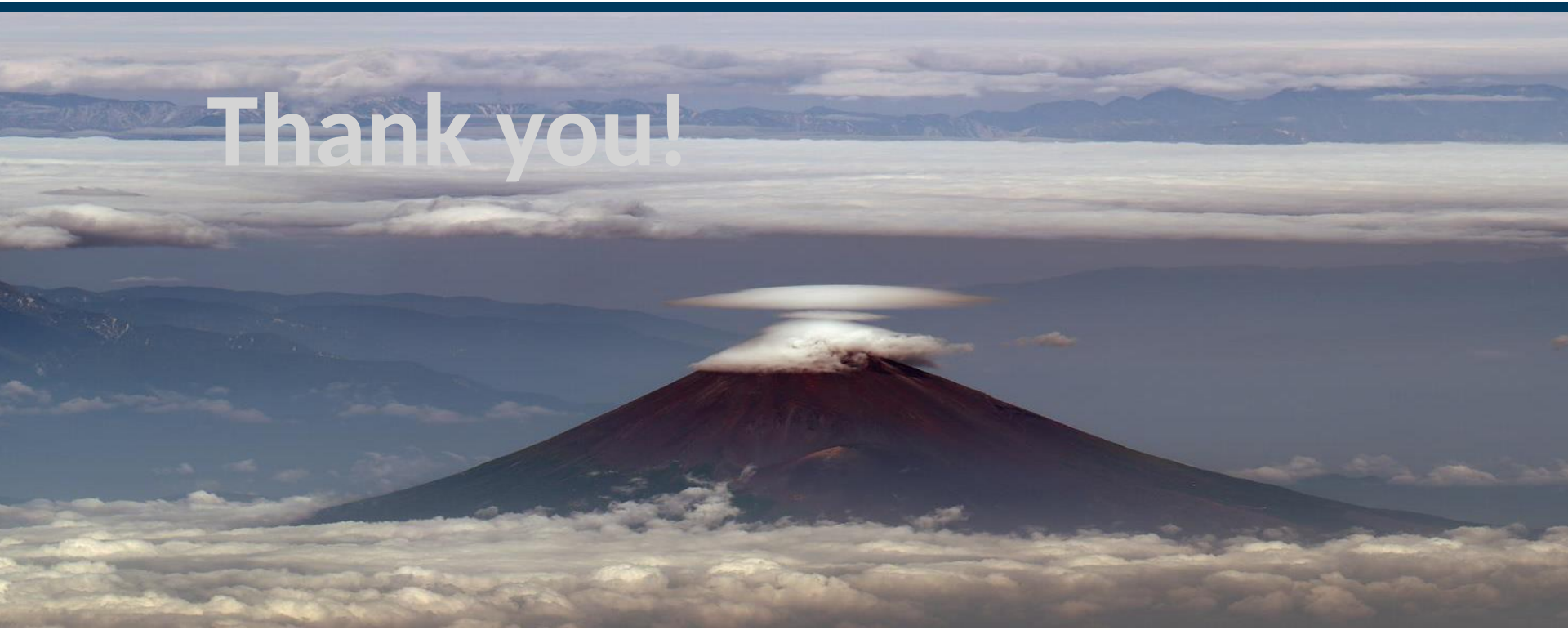
EUROPEAN SPACE IMAGING®

WORLDVIEW GLOBAL ALLIANCE™

Conclusions

Conclusions

- EUSI is providing the most sophisticated commercial VHR Earth Observation satellites in market through its Partnership with DigitalGlobe
- EUSIs Local Tasking enables instant tasking & near real time delivery
- WorldView-3 has the unprecedented resolution of 30cm and it provides SWIR and CAVIS bands.


Thank you!