



**Big Data challenge & Opportunity**  
Alain Kabamba , Hexagon Geospatial

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United Nation - GGIM

20 – 22 April 2016, Addis Abeba, Ethiopia







**A dynamic Earth of constant change**

# Hexagon - Information technologies

## SENSORS



Fuelled by information,  
Hexagon's information  
technologies are a driving  
force behind many of the  
transformative solutions  
shaping our future

## SOFTWARE





# Global satellite observation system



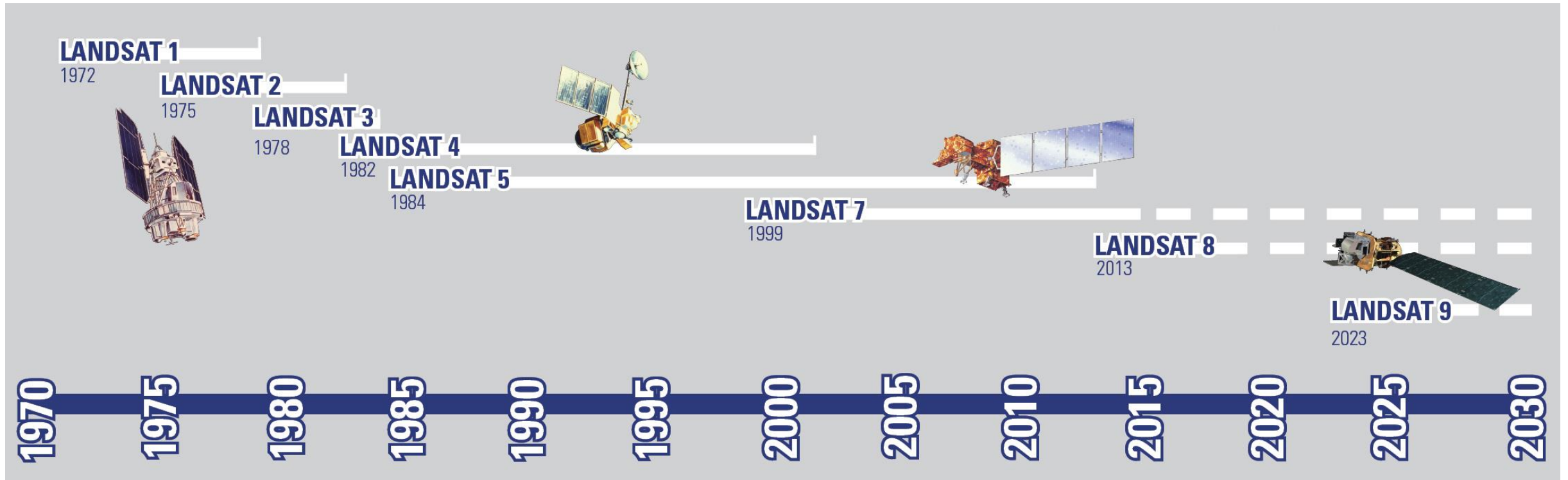
41 MILLION KM<sup>2</sup>

37 DAYS

100 BILLION KM<sup>2</sup>



# Landsat





# EU Sentinel Program

## COPERNICUS AND ITS 5 SENTINELS

Observing our planet for a safer world. The European Earth Observation Programme Copernicus provides geo-information products and services based on satellite imagery.

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Known as **GMES** until 2012: Global Monitoring for Environment and Security
- 

**30** Public and Private missions are also contributing data
- 

**16 years** of development and testing
- 

**Five Sentinel-Missions** at the heart of the space component
- 

**Civil Security.** Allowing early warning and crisis prevention in conflict and disaster areas
- 

**Emergency Management.** Accurate and timely data for emergency plans and rescue for disaster management
- 

**Land Surface Monitoring.** Geographical information on land cover, related variables and urban development
- 

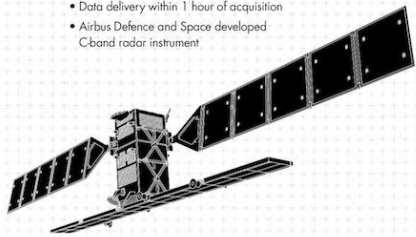
**Marine Environmental Monitoring.** Observations and forecasts on the state of the physical oceans and regional seas
- 

**Climate Change Monitoring.** Helps to understand the reason for climate change, rising sea levels and melting ice caps
- 

**Earth Atmosphere Monitoring.** Daily information on the global atmospheric composition and when Sentinel-4 is in service this will be hourly

### SENTINEL-1A/1B

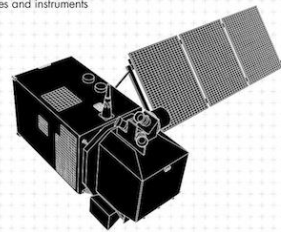
-  **All-weather, day-and-night radar imaging satellite for land and ocean services**
- Able to "see" through clouds and rain
- Data delivery within 1 hour of acquisition
- Airbus Defence and Space developed C-band radar instrument



2014: Sentinel-1A  
2015: Sentinel-1B

### SENTINEL-2A/2B

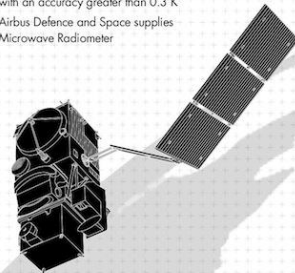
-  **Medium Res Multispectral optical satellite for observation of land, vegetation and water**
- 13 spectral bands with 10, 20 or 60 m resolution and 290 km swath width
- Global coverage of the Earth's land surface every 5 days
- Airbus Defence and Space prime contractor for satellites and instruments



2014: Sentinel-2A  
2015: Sentinel-2B

### SENTINEL-3A/3B

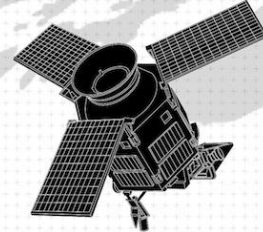
-  **Measures sea-surface topography with a resolution of 300 m, sea and land surface temperature and colour with a resolution of 1 km**
- Measures water vapour, cloud water content and thermal radiation emitted by the Earth
- Determines global sea surface temperatures with an accuracy greater than 0.3 K
- Airbus Defence and Space supplies Microwave Radiometer



2014: Sentinel-3A  
2015: Sentinel-3B


### SENTINEL-5P

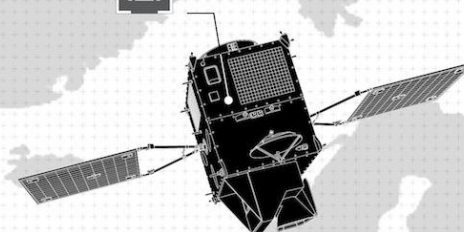
-  **Global observation of key atmospheric constituents, including ozone, nitrogen dioxide, sulphur dioxide and other environmental pollutants**
- Improves climate models and weather forecasts
- Provides data continuously during five-year gap between the retirement of Envisat and the launch of Sentinel-5
- Airbus Defence and Space prime contractor for satellite and TROPOMI instrument



2015: Sentinel-5P


### SENTINEL-4

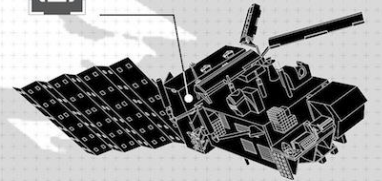
-  **Provides hourly updates on air quality with data on atmospheric aerosol and traces gas concentrations**
- Spatial sampling is 8 km and spectral resolution between 0.12 nm and 0.5 nm
- Airbus Defence and Space prime contractor for spectrometer
- Carried aboard EUMETSAT's Meteosat Third Generation (MTG) satellites



2020: Sentinel-4 with Meteosat-TG

### SENTINEL-5

-  **Measures air quality and solar radiation, monitors stratospheric ozone and the climate**
- Global coverage of Earth's atmosphere with an unprecedented spatial resolution
- Airbus Defence and Space prime contractor for instrument
- Carried aboard EUMETSAT's MetOp Second Generation satellites



2020: Sentinel-5 with MetOp-5G



# Airborne, Land & drones Sensors



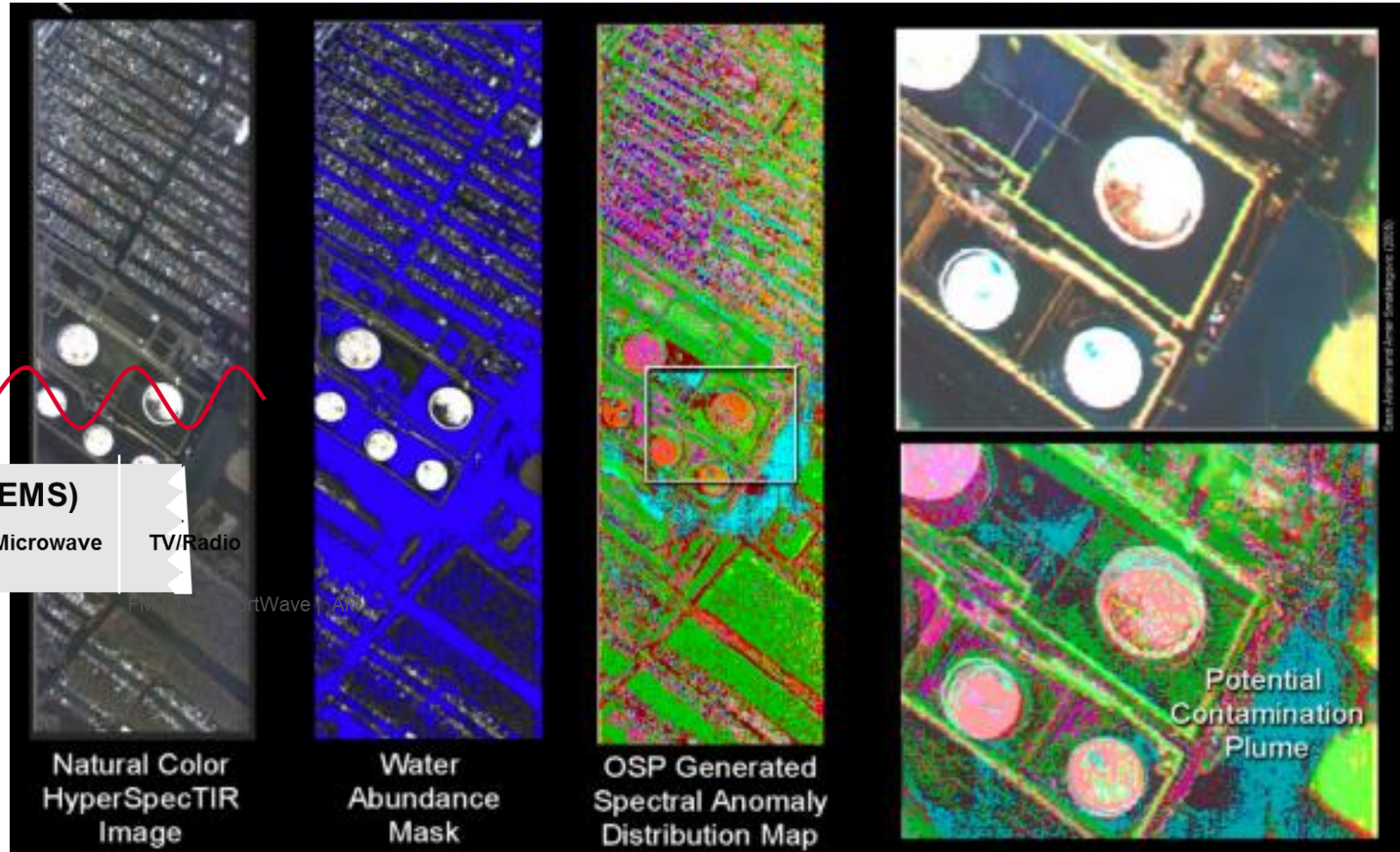
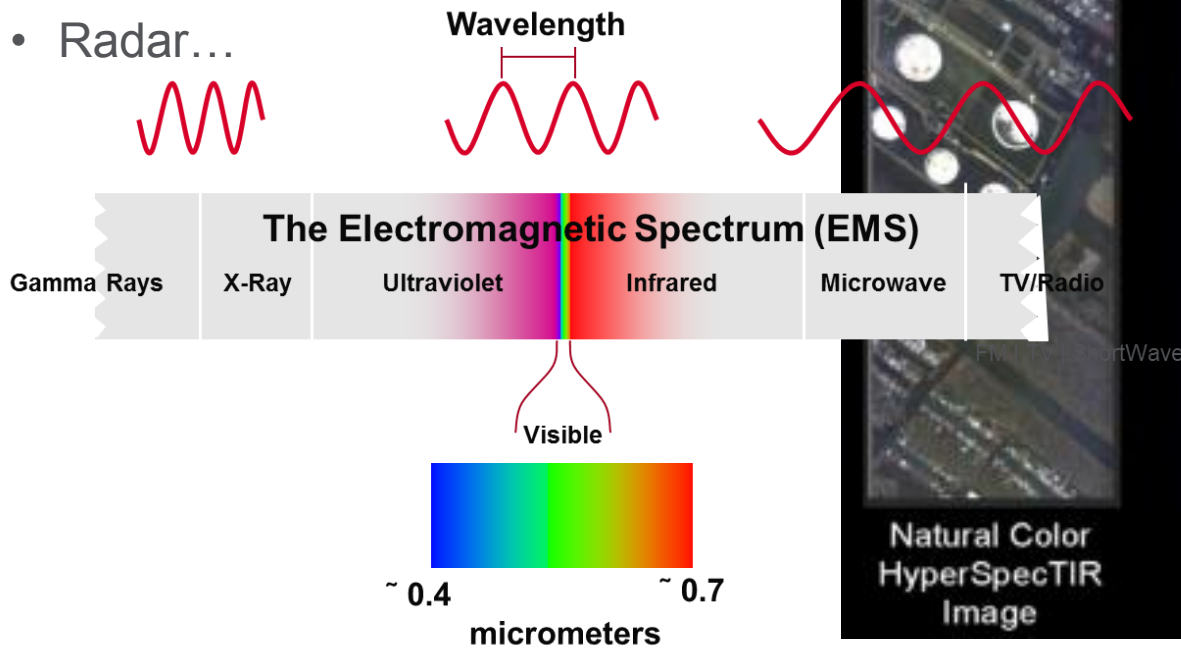
- when it has to be right





## More Information...

- Greater Resolution
- Greater Coverage
- Greater Frequency
- Hyperspectral, Point Cloud, Oblique
- Radar...

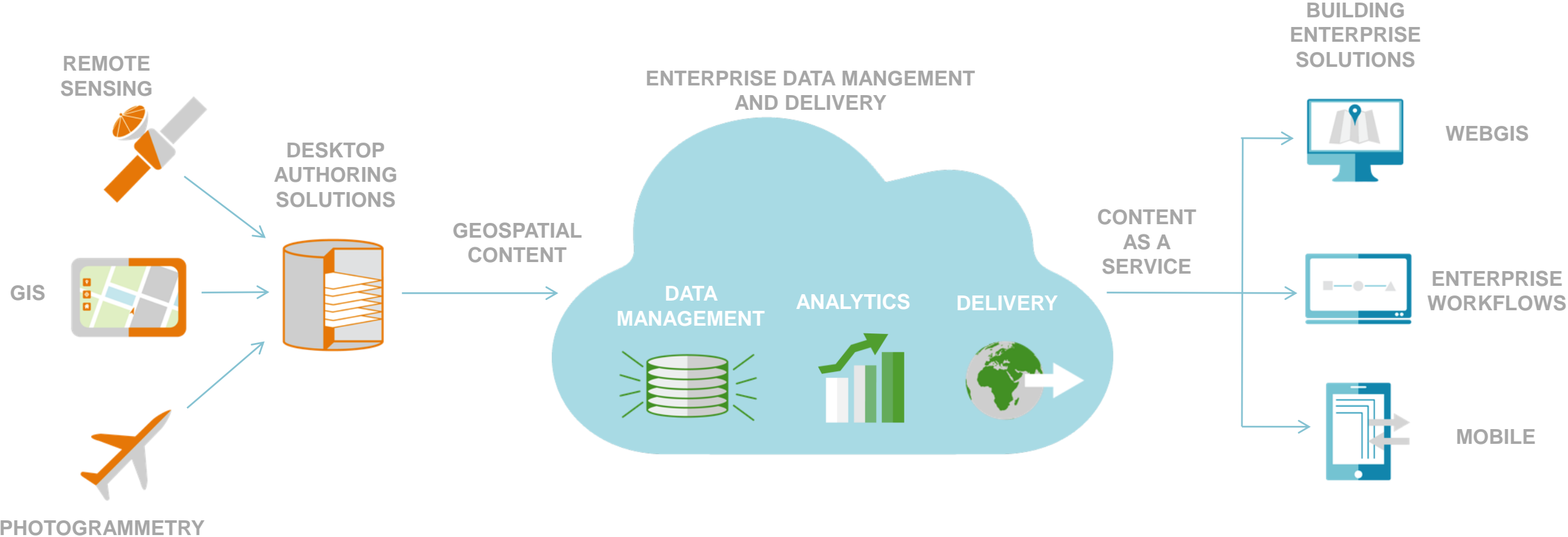








# Hexagon Geospatial Power Portfolio





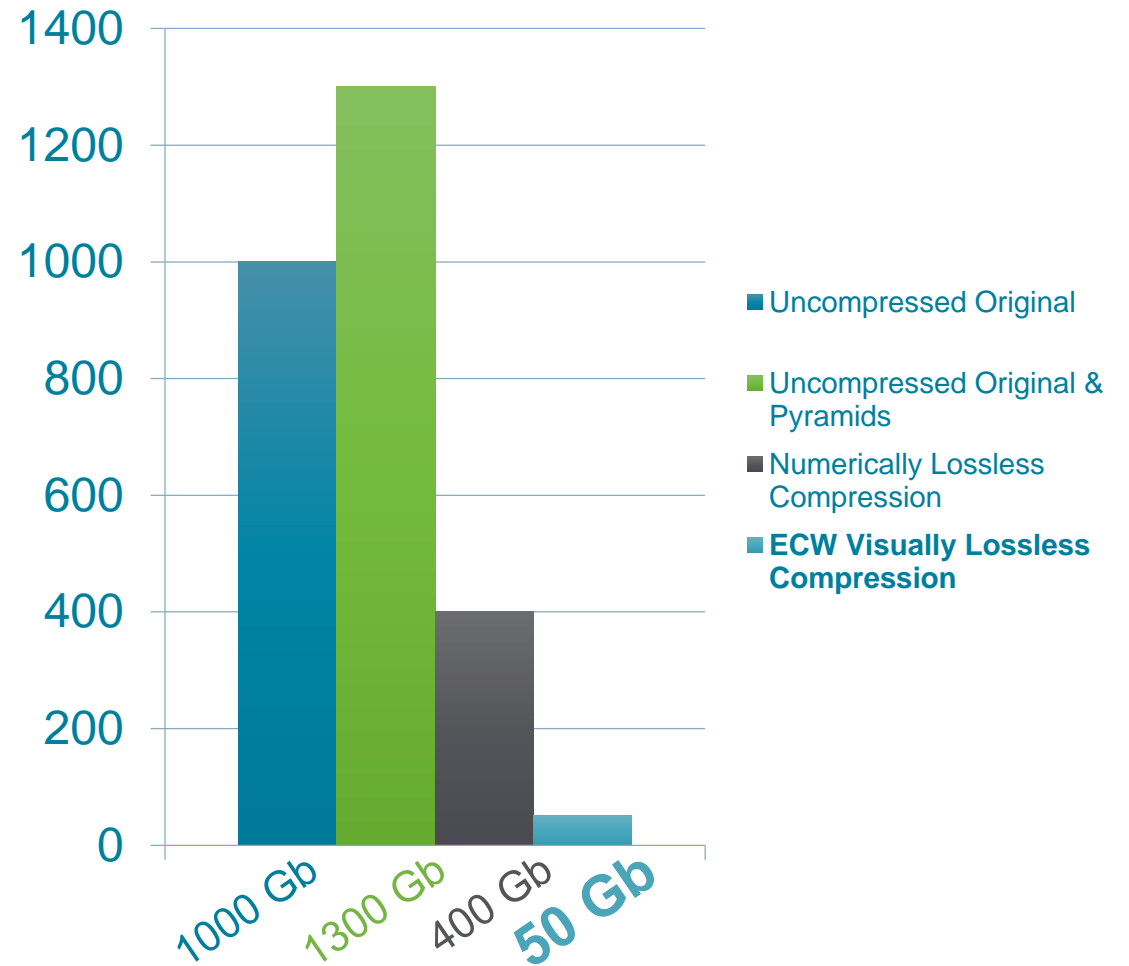
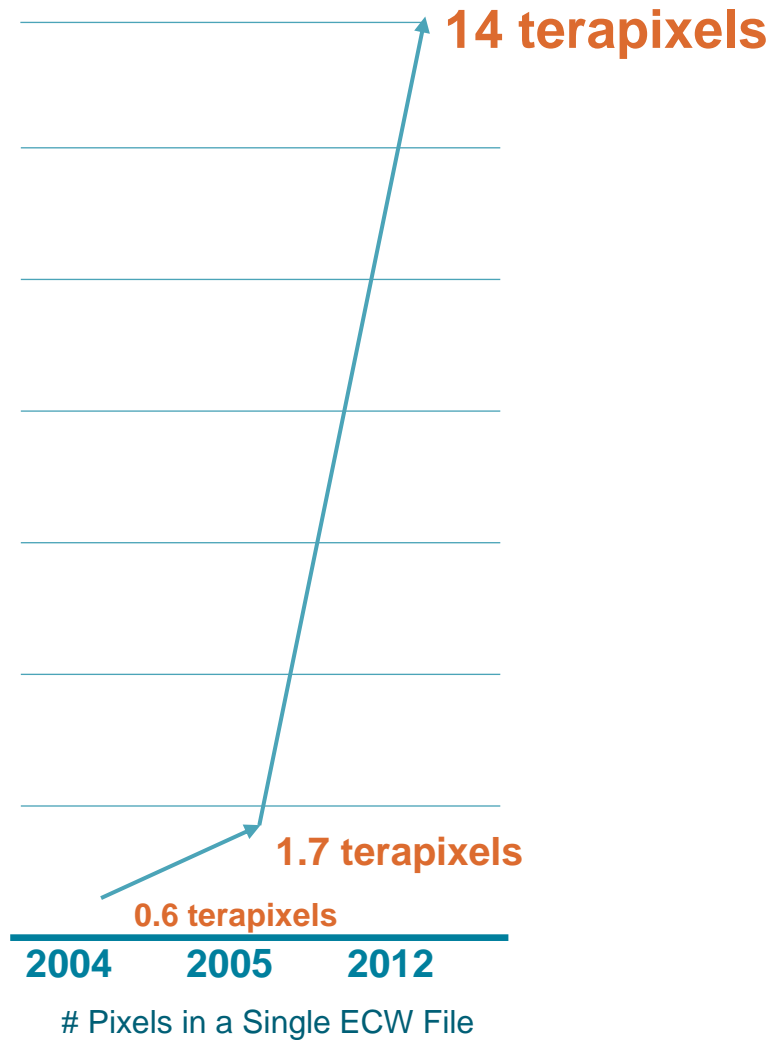
A large, white, stylized quotation mark icon consisting of two facing chevrons.

**“The most common purpose of Big Data is to produce Small Data”**

— *Principles of Big Data* - Jules J. Berman



# Big Data Made Small : ECW Compression





## Large, But Manageable Data

### The World's Largest Geospatial Image

A single aerial image covering Germany @  
20cm GSD

3,210,000 px by 4,340,000px

Big Data Made Small

38,000gb Uncompressed

50,000gb with image pyramids

**875gb** ECW Compressed

370,000 source files

1 ECW file





Workspace

Map Layers

- Germany\_v2\_64\_20\_G\_Temp

Properties

Property	Value
DataSource	F:/Germany_v2_64_20_G...
Description	Germany_v2_64_20_G_Te...
Comments	
MinScale	0.00
MaxScale	2,147,483,647.00
Format	ERDAS ECW
CoordSysName	Unknown
Transparency	1.00
CellSizeX	0.20
CellSizeY	-0.20
NumberOfBands	3
Size	322,000 x 434,000
CellType	UInt8
SizeOnDisk	875.52 GB
SizeGigaPixel	13931.40 GP
ECWVersion	0
FileFormatVersion	2
Contrast	1.00
Brightness	1.00
FreeCache	<input checked="" type="checkbox"/> True
PostmapSmoothing	<input type="checkbox"/> False
Progressive	<input checked="" type="checkbox"/> True
AdaptiveRoam	<input checked="" type="checkbox"/> True
ReadRGBA	<input checked="" type="checkbox"/> True
TransformClip	100
HasOpacity	<input type="checkbox"/> False
OpacityBandNumber	-1
DrawOutline	<input type="checkbox"/> False
OutlineColor	[0, 255, 255] (255)



ECW JPEG 2000 Properties

Transparency: 0 %

Contrast: 100 %

Brightness: 100 %

Dynamic Range Adjustment: 100 %

Bands:

- Red: Red
- Green: Green
- Blue: Blue
- Opacity: None

Display:

- Use progressive rendering
- Use adaptive pan/zoom
- Draw image outline Color

Resample Method: Nearest Neighbour

Advanced:

- Flush memory cache when closing images

Read Line Method:

- ReadLineRGBA
- ReadLineBIL





File Home Manage Data Raster Vector Terrain Toolbox Help Debug Review Process

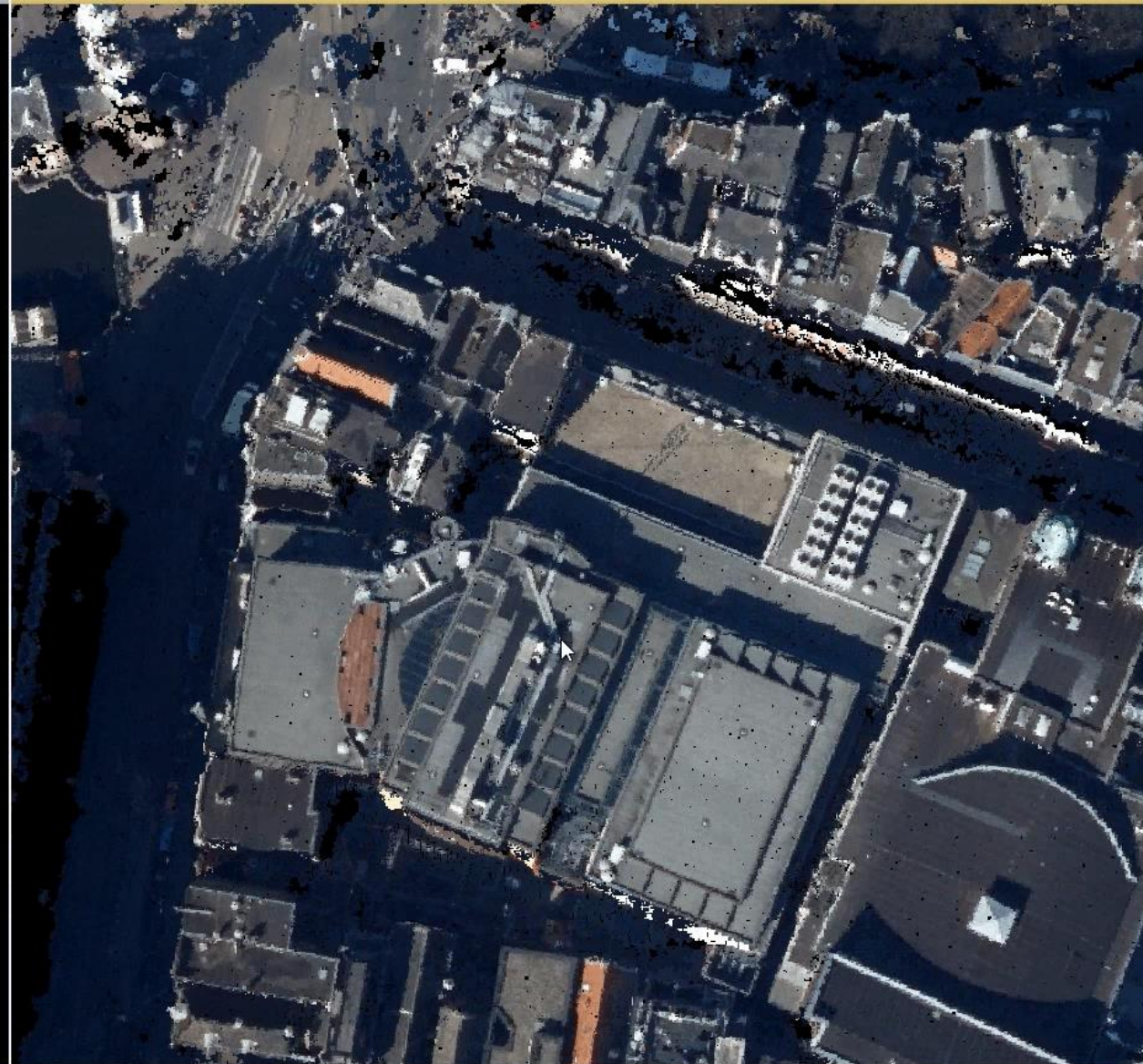
Contents Metadata Select Inquire Measure Copy Paste Fit to Frame Reset 12.5% Previous Extent Add Views Link Views Equalize Scales Align North Swipe Clear View Basemap

Information Edit Extent Window View Scale and Angle Room

Phoenix Viewer #1

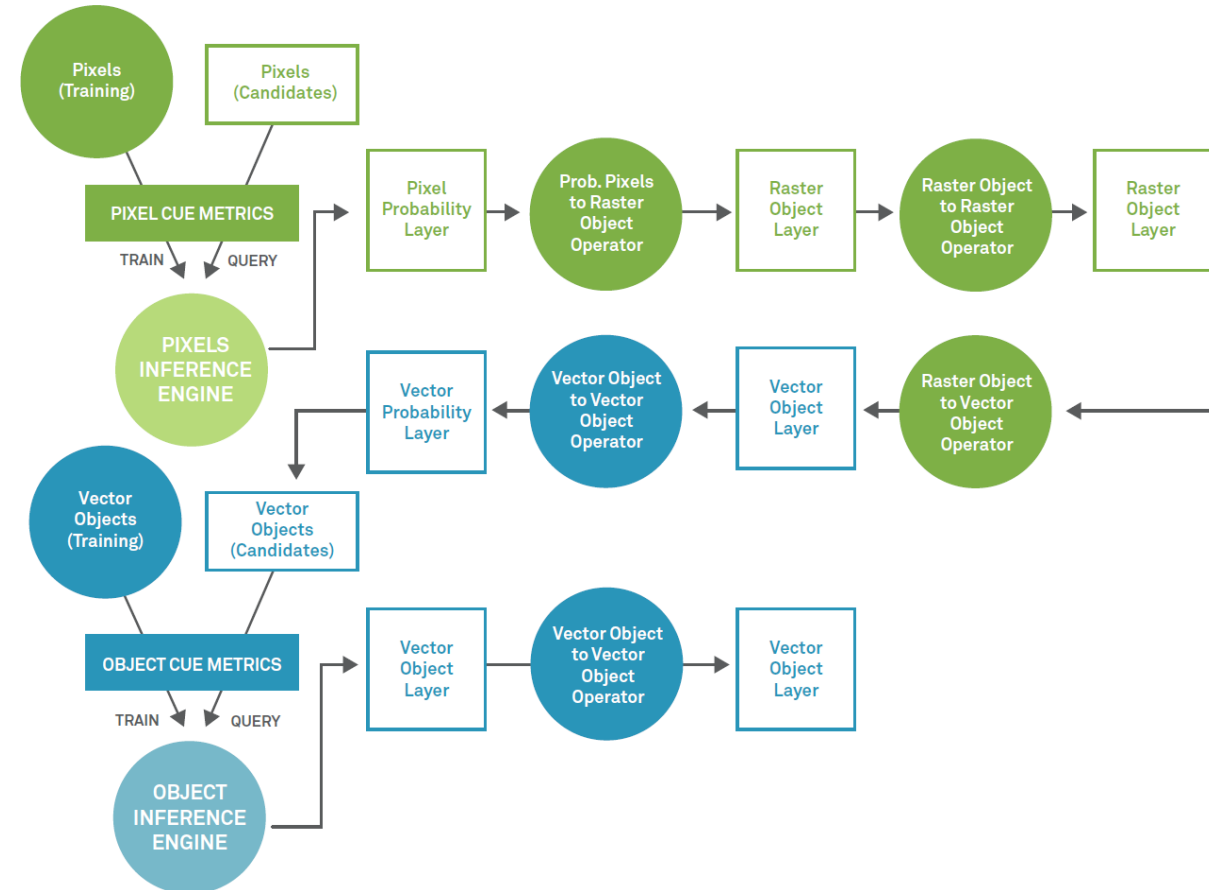
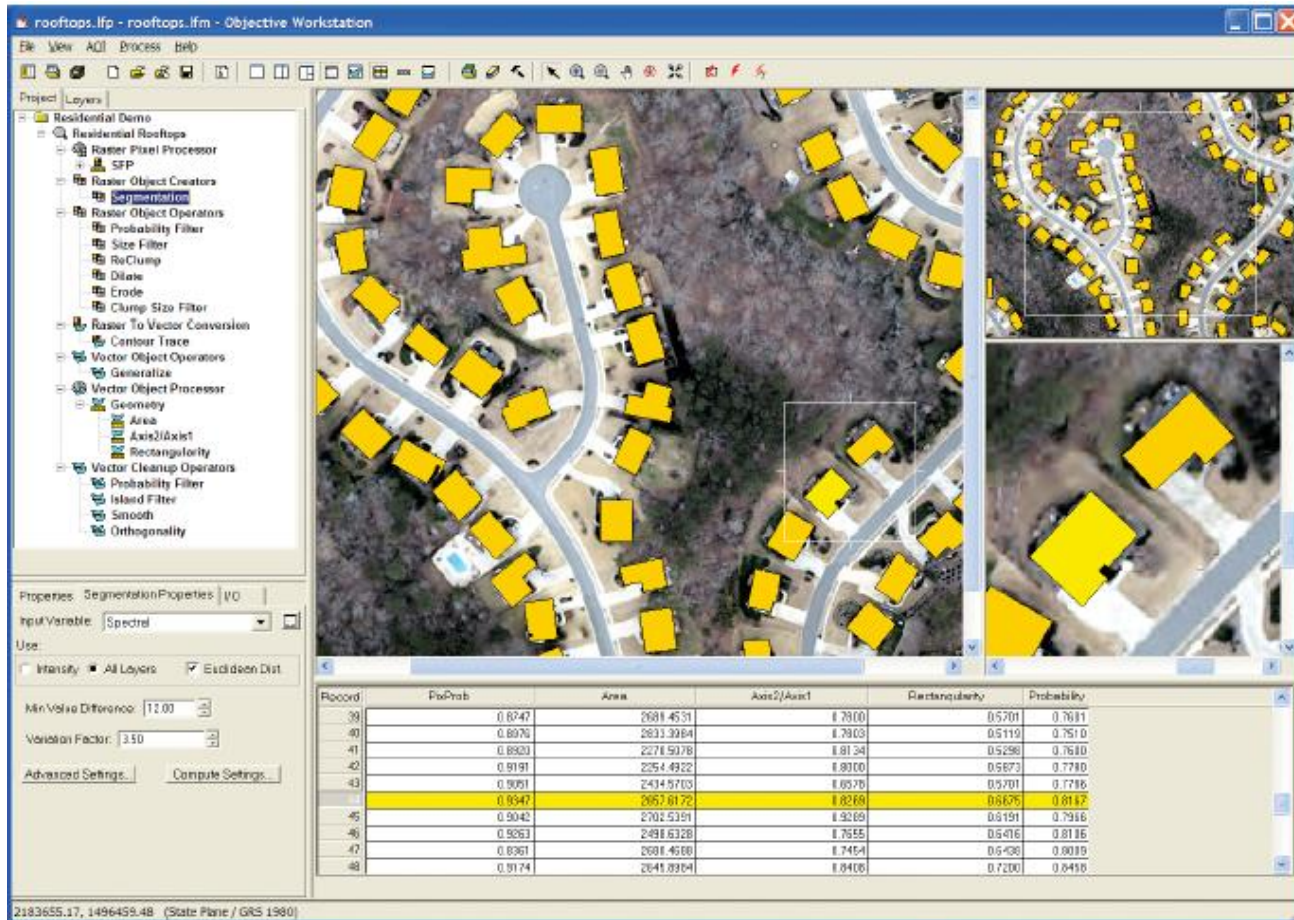


Phoenix Viewer #2





# Automatic feature extraction remote sensed data

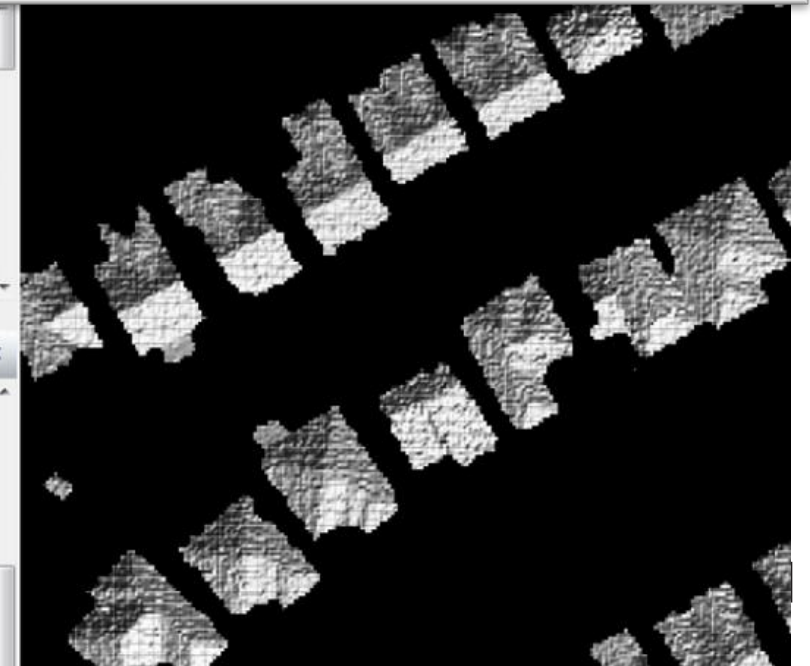
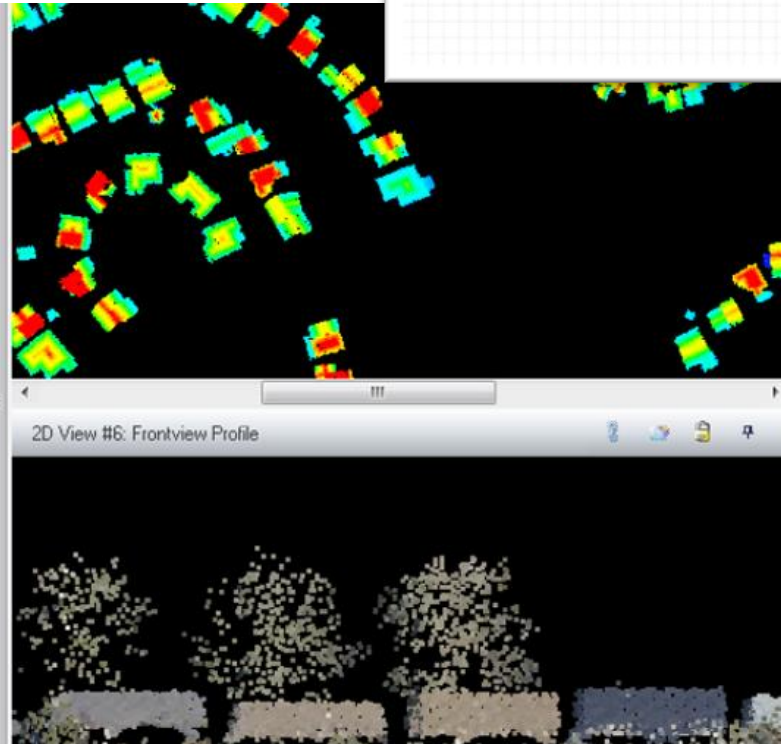
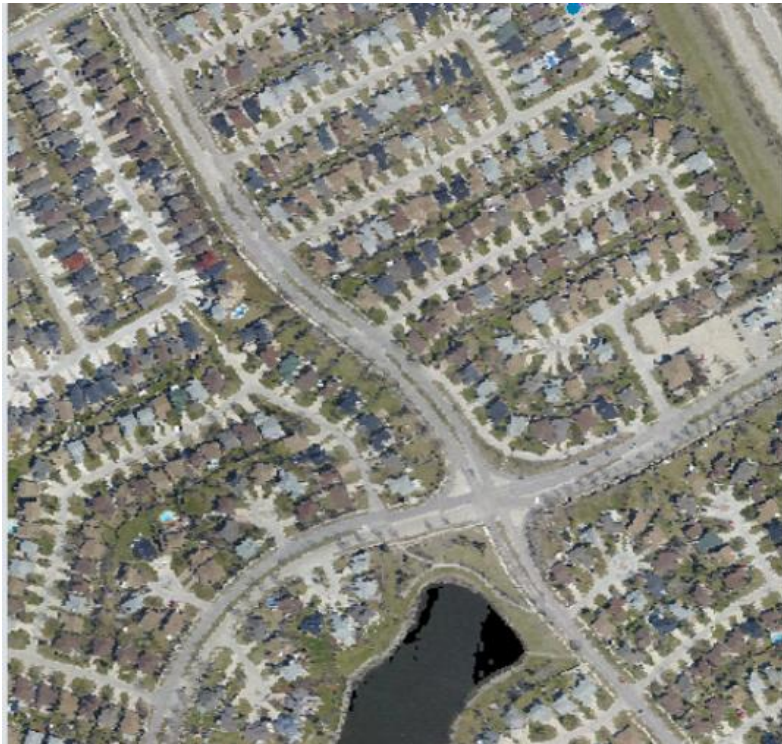
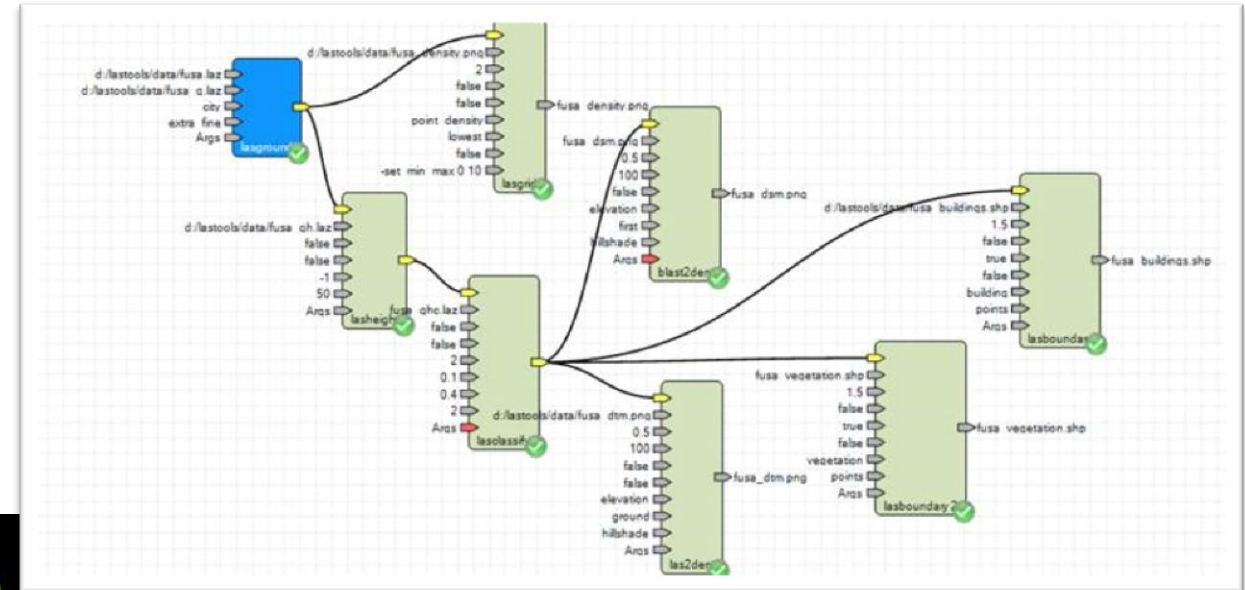




# Feature extraction based on Point cloud

## LAStools in Spatial Modeler

- LAStools software suite is a collection of highly efficient, batch-scriptable, multicore command line tools for processing LiDAR data. These tools include, classify, tile, convert, filter, raster, triangulate, contour, clip, polygonise LiDAR data and more.





# Land Cover generation – crop classification

The screenshot displays the Objective Workstation interface for a land cover classification project. The main map area shows a highly segmented and colorful land cover map. The interface includes a Project Layers panel on the left, a Properties panel at the bottom left, and a main map area displaying a colorful, segmented land cover map. A table at the bottom right shows the classification results.

**Project Layers:**

- ProjectName
  - Feature1
    - Raster Pixel Processor
    - SFP
    - Raster Object Creators
      - Segmentation - Lambda Schedule
    - Raster Object Operators
    - Raster To Vector Conversion
    - Vector Object Operators
    - Vector Object Processor
    - Vector Cleanup Operators

**Properties - Segmentation Properties:**

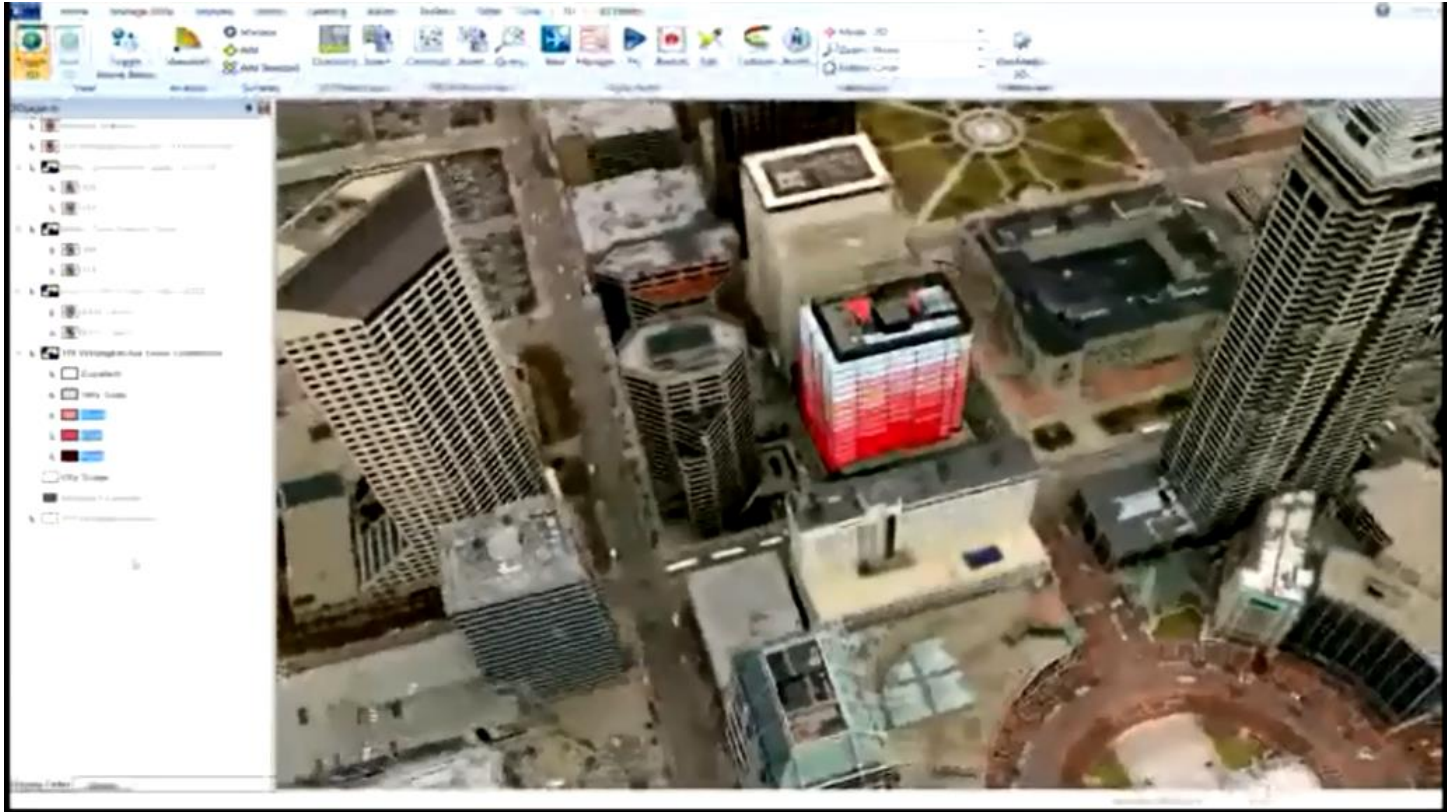
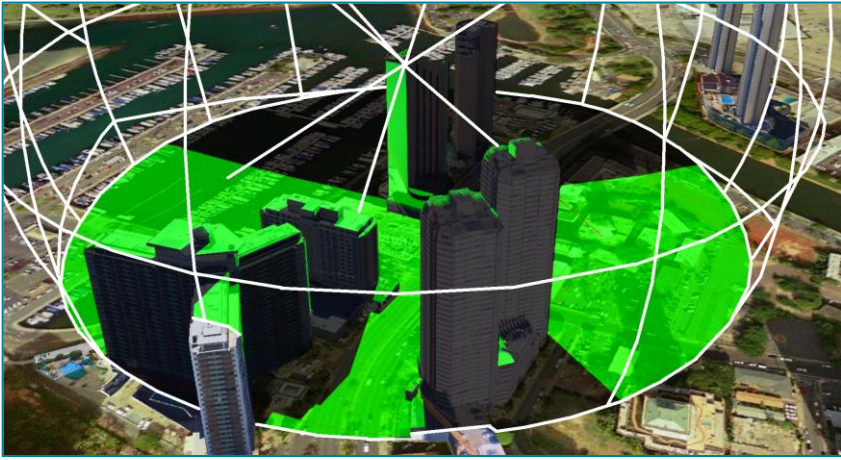
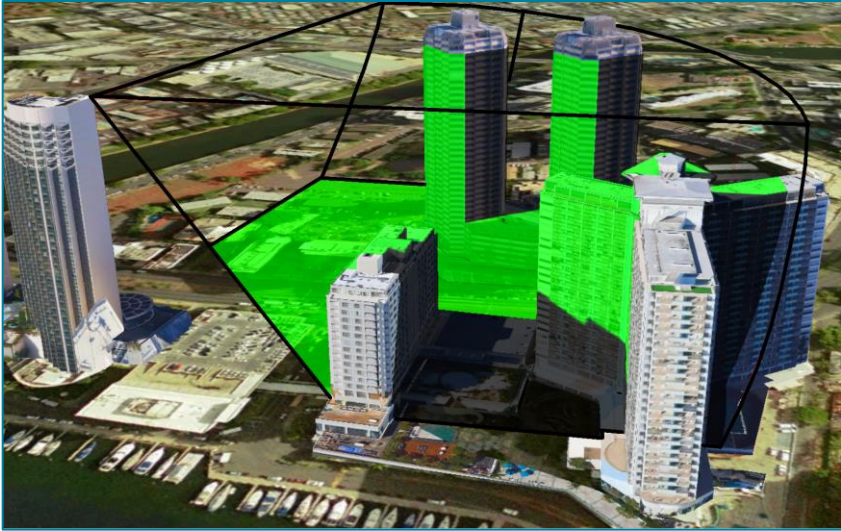
- Input Variable: 5band
- Pixel Segment Ratio: 400
- Relative Weights:
  - Spectral: 0.95
  - Texture: 0.60
  - Size: 0.60
  - Shape: 0.50
- Size Limits: Min: 200, Max: 1000000

**Classification Results Table:**

Row	Histogram	Color	Red	Green	Blue	Opacity	PixProb
0	0		0	0	0	0	0
1	1301		0.506	0.333	0.059	1	0.00373407
2	809		0.976	0.855	0.953	1	0.00221135
3	203		0.937	0.675	0.486	1	0.000892088
4	355		0.753	0.137	0.612	1	0.00470845
5	328		0.349	0.247	0.478	1	0.00267782
6	737		0.596	0.129	0.376	1	0.0151312
7	984		0.741	0.251	0.976	1	0.0164937
8	264		0.141	0.070	0.065	1	0.00000000



# True 3D Volumetric Analysis







# Geospatial Big Data Management on the Cloud





# Cloud based Geospatial Ecosystem

Content  
Hosting  
and Delivery  
Open Standard  
Open Data  
Sensor based data



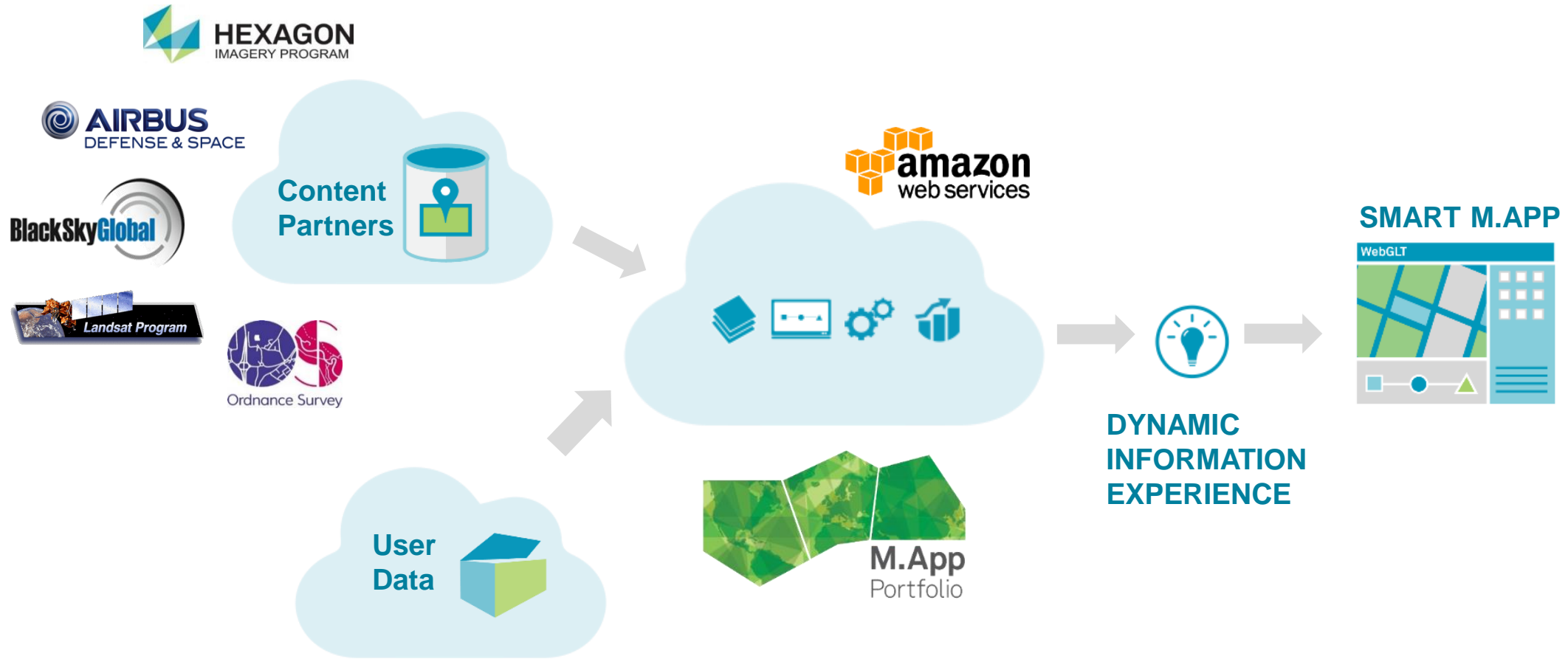
Geospatial  
Production  
Services  
(Workflow, Analytics,..)



Smart M.Apps  
Information  
Services



# How Does it Work?







## Conclusion

- The Geospatial Big Data deluge is a reality and it will keep growing...
- The Geospatial Big Data deluge is a **challenge** but also a great **opportunity** to speed up Land data capture
- Big Data will help improve Land data update over time
- Tools will be required for
  - Automatic feature generation (highly dependant on data accuracy)
  - Automatic change detection
  - Analytics will be key element to deal with Big Data
- Open platforms connecting to Open Data through Open Standard with Open API will be required
- New type of applications combining real time data from sensors, crowd data from social media and dynamic GIS