A satellite image of the Florida Keys, Florida, showing the coastline and the surrounding ocean. The land is brownish-orange, and the water is blue. The image is taken from a high angle, showing the intricate patterns of the coastline and the surrounding ocean. A semi-transparent dark grey box is overlaid on the top left of the image, containing white text.

DigitalGlobe Incorporated Satellite and Aerial Program Update - JACIE 2012

The DigitalGlobe logo, featuring a white curved line above the text "DIGITALGLOBE" in a bold, sans-serif font.

DIGITALGLOBE®

DigitalGlobe

Driving the Evolution of Imagery Analytics

The Commercial Geospatial industry has experienced four eras:

1st Era: Resolution

Customer needs places premium on detail within the image



DigitalGlobe drives the “better than one meter” satellite imagery standard

2nd Era: Accuracy

Emergence of map making industry and greater accuracy drives growth



With launch of WV1 & WV2, DigitalGlobe drives the 5.0 meter CE90 spec

3rd Era: Speed

Reliance on quick access to imagery at an all-time high and customer priority becomes speed and relevancy



DigitalGlobe drives on-demand access standard

4th Era: Analytics

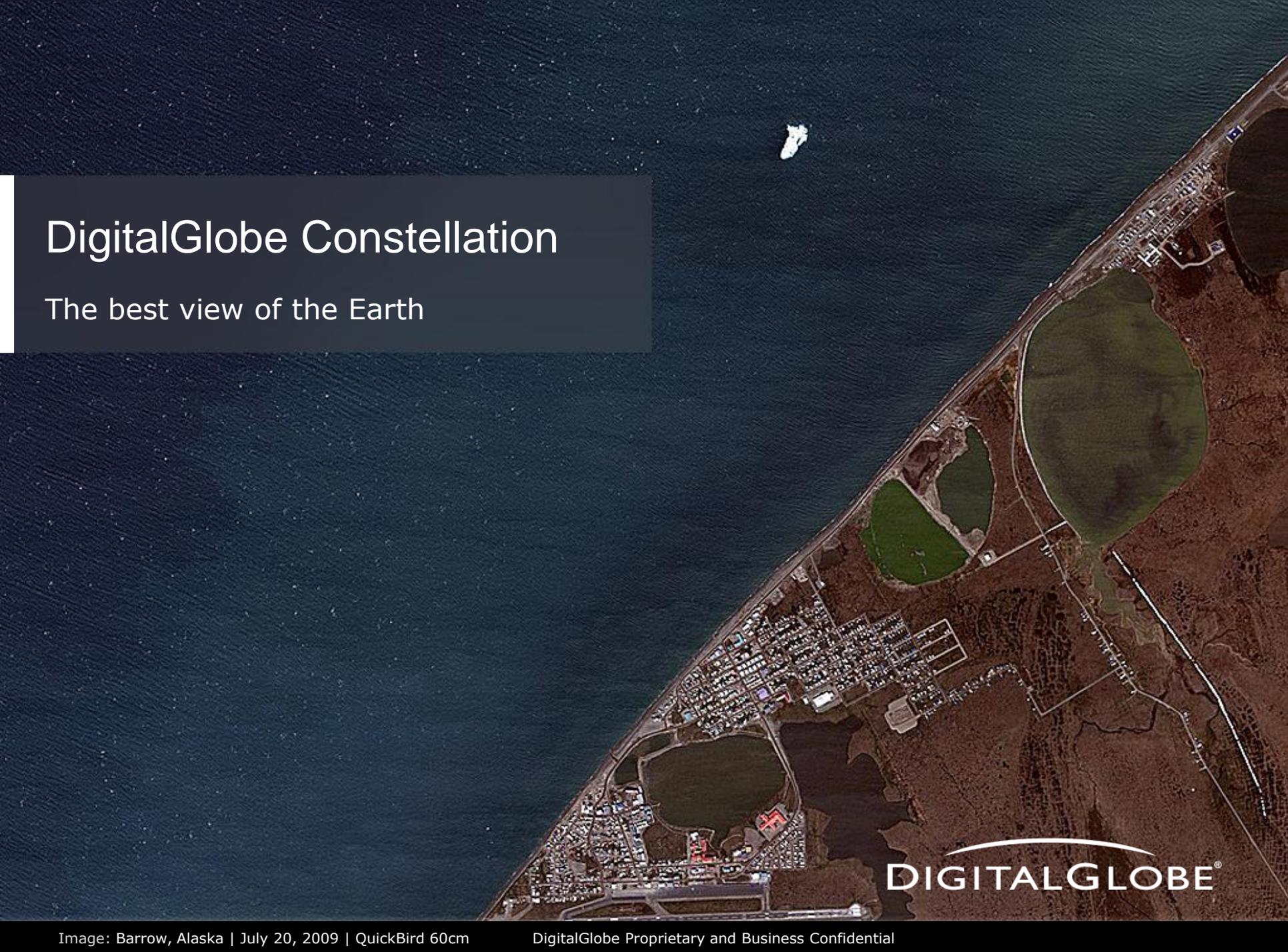
New valuable problem-solving uses emerging and priority becomes measuring both on land areas surface and below water



DigitalGlobe drives 8-band standard and custom analysis via DG Analysis Center

DigitalGlobe Constellation

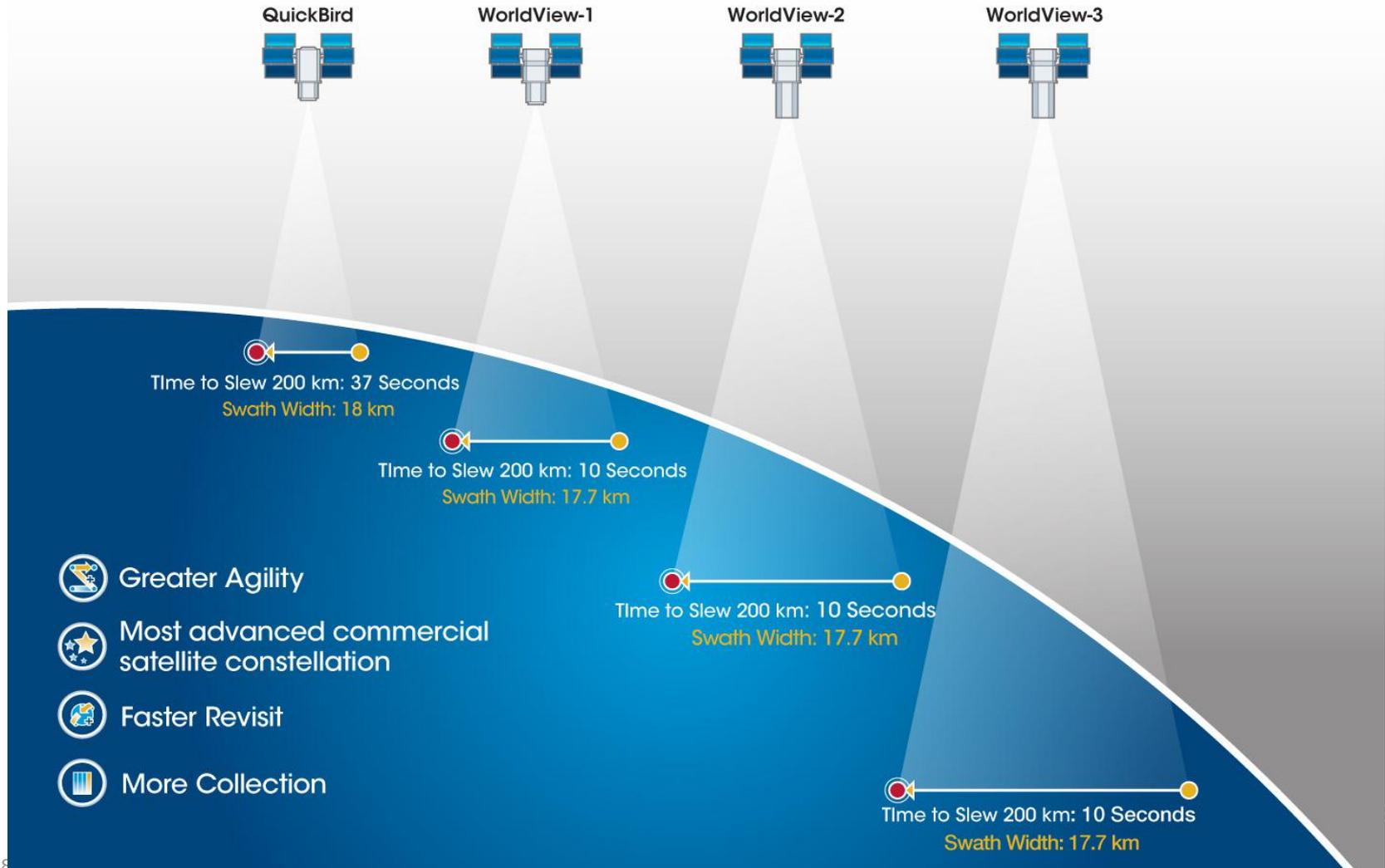
The best view of the Earth

A satellite image of Barrow, Alaska, showing a coastal town with numerous buildings and roads, several large green ponds, and a dark blue sea. The image is taken from a high angle, showing the coastline and the surrounding landscape.

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DigitalGlobe - The Best View of the Earth

Current Constellation Collects 2-3X more Imagery



DigitalGlobe Advanced Ortho Aerial Program (AOAP) Update

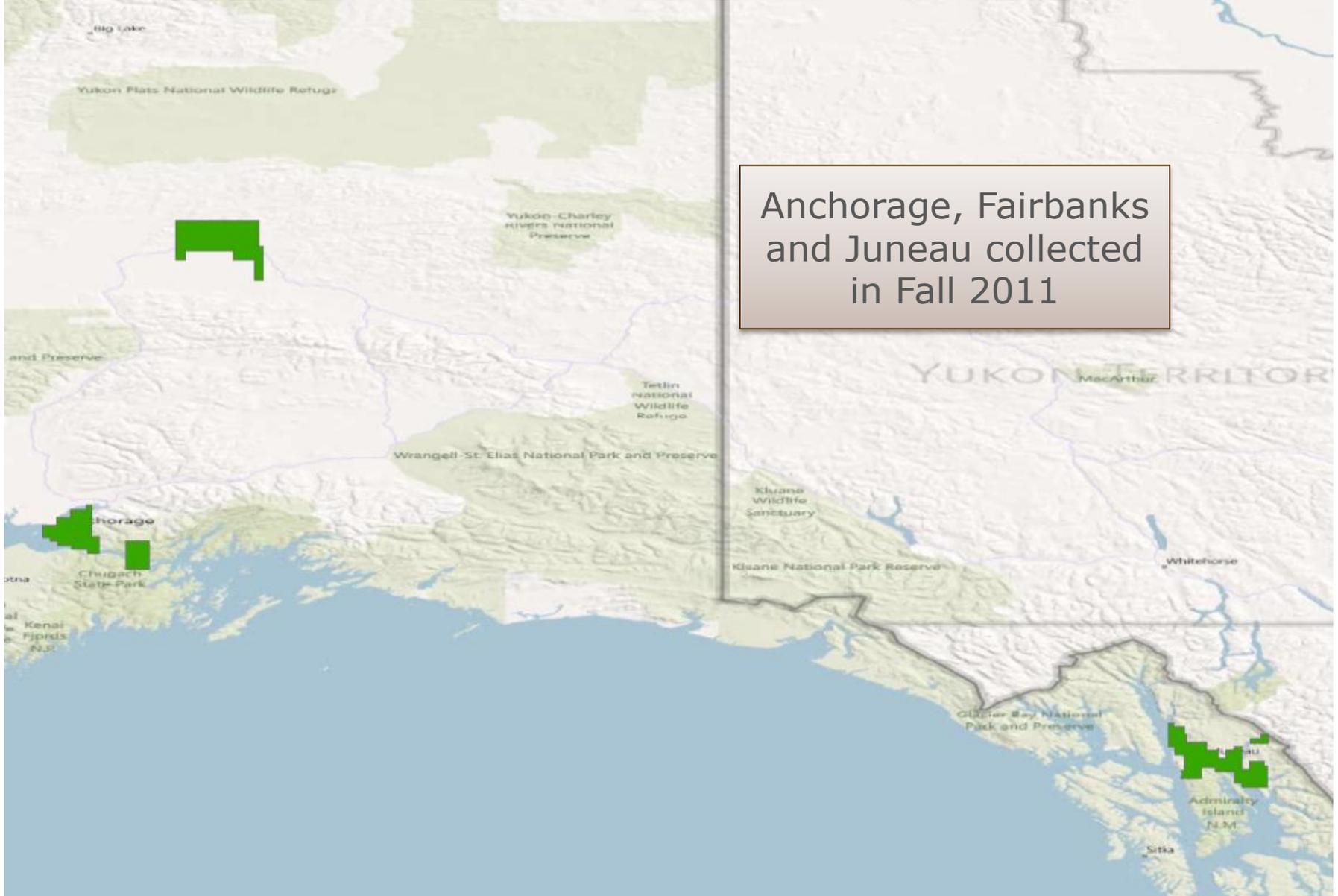
- First ever high resolution, wall-to-wall Precision Aerial ortho program for Contiguous United States, Alaska and Western Europe
 - 30cm (natural color) and 60cm (infrared) Phase 1 coverage to complete by mid 2012 (CONUS 99% complete); Phase 2 planned
- Consistent & optimized coverage:
 - Standard format, common platform & sensor, uniform resolution, consistent accuracy
- DigitalGlobe is [REDACTED] distributor of offline source GeoTIFF imagery (color and infrared) and [REDACTED] associated metadata



AOAP Acquisition Status - CONUS

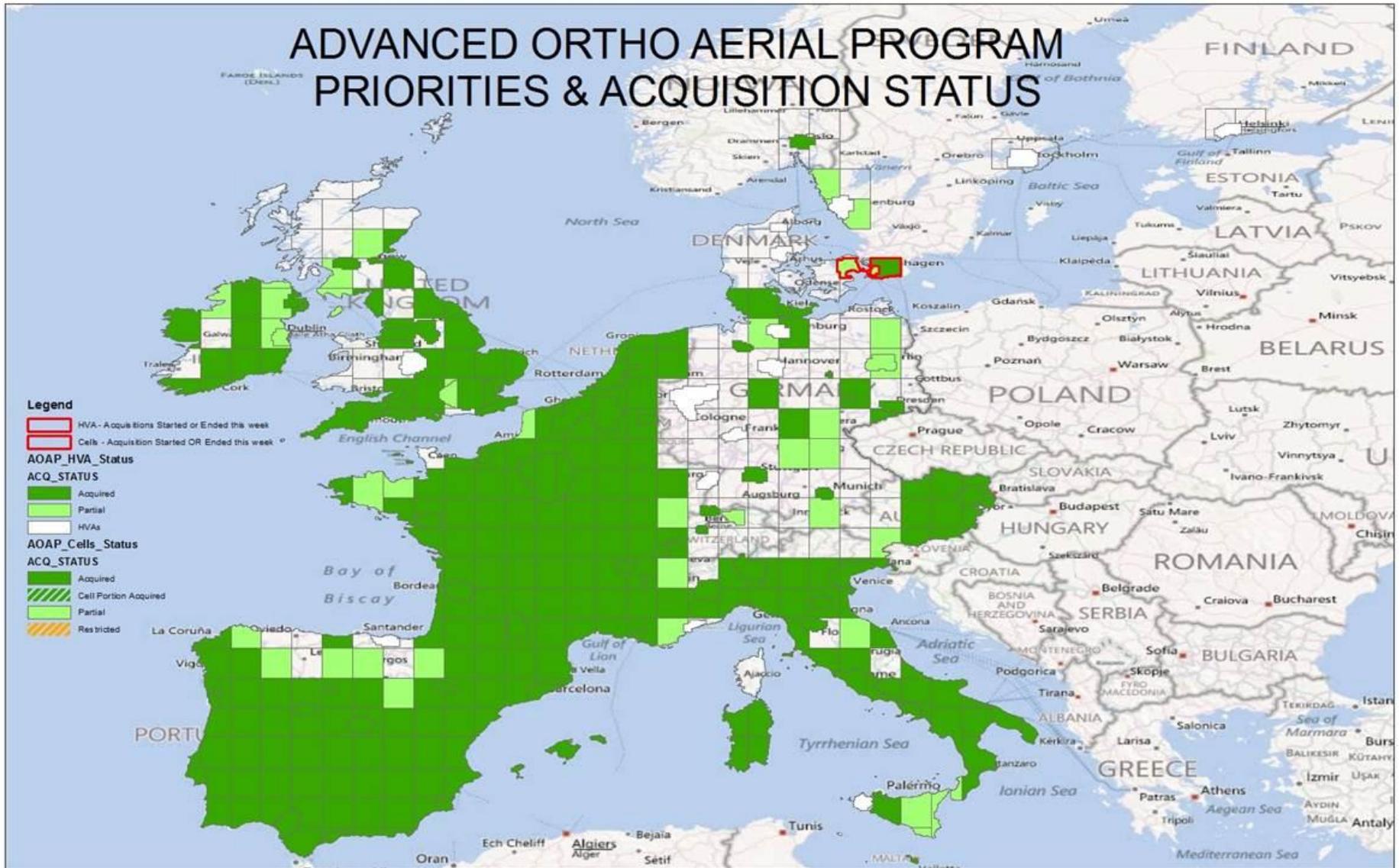


AOAP Acquisition Status - Alaska



AOAP Acquisition Status – Western Europe

ADVANCED ORTHO AERIAL PROGRAM PRIORITIES & ACQUISITION STATUS



An aerial photograph showing a wide river delta with a dense forest of green trees. The river is a light brown color, and the surrounding land is covered in lush green vegetation. The image is taken from a high angle, showing the intricate patterns of the river and the forest.

DigitalGlobe Coverage

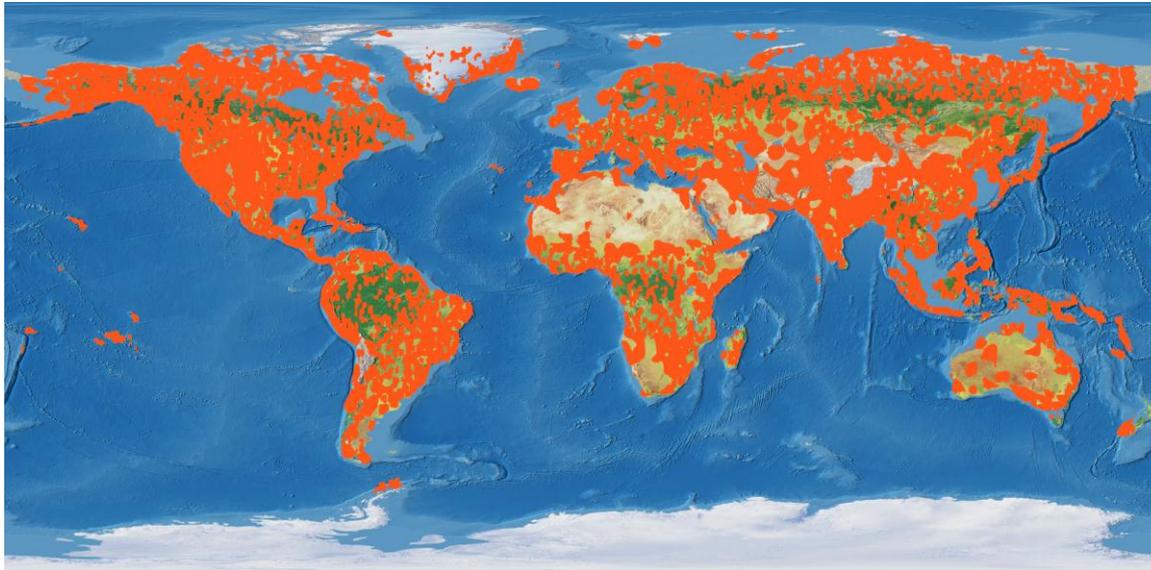
See more of the Earth

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DigitalGlobe - See More of the Earth

Satellite Coverage

■ 30 days collection



- **2.6 million km²** added each day – we capture over six times the earth's landmass every year
- **More access** – three satellites with the some of the most agile technology
- **Better collection** – we can capture the earth's landmass in 75 days
- **Content leader** – with 2 billion km² archived imagery available
- **Faster refresh** – 33% of archive is less than one year old

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DigitalGlobe Currency

See the Earth now!



DIGITALGLOBE®

See the Earth Now!



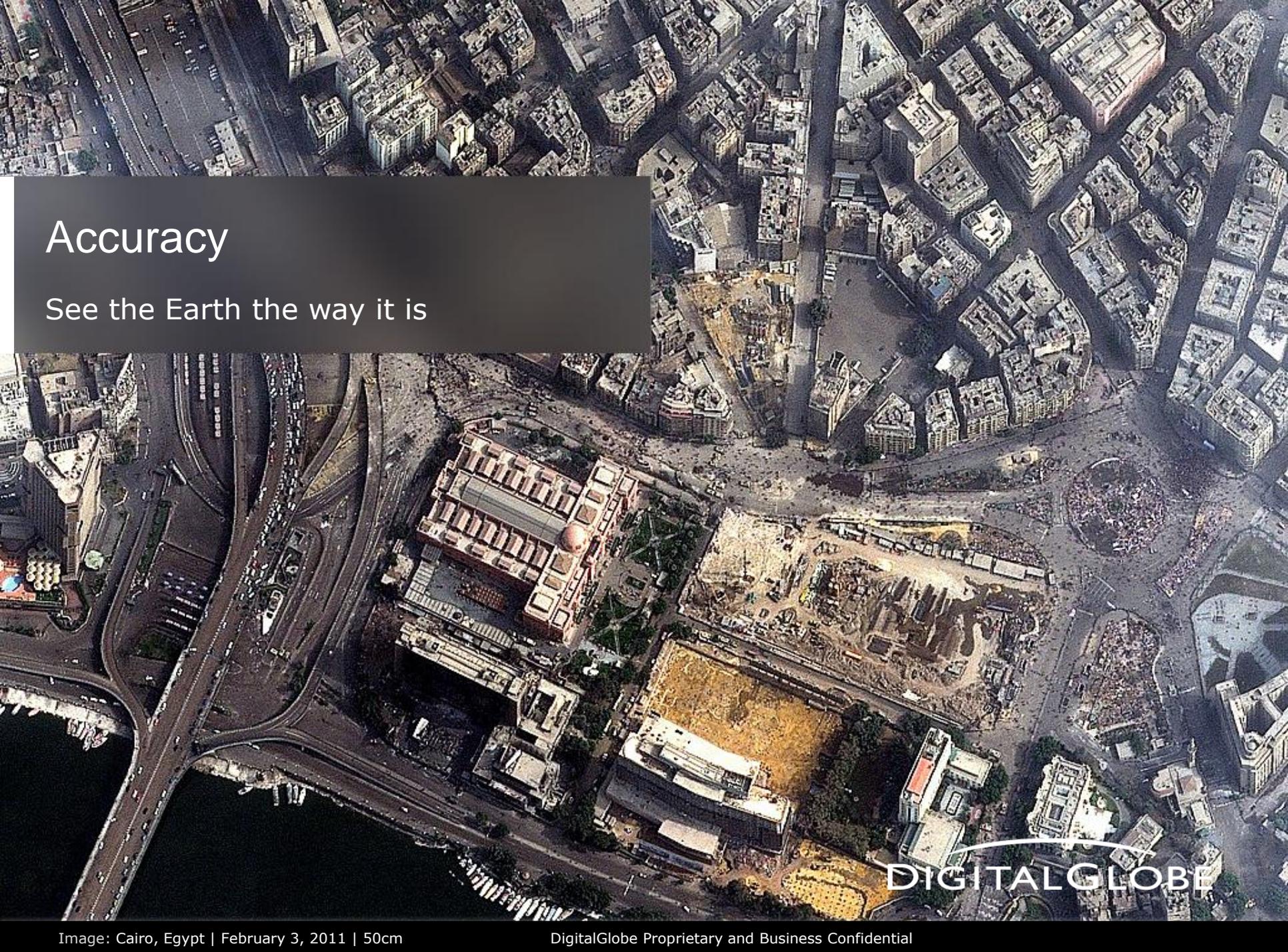
Delivery of images within hours after collection



Offering on-demand access and offline delivery and online download



Ability to refresh imagery over the same location almost daily with intraday revisit capabilities



Accuracy

See the Earth the way it is

DIGITAL GLOBE

Accuracy - See the Earth the Way It Is



Platform	Accuracy Levels
QuickBird	<ul style="list-style-type: none">• 23m CE90 or better• Quick production
WorldView-1 WorldView-2	<ul style="list-style-type: none">• 5.0m CE90 or better• Broad coverage with high accuracy for mapping and feature extraction
Precision Aerial	<ul style="list-style-type: none">• 2.6m CE90• United States and Western Europe



An aerial photograph of a vast, cracked, and textured icy landscape, likely a frozen body of water or a large ice field. The cracks form a complex, web-like pattern across the surface. In the upper left corner, there is a rocky shoreline with dark, jagged rocks and some snow. The overall scene is desolate and cold.

DigitalGlobe Analysis

The power to understand and take action

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DigitalGlobe Analytics

The Power to Understand and Take Action

Analysis

- Imagery + Analysis = Insight
- Empower better decision making
- Custom solutions for customers

What do we mean by custom solutions?

Japan Crisis 2011

In the aftermath of the tsunami, more than 95,000 downloads of imagery and analysis details of the damaged Fukushima Daiichi nuclear power plant were downloaded from our website.



Vermont Floods 2011

This August 29, 2011, image of Pico Mountain Resort, Killington Township, Vermont, shows the damage caused by Hurricane Irene-related rainwater and mud runoff to the lodges and parking lots at the base of the ski slopes.





DigitalGlobe Product Offerings

Flexible options for imagery, information, and insight


DIGITALGLOBE®

Flexible Options for Imagery, Information, and Insight

DAP (Direct Access Program)

Get secure, direct access to our growing constellation of satellites for defense, intelligence, and large commercial customers.

Satellite and Aerial Imagery

Global imagery sourced from DigitalGlobe's own high-resolution satellite constellation and aerial network.

- **Base Products**
- **Stereo**
- **Ortho Series**
- **Global Basemap**
- **Precision Aerial**

Monitoring Services

Find fast web-based access to pre- and post-event imagery of world disasters delivered to almost any desktop or web-based mapping platform.

- **FirstLook/Crisis Event Service**
- **Diplomatic Facility Support Program**

Information/Insight

Get analytical insights of global events and changes to support decision-making.

- **Custom Analysis**
- **Analysis Center**
- **FirstWatch**
- **Elevation Series**
- **Land Use / Land Cover, Change Detection, and more**

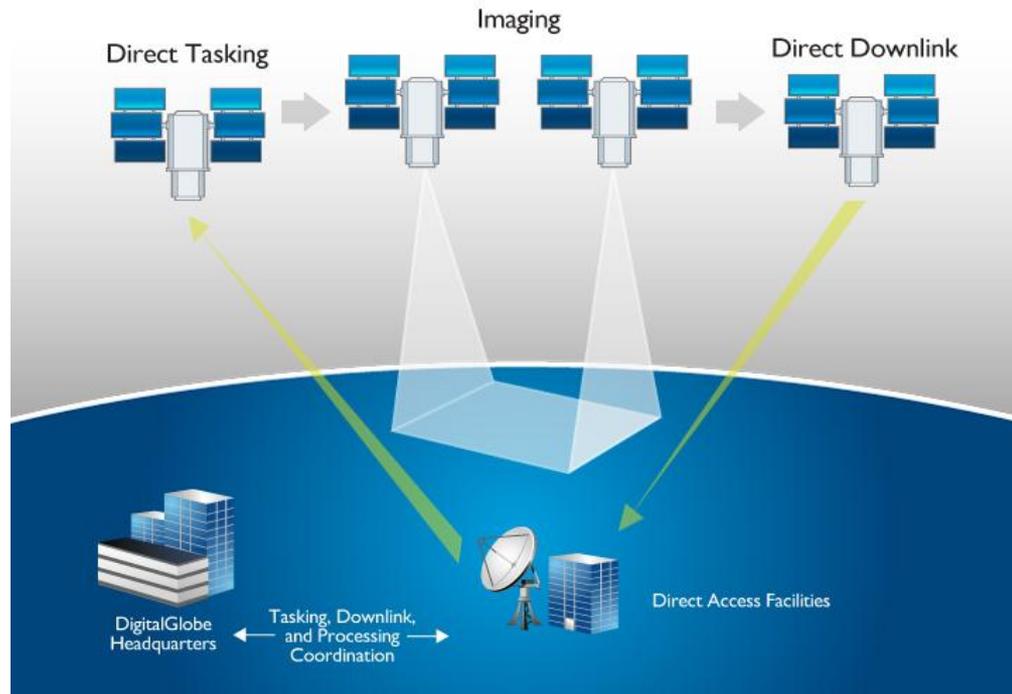


DAP: Direct Access Program

You directly access our satellites

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DAP - You Task our Satellites



What it is

Provides direct tasking and direct downlink of imagery from DigitalGlobe's next generation WorldView-1 and WorldView-2 satellites.

Who it's for

Designed to meet the imagery needs of defense, intelligence, and large commercial customers by offering **secure, direct** access to DigitalGlobe's growing constellation of satellites.



DigitalGlobe Imagery

The world's largest, consistently refreshed commercial imagery library

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The World's Largest, Consistently Refreshed Commercial Imagery Library



What it is

Premium imagery covering major operating areas worldwide that has the ability to integrate with existing GIS implementations.

- Base Products
- Stereo
- Ortho Series
- Global Basemap
- Aerial

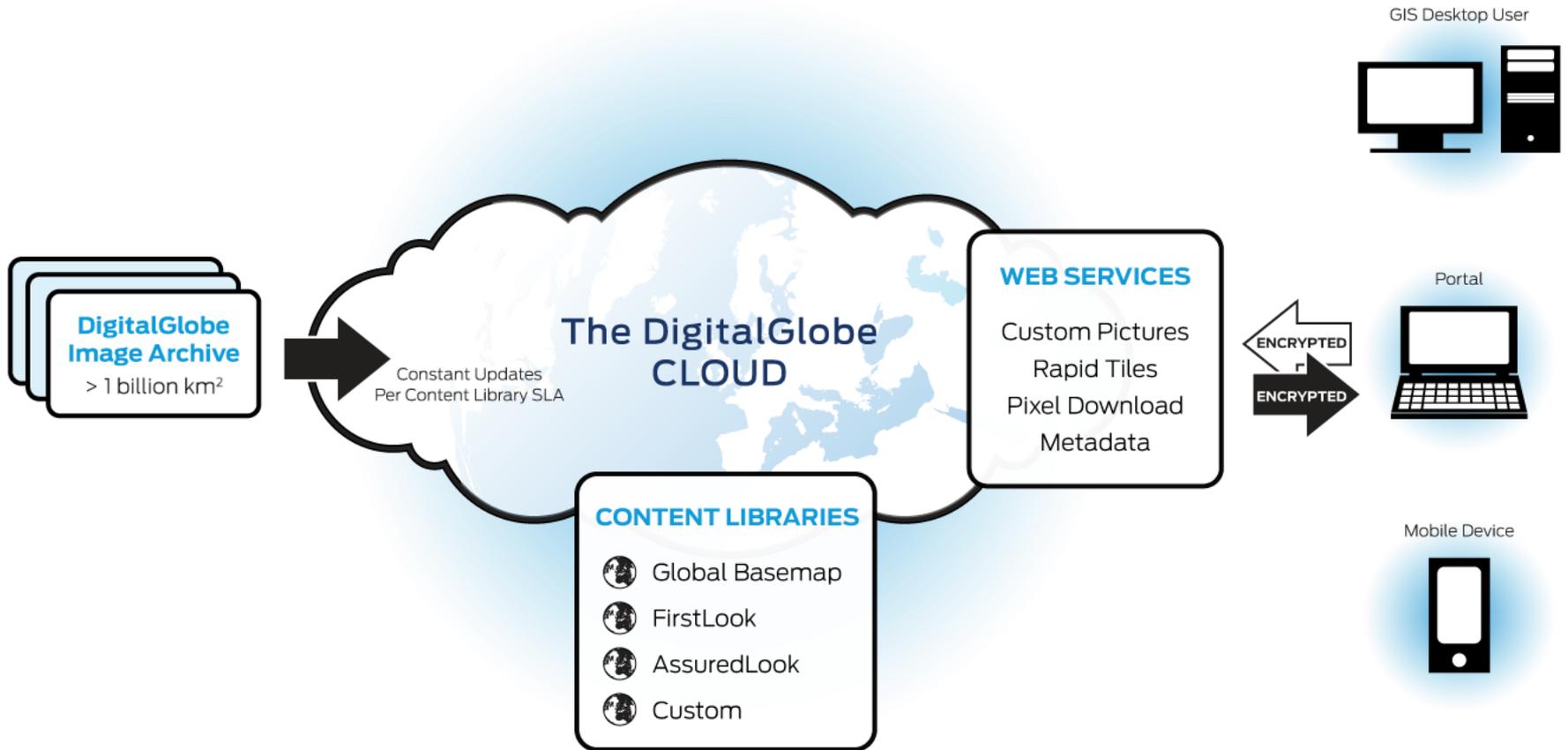
Who it's for

Professionals who need to:

- Identify the world's natural resources, monitor pipelines and facilities
- Understand the earth's environmental condition
- Protect homelands and borders
- Respond to emergencies and natural disasters; then recover
- Plan investments in multi-million dollar infrastructure development

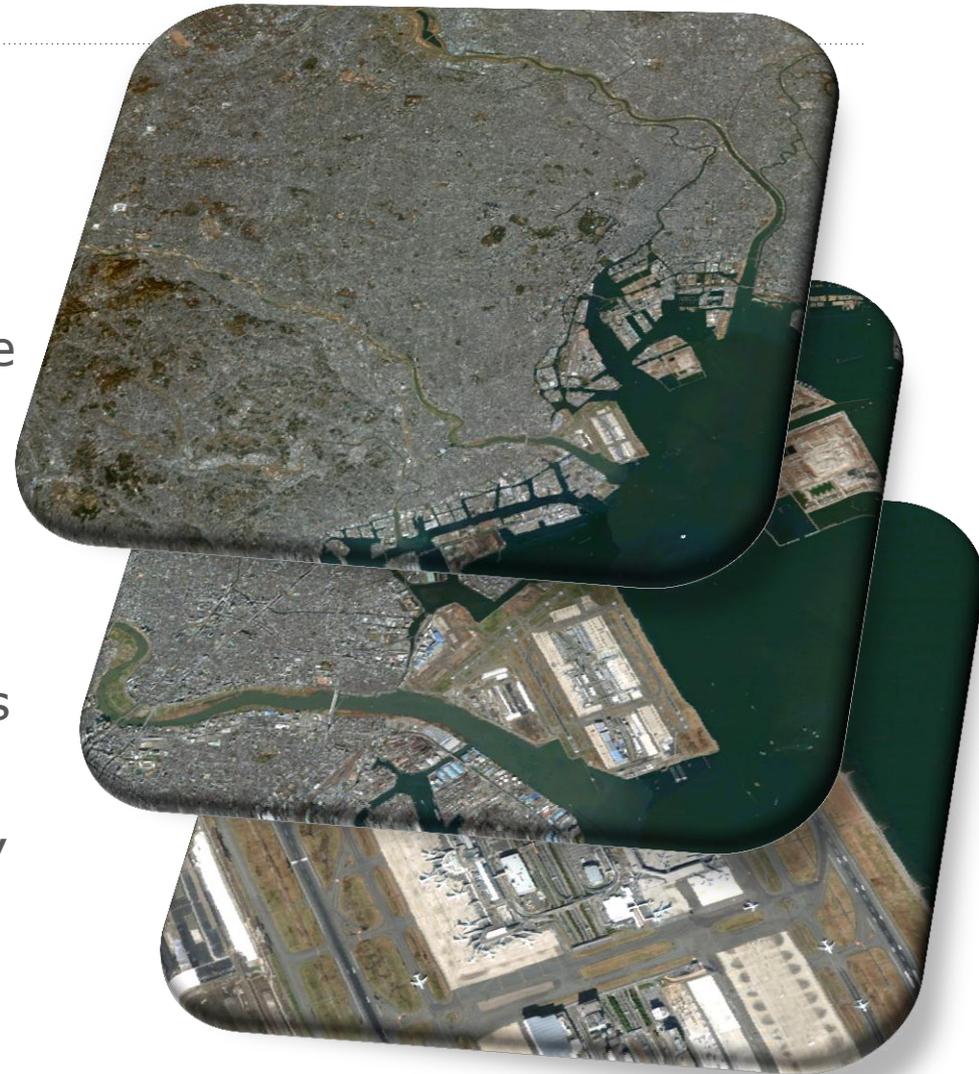
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DigitalGlobe Cloud Services



DG Global Basemap

- On-demand subscription based offering providing access to the industry's largest online image library
- Includes global imagery coverage sourced from various collection systems
- Committed update schedule leveraging the collection capabilities of the DigitalGlobe constellation and aerial platforms
- Imagery is fully processed and finished: orthorectified, accurate, mosaiced, and color balanced
- Delivered in OGC[®] compliant formats and specifications
 - Web Mapping Service (WMS)
 - Web Mapping Tile Service (WMTS)
 - Web Coverage Service (WCS)
 - Web Feature Service (WFS)





DigitalGlobe Monitoring

An eye on global events

DIGITALGLOBE

DigitalGlobe Monitoring - An Eye on Global Events



What it is

Online subscription services for monitoring urgent global situations and disasters delivered to almost any desktop or web-based mapping platform.

- **FirstLook**
- **Diplomatic Facilities Support Package**
- **FirstWatch Reports**
- **Analysis Center**

Who it's for

Government agencies and organizations interested in:

- **Timely coverage and responsiveness to regional and world events**
- **Broad area emergency planning, search, disaster and response**
- **Risk and damage assessment**
- **Diplomatic facility monitoring and threat planning**
- **Change detection and insight reports**

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Case Study:
Hitachi Solutions, Ltd.
Monitoring disasters saves lives

DIGITALGLOBE®

Monitoring disasters saves lives

During the 2011 Japan earthquake and tsunami, DigitalGlobe enabled Hitachi Solutions to:

- View imagery of the entire impact zone (48,000 km²) in a single day
- Distribute the most current imagery and analysis within hours of collection, to aid agencies, rescue teams and government entities
- Make better decisions based on access to more than 200,000 km² of imagery



HITACHI

Inspire the Next

Hitachi Solutions provides IT services throughout the IT life cycle, from systems planning to systems integration, operation and maintenance.

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DigitalGlobe Information/Insight

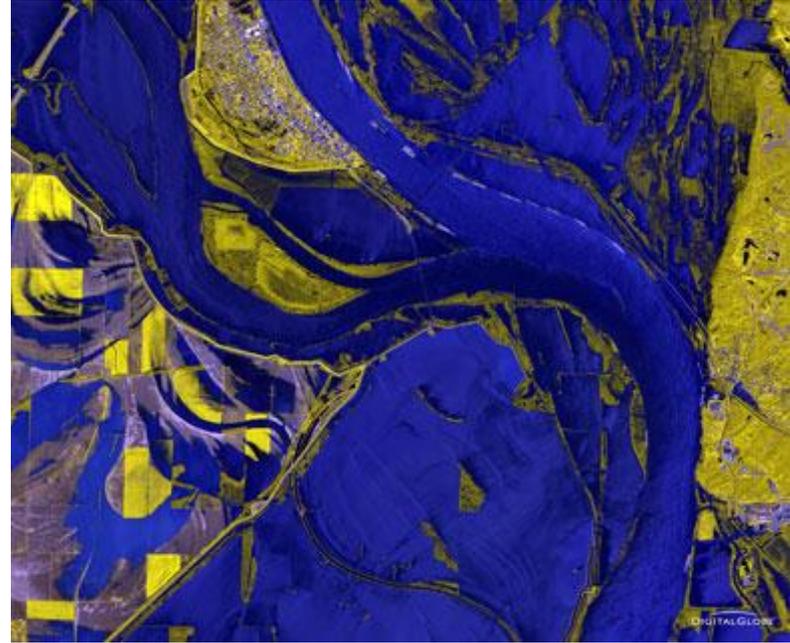
Analyzing the past to prepare for the future


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Analyzing the past to prepare for the future



Flooding in the Midwest (Cairo, Illinois)



This multispectral band combination illuminates the flooded areas. In this instance, the flooded areas are blue while the healthy vegetation is yellow.

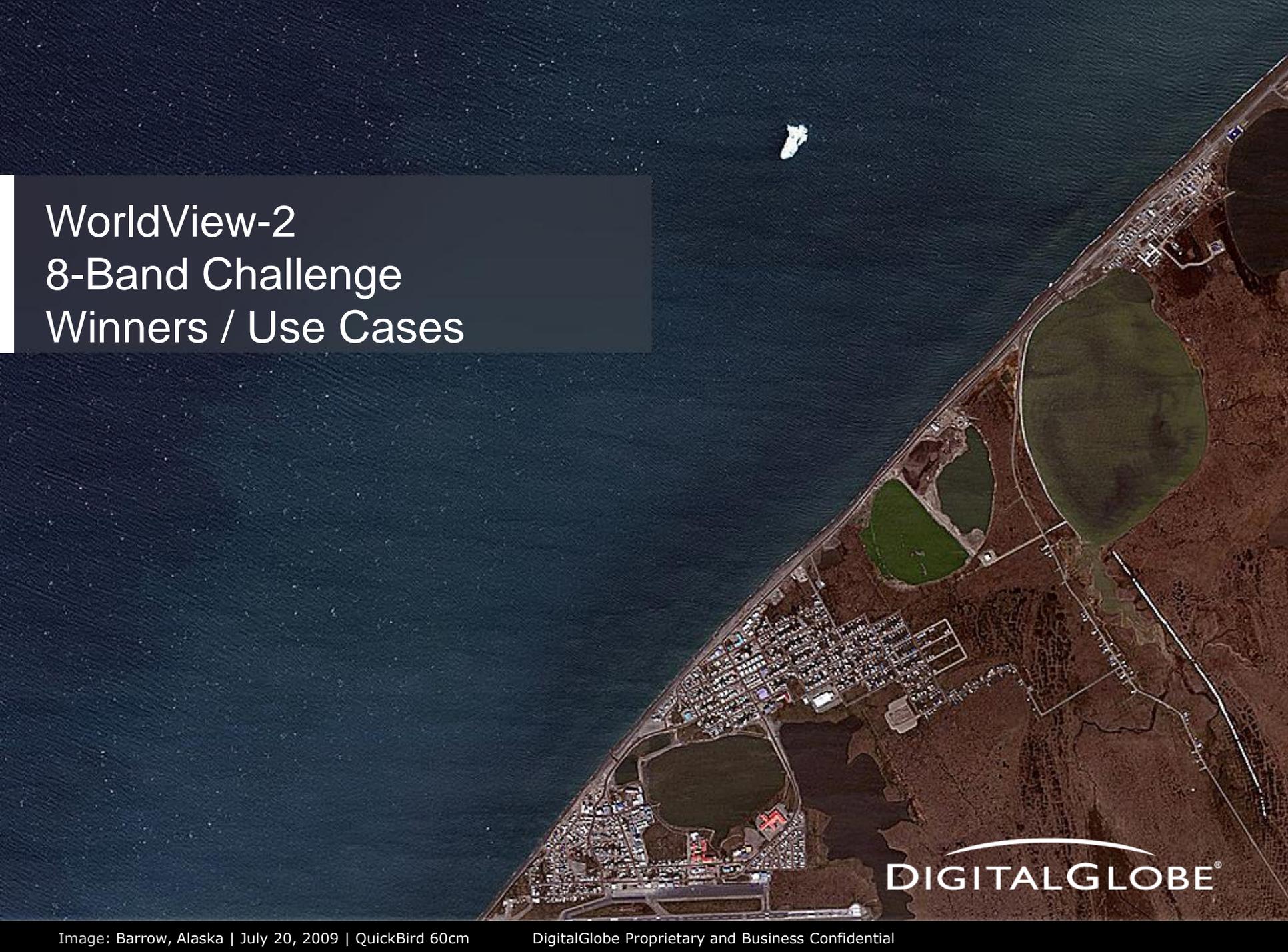
What it is

Analytical insights of global events and changes to support decision-making

- Custom Analysis
- Vegetative Analysis
- Change Detection
- Volumetrics

Who it's for

Government agencies and other organizations with the need to monitor and analyze long-term trends—defense, homeland security, economic, and environmental.

A satellite image of Barrow, Alaska, showing a coastal town with buildings, roads, and several large, irregularly shaped ponds or lakes. The terrain is brown and appears to be tundra. The town is situated along a dark blue body of water. A small white object is visible in the water in the upper left quadrant.

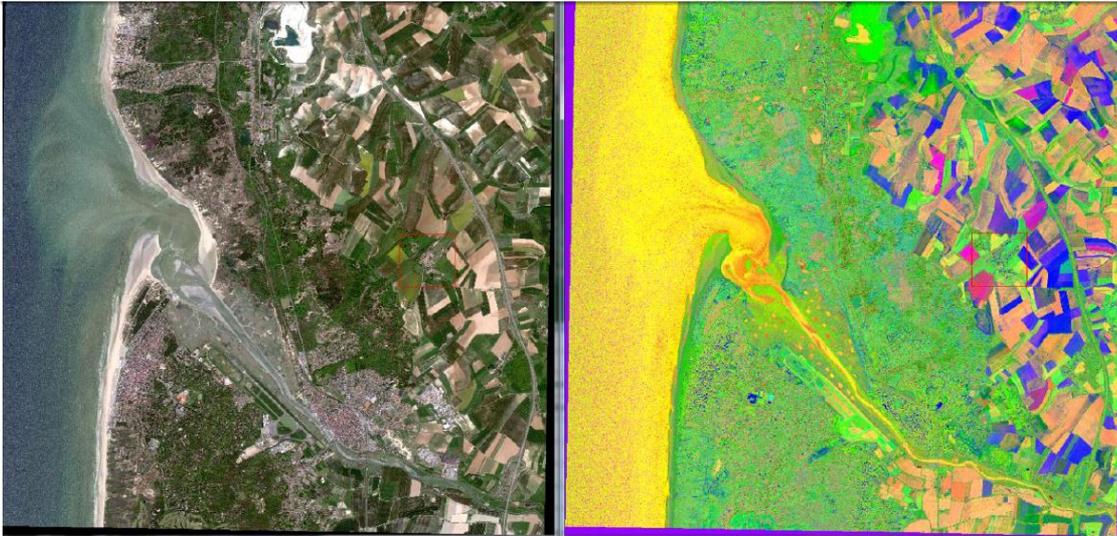
WorldView-2 8-Band Challenge Winners / Use Cases

DIGITALGLOBE®

Christoph C. Borel

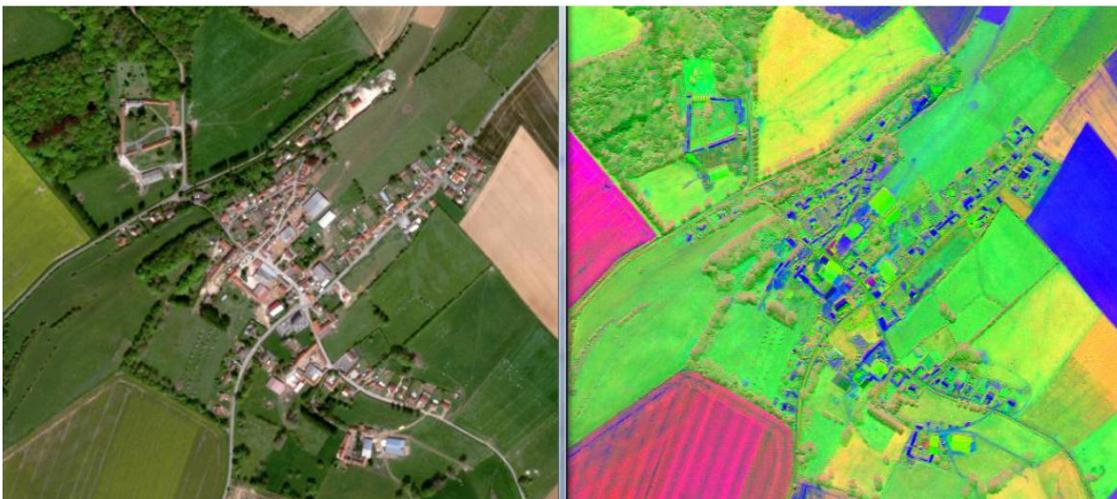
Vegetative Canopy Parameter Retrieval Using 8-Band Data

Modeling of plant nitrogen content, leaf water content, and canopy leaf area to estimate vegetation health, plant growth stage, mapping various diseases



Results:

- Regression analysis for the 8 WV-2 bands shows the **leaf area index can be determined with improved accuracy and is better than using 4 bands**
- Average leaf angle, chlorophyll content and brown pigment content can be determined with higher accuracy.
- Leaf mass, structure coefficient and carotenoid content have high uncertainty.
- Leaf water content and soil dryness are not retrievable

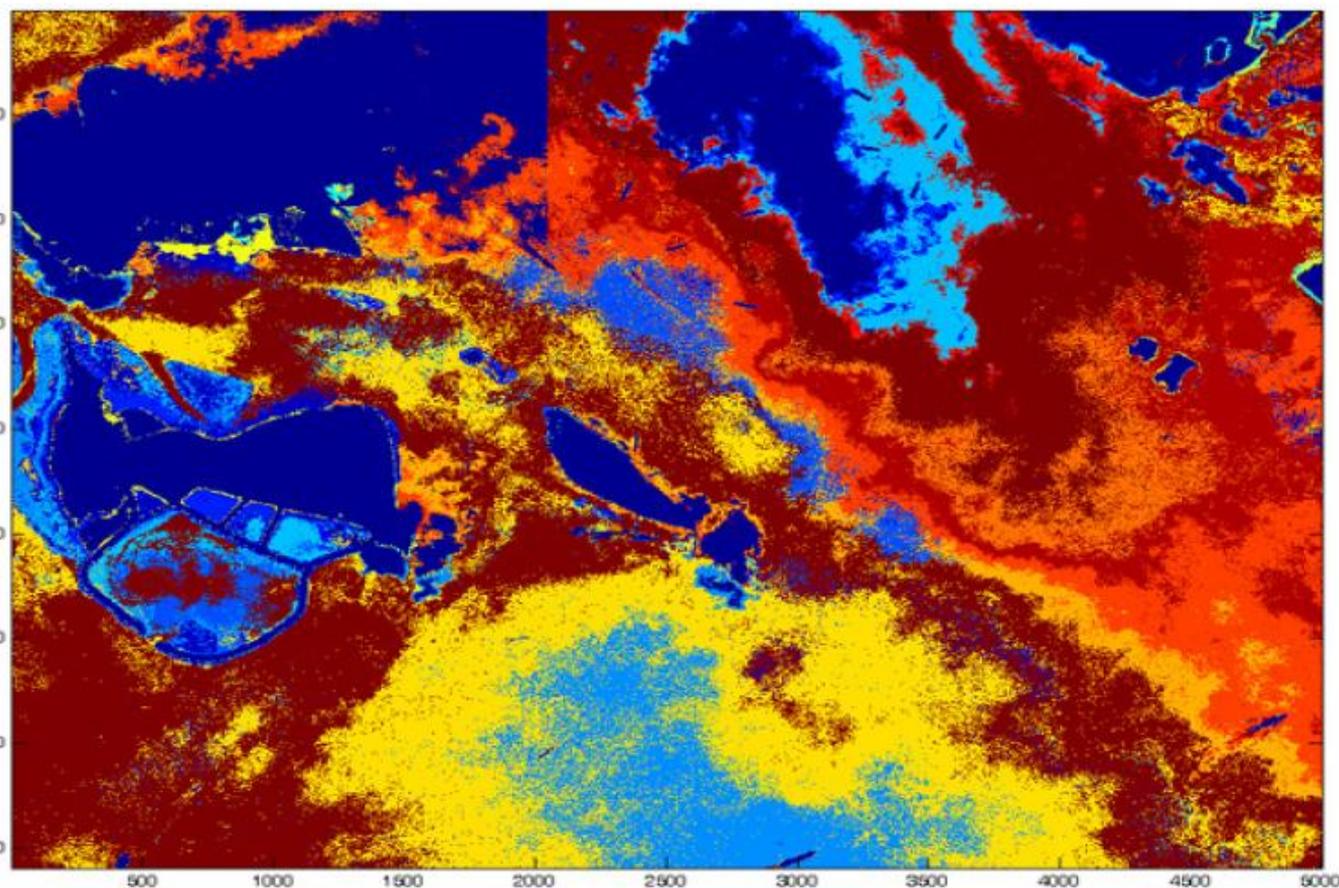


Pseudo color image the channel indices were:
Red=Leaf area index,
Green=Brown pigment,
Blue=Average leaf angle

James F. Bramante

Derivation of Bathymetry from Multispectral Imagery in the Highly Turbid Waters of Singapore's South Islands

Band-Classified Bathymetry



- Involved the use of WV2 data and 4 different Bathymetry Models
- Two of the four algorithms were simple look-up table classifications similar to that of Louchard et al. (2003).
- The remaining two algorithms are based on a one-dimensional simple solution to the radiative transfer model in ocean water as presented by Lyzenga (1978).
- Bathymetry training data for the algorithms and look-up tables was taken from an electronic nautical chart (ENC), provided by Singapore Marine and Port Authority (MPA).

Figure 6: Band Classification-derived bathymetry of the study area. Pixels reporting 0 depth have been masked out because of the presence of land, cloud, cloud-shadow, shipping vessels, or thick haze. As in Figure 7, some of the northwestern corner of the image has been over-masked. Note how in deep water (classified as about 2 m), water masses with high suspended sediment concentrations are classified as relatively shallow with sediment plumes visible stretching from the shipping vessels in the center of the study area to the southeast corner.

WorldView-2 Offers New Capabilities for the Monitoring of Threatened Coral Reefs

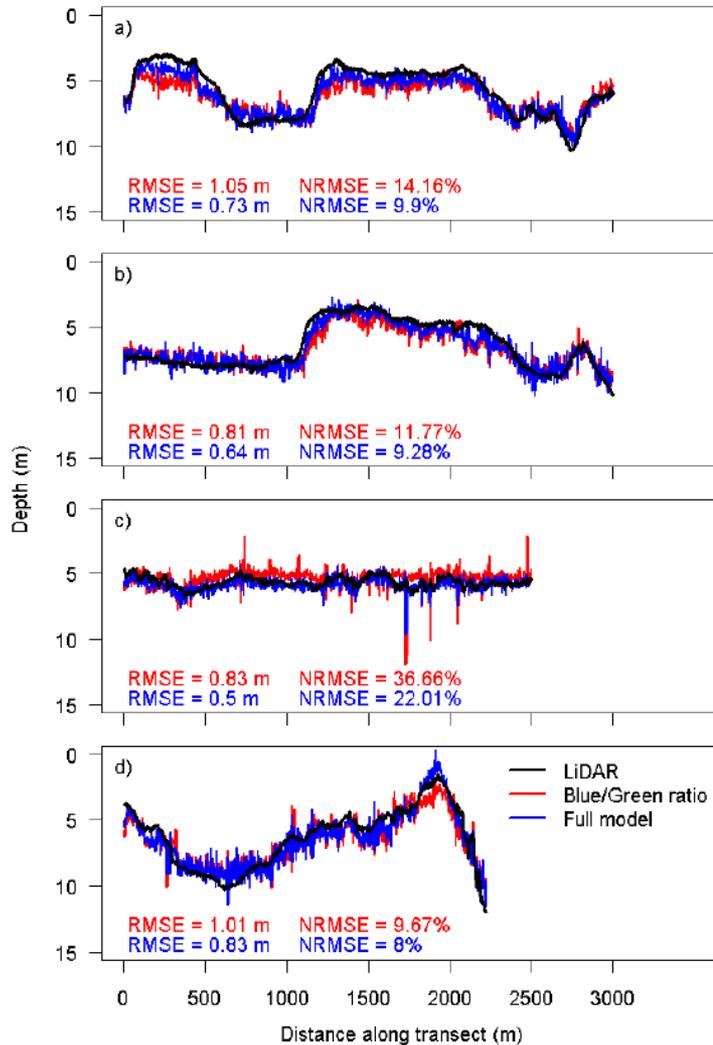


Figure 5: LiDAR depth (black line) with depth estimated by the blue/green band ratio (red) and the best-fit model (blue) along a) Transect A, b) Transect B, c) Transect C, and d) Transect D. The full-model better estimated depths for shallow reef areas (e.g., reef crests) and sand than the blue/green band-ratio, and it had a lower root-mean-squared error (RMSE) and normalized RMSE (NRMSE) indicating an improvement in depth estimation.

- Use of Worldview-2 8-band MS imagery to improve optically-derived bathymetric maps
- WV2 imagery bridges gaps in coral reef mapping and conservation previously addressed by more traditional 4-band sensors, such as QuickBird, thus positioning the satellite as a vital tool in the near-term and long-term conservation of these threatened ecosystems
- Models were used to estimate depth by creating band-ratios for the different band combinations enabled by the six WV2 bands in the visible spectrum
- This study affirmed that deglinting and atmospheric correction methods should be applied to WV2 imagery prior to the development of bathymetric maps in order to increase the accuracy of the final products

Hamdan Omar

Commercial Timber Tree Species Identification Using Multispectral WorldView-2 Data

Table 3 Confusion Matrix

Class	<i>Dyera costulata</i>	<i>Sindora</i> spp.	<i>Shorea kunstleri</i>	<i>Shorea leprosula</i>	<i>Neobalanocarpus heimii</i>	<i>Anisoptera scaphula</i>	<i>Dipterocarpus baudii</i>	<i>Dipterocarpus baudii</i>	<i>Dryobalanops aromatica</i>	<i>Palaquium rostratum</i>	Total
<i>Dyera costulata</i>	79.17	0	0	0	0	0	15	15	0	0	7.61
<i>Sindora</i> spp.	8.33	100	0	0	0	0	10	10	4.17	0	5.19
<i>Shorea kunstleri</i>	0	0	100	0	0	0	0	0	0	0	10.03
<i>Shorea leprosula</i>	0	0	0	96.97	0	0	0	0	4.17	0	11.42
<i>Neobalanocarpus heimii</i>	0	0	0	0	100	0	0	0	0	0	26.64
<i>Anisoptera scaphula</i>	0	0	0	0	0	100	0	0	0	0	10.73
<i>Dipterocarpus baudii</i>	12.5	0	0	3.03	0	0	25	25	0	14.63	5.19
<i>Intsia palembanica</i>	0	0	0	0	4.77	0	0	96.85	0	0	6.02
<i>Dryobalanops aromatica</i>	0	0	0	0	0	0	0	0	91.67	0	7.61
<i>Palaquium rostratum</i>	0	0	0	0	0	0	50	50	0	85.37	15.57
Total	100	100	100	100	100	100	100	100	100	100	100

Table 4 Classification Accuracy

Class	Percent (%)			
	Commission	Omission	Producer Accuracy	User Accuracy
<i>Dyera costulata</i>	13.64	20.83	79.17	86.36
<i>Sindora</i> spp.	0	0	100	100
<i>Shorea kunstleri</i>	22.22	14.63	85.37	77.78
<i>Shorea leprosula</i>	0	8.33	91.67	100
<i>Neobalanocarpus heimii</i>	0	0	100	100
<i>Anisoptera scaphula</i>	66.67	75	25	33.33
<i>Dipterocarpus baudii</i>	33.33	0	100	66.67
<i>Intsia palembanica</i>	3.15	3.15	96.85	96.85
<i>Dryobalanops aromatica</i>	0	0	100	100
<i>Palaquium rostratum</i>	3.03	3.03	96.97	96.97

Overall Accuracy : 89.97%

Kappa Coefficient : 0.88

- This research indicates that WorldView-2 multispectral is capable to delineate common timber species.

- Conversion to Top-of-Atmosphere Reflectance

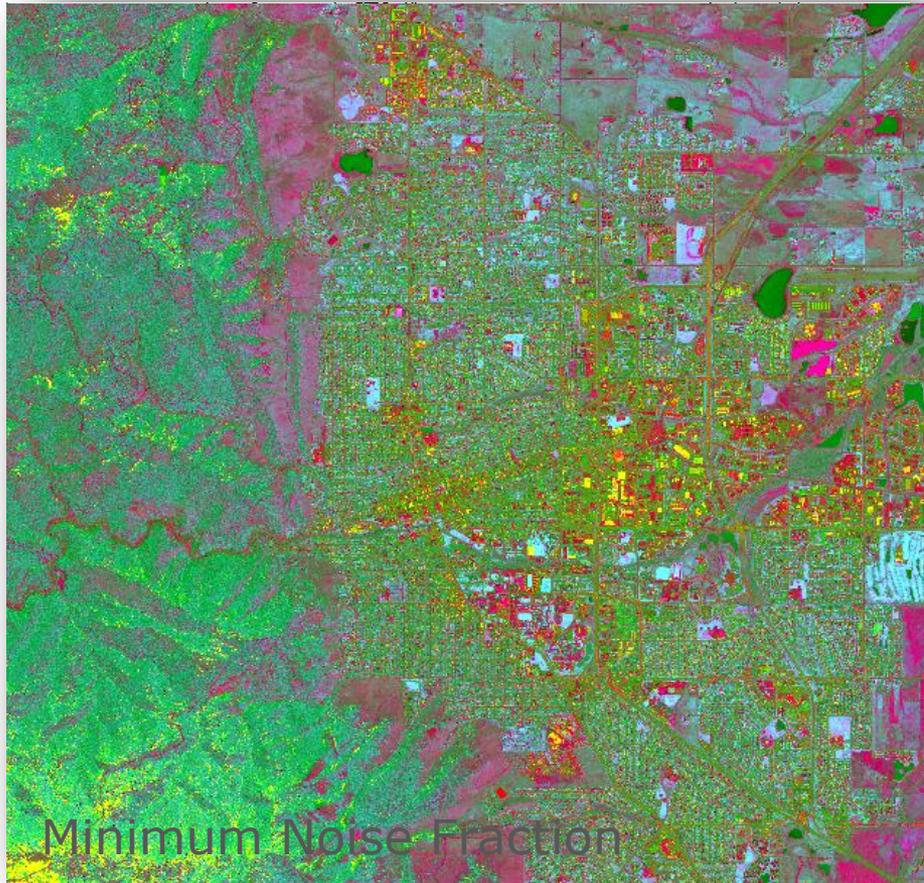
- Classification using Random Forest Algorithm

- Validated results using ground truth

- Object Oriented Technology applied on pan image for tree counting

Antonio Wolf

Using WorldView-2 Vis-NIR MSI Imagery to Support Land Mapping and Feature Extraction Using Normalized Difference Index Ratios



- Utilizing the unique bands of WorldView 2 offers a contextual foundation for land mapping and scene characterization unlike any other commercial MSI sensor
- The unique bands increase the spectral resolution of MSI, and foster new means of using traditional land mapping methods
- This analysis proves that new means of determining land-use, and many other applications of MSI, merged with other types of processing, could grow the commercial user base (something for everyone)
- Very little pre-processing is necessary in order to perform advanced analysis techniques

8 Band Challenge Winners (Posters)

- **Dragos Bratanu** – Romanian Space Agency
Bridging the Gap Between Research and Operations - A World View of the Environment
- **François Cavayas** – Montreal University
*Urban **Vegetation Cover Inventory** Update and Monitoring from Space using WorldView-2 Imagery: the Case of the Montreal Metropolitan Community Territory*
- **Qi Chen** – University of Hawai`i at Mānoa
*Comparison of WorldView-2 and IKONOS-2 imagery for **identifying tree species** in the habitat of an endangered bird species in Hawaii*
- **Wisdom M. Dlamini** – Swaziland National Trust Commission
***Multispectral discrimination of invasive alien plants** using probabilistic graphical models and very high resolution 8-band satellite imagery -*
- **Batsi Gwata** – ComputaMaps
***Developing High Resolution Clutter for Wireless Network Propagation** using WorldView-2 Imagery*
- **Anil Kumar** – Indian Institute of Remote Sensing (National Remote Sensing Centre/Indian Space Research Organisation)
*Effect on **specific crop mapping using WorldView-2 Multi-Spectral add-on bands** - A Soft classification approach*
- **Luis A. Ruiz** – GeoEnvironmental Cartography and Remote Sensing Research Group (CGAT), Universidad Politécnica de Valencia
*A Multi-Approach and Object-Oriented Strategy for **Updating LULC Geo-Databases** Based on WorldView-2 Imagery -*
- **Claudio Silva** – Universidad de Cádiz
***Environmental monitoring and mapping in a tidal salt marsh creek** affected by fish aquaculture using WorldView-2 multispectral imagery -*
- **Harini Sridharan** – The University of Texas at Dallas
***Multi-Level Urban Forest Classification** Using the WorldView-2 8-Band Hyperspatial Imagery -*

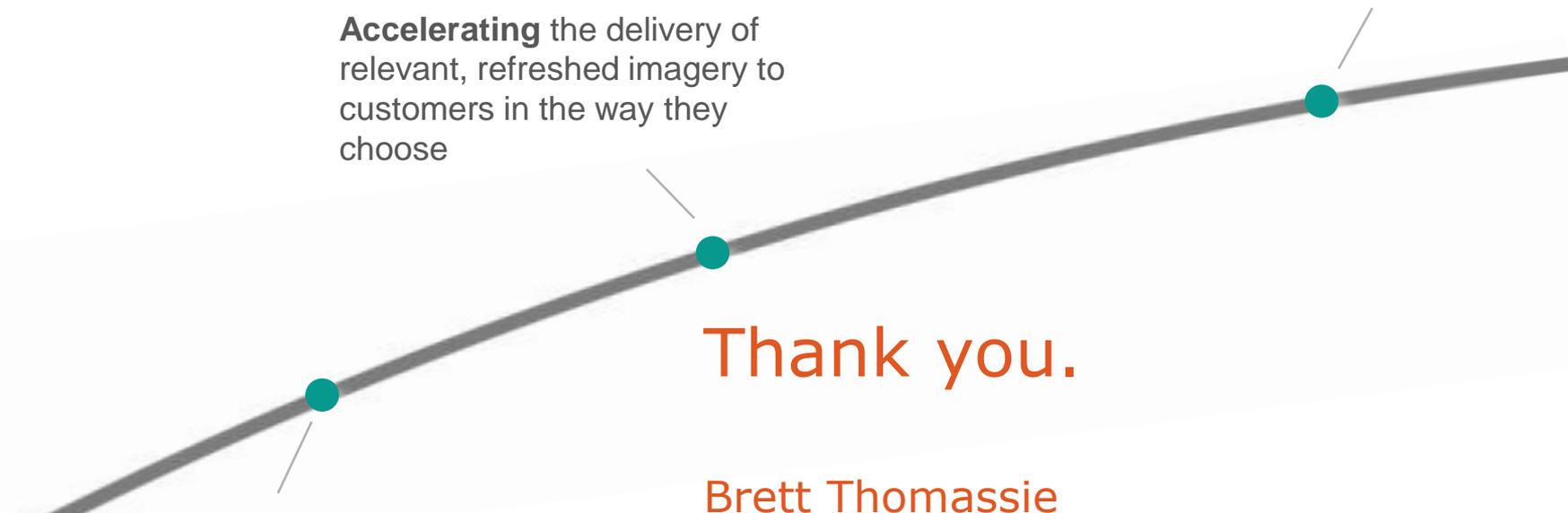


What's next?

Visualizing a better world


DIGITALGLOBE®

DigitalGlobe - Visualizing a Better World



Accelerating the delivery of relevant, refreshed imagery to customers in the way they choose

Pioneering new, faster, higher-value analytics capabilities to expand the Industry and drive new growth

Launching new solutions to help customers solve their large-scale challenges faster

Thank you.

Brett Thomassie
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