HEXAGON
empowering an autonomous future

Hexagon Content Program

Rob Eadie

Rob Eadie

- M.Sc. Remote Sensing & GIS
- B.Sc. Geography & Computer Science
- More than 35 years of experience in the geospatial industry
- Expertise in content data programs
- **Reseller/Partner Manager - Hexagon Content Program**

HEXAGON

HEXAGON

Geospatial **C**ontent **S**olutions

Core capabilities: Mapping from the air

AIRBORNE

Sensing Technology

Researching, developing, producing and distributing cutting-edge airborne imaging, LiDAR and hybrid sensors and data processing software to provide customers with higher data capture efficiency and more data from every flight.

CONTENT

Capture & Distribution

Capturing and distributing high-resolution airborne data, including orthophotos, elevation data, 3D models and analytics as a service to provide customers with immediate access to geospatial information.

MAPPING

Services

Providing data acquisition and processing services to selected, strategic Hexagon customers and partners to expand their capacities to serve their clients and local markets.

HEXAGON

History of Mapping

100 years of Aerial Acquisition

1923

2000

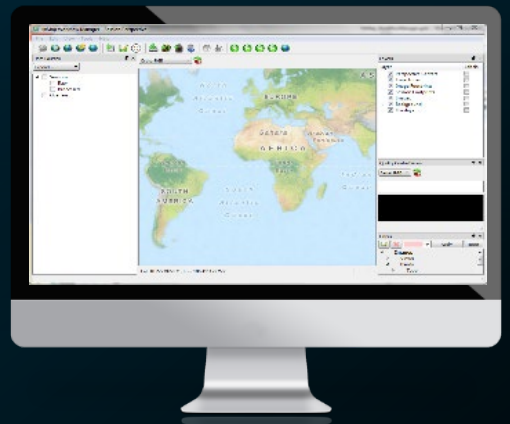
Analog Era
1923 - 2000

Digital Era
2000-2016

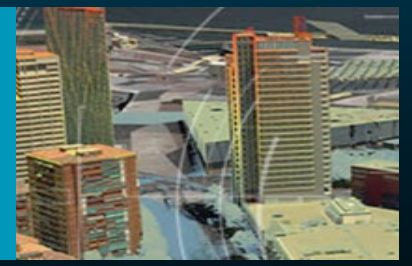
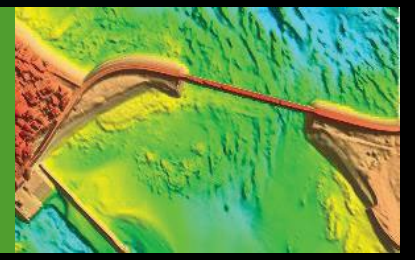
Hybrid Era
2016 - Today

Leica Geosystems Airborne sensor portfolio

Airborne Hybrid Oblique Imaging & LiDAR Sensor	 CountryMapper	 CityMapper-3	 MultiMapper
Airborne Imagery Sensors	 ADS100	 DMC 4	
Airborne Topographic LiDAR Sensors	 SPL100	 TerrainMapper-3	
Airborne Bathymetric LiDAR Sensors	 Chiroptera-5	 HawkEye-5	 CoastalMapper



Unified HxMap Processing Workflow

Orthophotos, Obliques, LiDAR, Mesh, DTM	
Orthophotos, DSM	
Topographic LiDAR Point Cloud	
Bathymetric LiDAR Point Cloud	

HEXAGON

HxGN Content Program

The largest library of high-resolution aerial imagery, elevation data, 3D models and analytics across North America and Europe.

The aerial data is orthorectified, accurate and available at multiple resolutions.

Seattle, Washington, US

HEXAGON

12 years of continuous data collection

2014

Start of U.S. data program at 30 cm resolution.

11 states captured in the first season including Texas and California.

2015

20 new U.S. states captured.

Start of European data program at 30 cm resolution.

Captured Italy, Portugal, Denmark and most of Spain.

2016

Start of U.S. urban program at 15 cm resolution.

Includes all U.S. cities above 50k population, making this the largest urban data acquisition year to date at 225 cities.

31,112 km^2 total area captured.

2017

First cycle of continental coverage in the U.S. completed with 20 states refreshed.

2018

Our biggest year in history. Refreshed half the continental U.S. and a third of European coverage in one season.

5,123,779 km^2 total area captured.

GSA

Availability of the data through GSA schedule.

2019

aws

Content hosting migrated to AWS in North America and Europe

HD

Start of Metro HD city program acquisition in the U.S.

USDA

16th consecutive year of collection for NAIP, now at 60 cm resolution.

2020

Start of U.S. data collection at 15 cm resolution. Third U.S. refresh cycle.

Completion of European coverage.

2021

16 states refreshed in the U.S.

Start of European city program at 5 cm resolution.

2022

9 states refreshed in the U.S.

HD

Start of Metro HD city program acquisition in the U.S.

HxDR

Orthoimagery available on Hexagon's Digital Reality (HxDR)

2023

13 states refreshed in the U.S. at 15 cm resolution.

2024

14 states captured in the U.S. at 15 or 30 cm resolution.

3,143,794 km^2 of high-resolution aerial data, including 4-band orthoimagery, 3D point clouds and stereo imagery.

Content Program Ecosystem

FLEET

20-30
planes flown per year

DATA

>2 PB
raw data collected in 2022

1 BILLION
images streamed per month

2500+
CPU cores

100 GB
network speed

22 PB
working storage

PRODUCTION

21+ MILLION
square miles of data processed since 2014

PARTNERS

32
authorized resellers

5+
acquisition partners

7
processing teams

HEXAGON

HxGN Content Program’s ecosystem

Partners

60%

of the HxGN Content Program is captured by trusted **Partners**.

75%

of the HxGN Content Program data is sold by **Resellers**.

HEXAGON

Temporally consistent, high-resolution aerial data products

Countrywide program

Standardized, high-resolution aerial imagery and digital surface models of the contiguous United States and Western Europe.

Countrywide data is offered at 15 cm and 30 cm resolutions in the United States and between 12.5 cm to 30 cm resolution across Europe.

The following off-the-shelf data sets are available:

- Standard aerial orthoimagery
- Digital surface model
- Stereo imagery

Metro HD city program

Ultra-high-definition 2D and 3D data sets derived from concurrent aerial imagery (5 cm resolution) and LiDAR data (20 points/m² density), delivering superior positional accuracy and temporal consistency.

The following data layers are offered in select global cities:

- Standard aerial orthoimagery
- True aerial orthoimagery
- Oblique imagery
- LiDAR point cloud
- Digital surface model
- Digital elevation model
- Mesh model
- Building model
- Tree model
- Land cover map

HEXAGON

Derive valuable insights with high-quality aerial data

Highly accurate & consistent

Our data is captured using high-performance sensors and processed using ground control and rigorous QA/QC routines that emphasize data accuracy and clarity.

Reliable refresh cycle

We capture data in the same season according to planned refresh schedules, allowing you to budget and prepare in advance.

Comprehensive

As the world's largest aerial data provider, we offer a full stack of high-resolution 2D and 3D data sets to enable you to make well-informed decisions.

Machine learning ready

Exceptional data consistency over large areas makes our data sets ideal for training machine learning algorithms.

Immediate data access

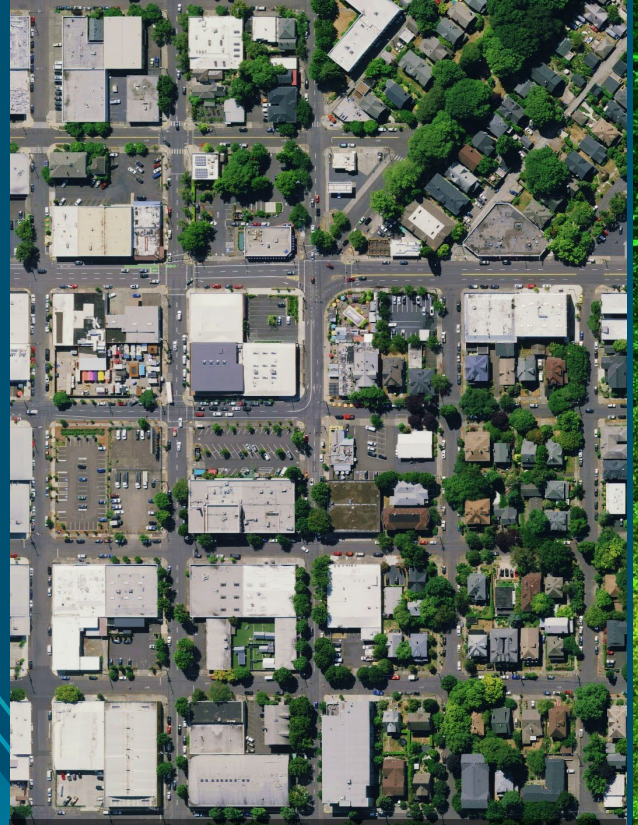
Deploy quickly with on-demand cloud streaming or pixel download. Multiple consumption models ensure smooth integration with existing workflows.

Flexible use terms

Flexible data use terms allow users to build derivative products, analytics, and value-added layers.

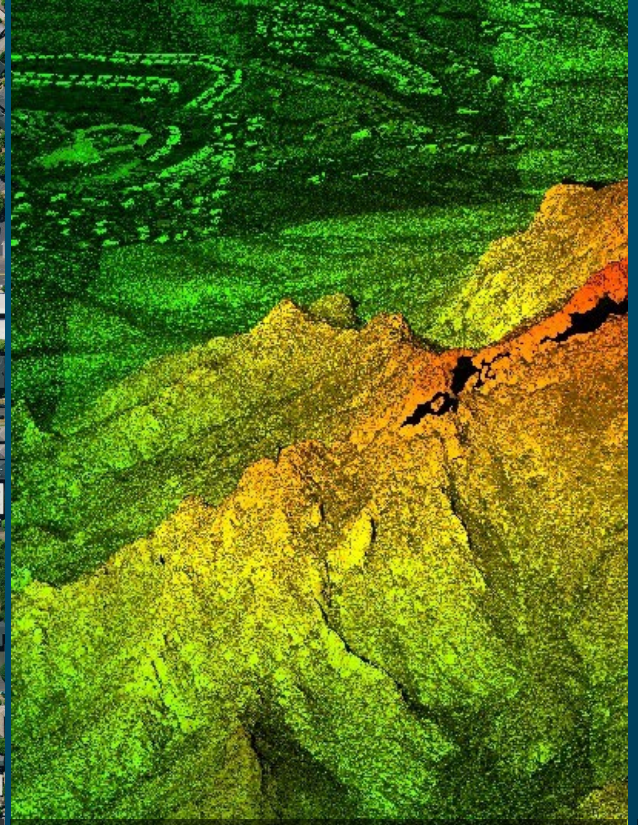
HEXAGON

Standard data products



Orthophotos (4-band)

- 15 cm and 30 cm GSD wide area coverage
- Available for streaming & download
- Ideal as a land base for GIS applications



Elevation Products and Stereo Imagery

- DSM and Stereo imagery available for 30 cm and 15 cm GSD data
- Coast-to-coast coverage of the United States
- Ideal to extract 3D vector maps and clutter

Machine Readable Data

- Consistency and positional accuracy
- Great licensing terms
- Ideal training data set for automatic feature extraction and analytics

Leica DMC-4X

MFC150 camera imaging technology

Respond to industry trends of more high-res data faster

Meet the needs of all use cases

Modular design

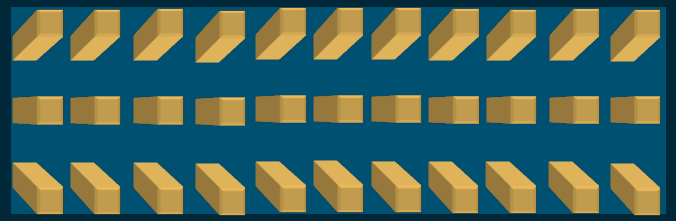
Integrated frame size	54,400 x 31,500 pixels (4-band)
Flying height	4470 m @ 15 cm GSD

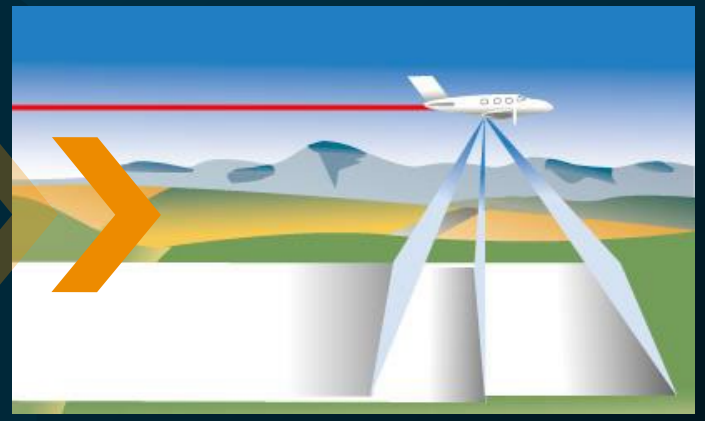
HEXAGON

Shift in Technology

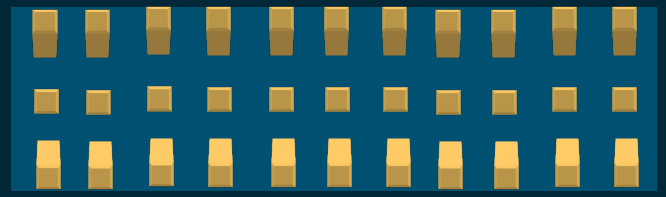
Airborne Line Sensor

Forward View Strip

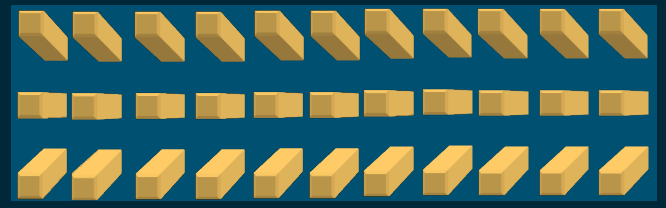


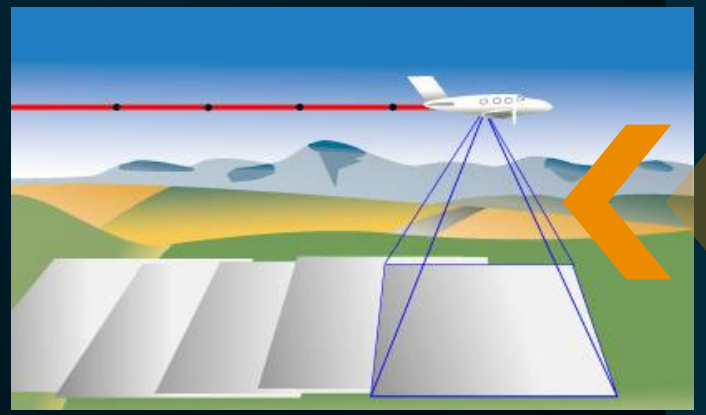


Nadir View Strip



Backward View Strip

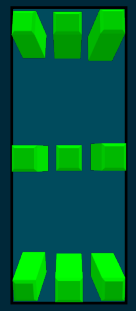




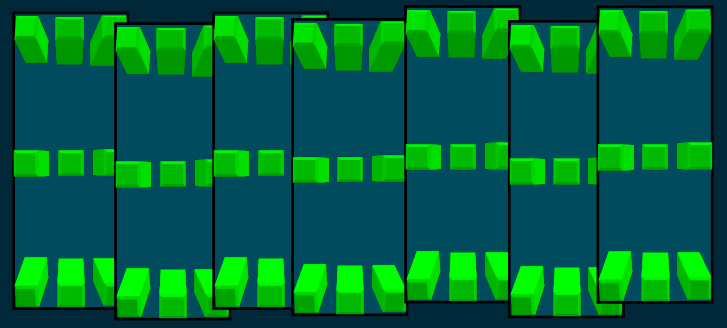
High-Aspect Frame Sensor

ContentMapper

Photograph with Central Perspective



Flight Line with Overlapping Photographs



Leveraging Forward-Motion Compensation

Shift the image to counteract blur from flight motion

HEXAGON

Content Mapper

Same Acquisition Parameters – Twice the Resolution

20,000 pixels across swath

ADS100

25,000 pixels across swath

DMC III

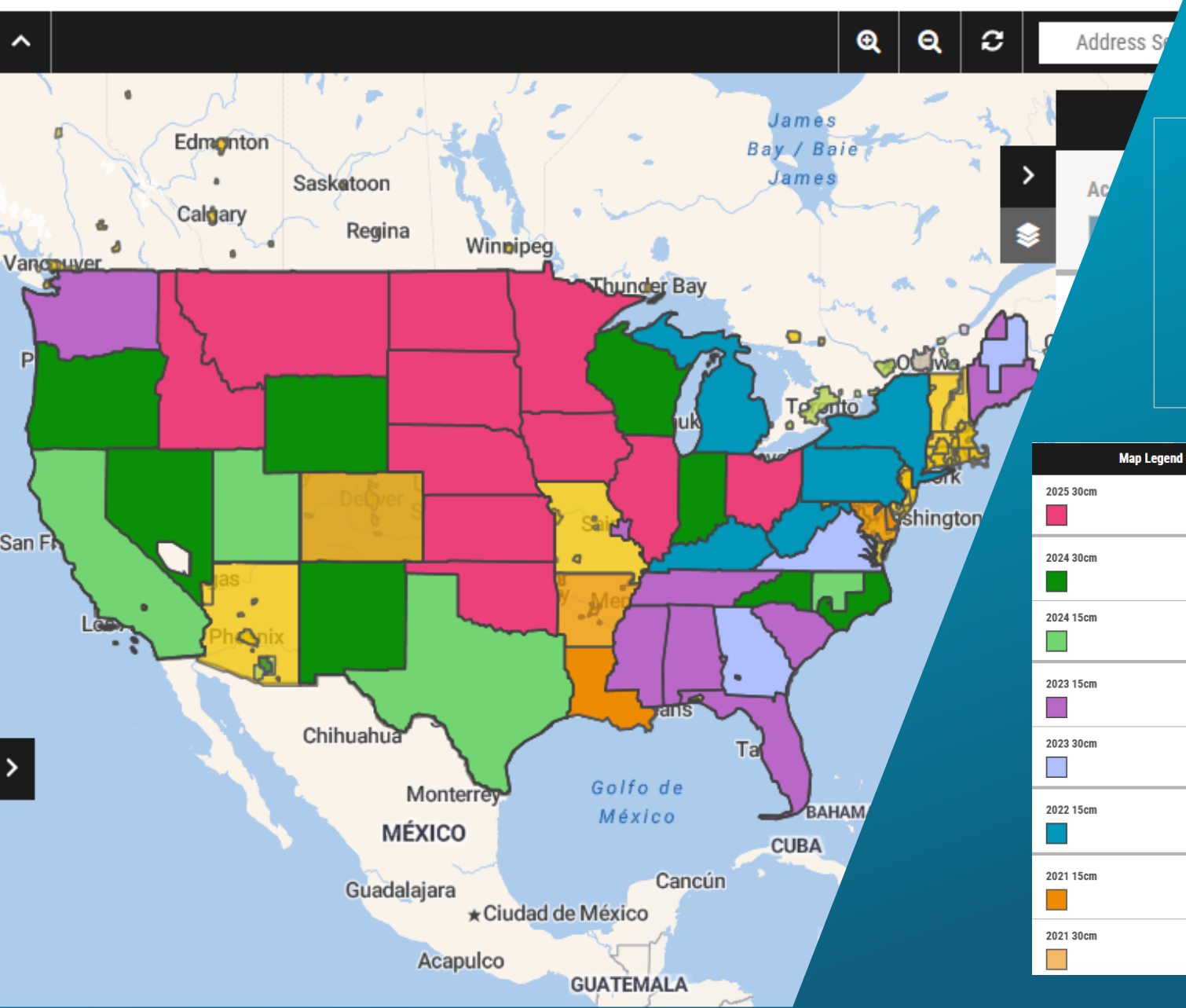
40,000 pixels across swath

ContentMapper

HEXAGON

HxGN Content Program

Status of Data Availability and Acquisition



100%
complete coverage of contiguous United States

8,648,512 mi²
total 30 cm resolution coverage

2,158,754 mi²
total 15 cm resolution coverage

HEXAGON

Metro HD Data Products

Orthophotos (4-band)

- 5-7.5 cm GSD ortho imagery

LiDAR Point Cloud

- QL0-QL2 data products
- 8 - 20 points / sq. m
- DEM / DSM

Data Products

- LOD 1-3
- Land Cover

Metro HD City Data

Ultra-high-definition 2D data and 3D digital twins of major cities

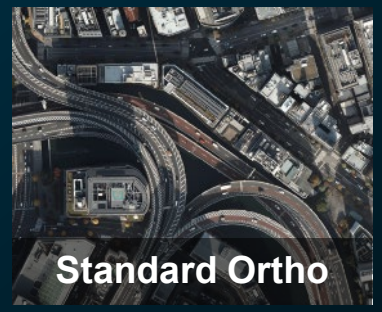
Leica CityMapper-2

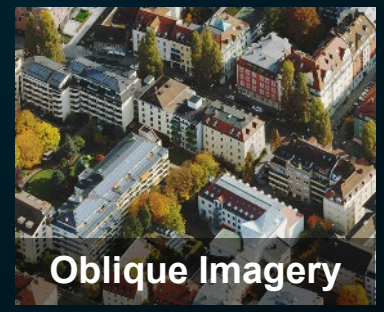
HEXAGON

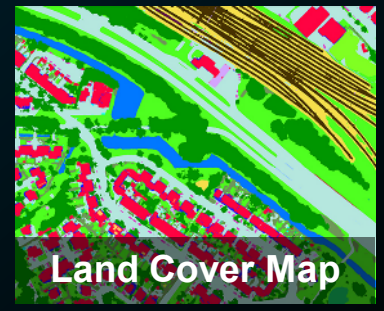
Metro HD City Data

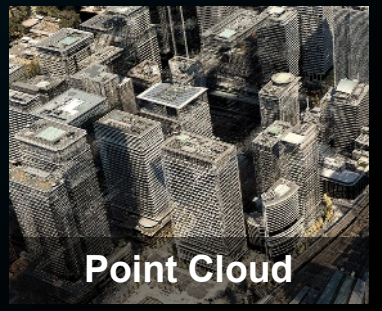
Ultra-high-definition 2D data and 3D digital twins of major cities

Leica CityMapper-2

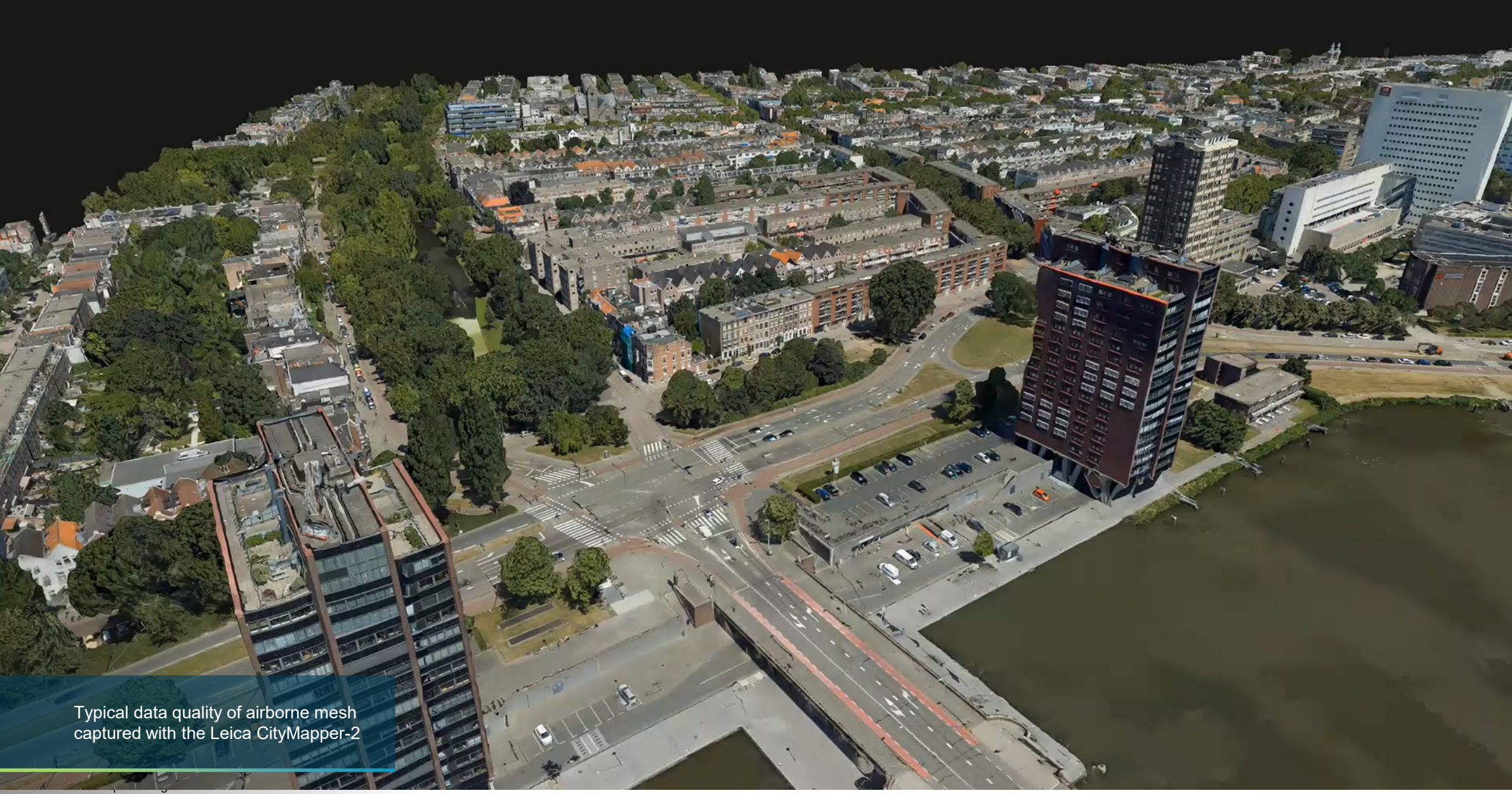








HEXAGON



Typical data quality of airborne mesh captured with the Leica CityMapper-2

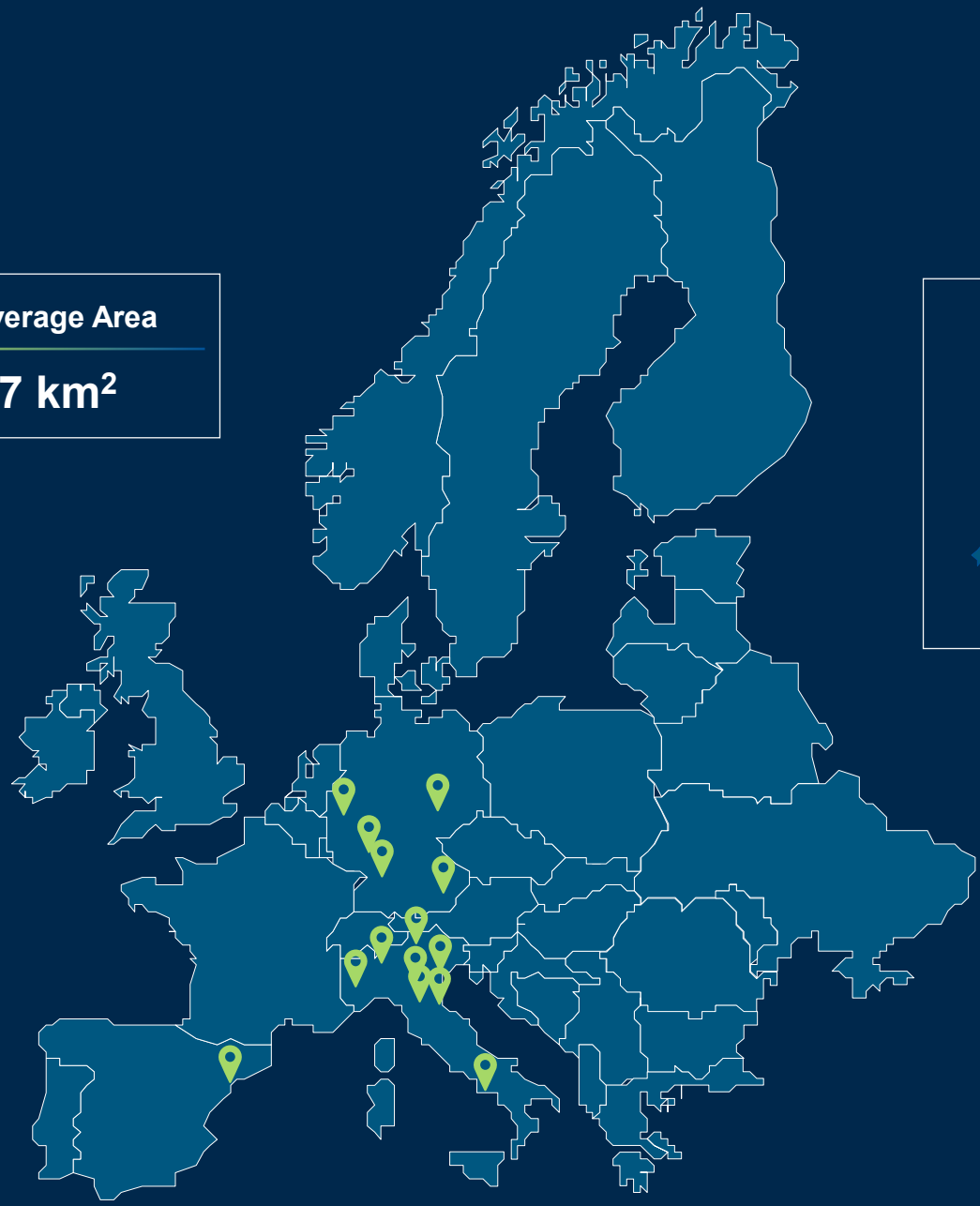
Metro HD coverage map

– Europe & Asia

Available Cities		
City	Collection Date	Coverage Area
Padova	2023	93 km²
Firenze	2023	105 km²
San Marino	2023	61 km²
Milano	2022	1,575 km²
Torino	2022	130 km²
Bolzano	2022	52 km²
Bologna	2022	140 km²
Barcelona	2022	100 km²
Stuttgart	Oct 2022	10 km²
Munich	2021	574 km²
Frankfurt	Sept 2021	10 km²
Cologne	Sept 2021	10 km²
Leipzig	Oct 2021	10 km²
Napoli	2023	117 km²
Tokyo	2023	1300 km²

Total Coverage Area

4,287 km²



HEXAGON

Metro HD coverage map

- United States

Total Coverage Area

476 km²

Available Cities		
City	**Collection Date**	**Coverage Area**
New York	May / Jun 2021	76 km²
Dallas	Jul / Aug 2021	10 km²
Orange	Dec 2023	130 km²
Los Angeles	Dec 2023	130 km²
Miami	Feb 2024	130 km²

HEXAGON

HEXAGON

Hexagon Content Program for States

2025

Hexagon Content Program Overview

The HxGN Content Program offers on-demand and new collection aerial imagery and derived products. Now in its sixth refresh cycle, it collects over one million mi^2 of data annually.

The program is designed to deliver cost-effective, high-quality geospatial data through a volume-based, subscription licensing model.

Standard Offering

An affordable option for on-demand statewide date:

Coverage: Complete, leaf-on, 6 -12 inch orthoimagery for the entire state.

Access: Immediate access to current and refreshed data via WMS/WMTS streaming services.

License Term: Typically a 3-year agreement with flexible payment options.

Use Rights: Includes access for state agencies, counties, municipalities, and approved partners at no additional cost.

HEXAGON

Content+ Program

A premium option tailored for large geospatial consumers:

Custom Collection: One-time data collection to state-defined specs

- Examples: leaf-off, higher resolution, metro buy-ups, enhanced accuracy specs, etc.

Bundled Access: Includes all standard Hexagon Content Program leaf-on data collected during the term.

Delivery: A hard copy of the custom dataset with streaming access options available

Flexibility: Supports multiple delivery models and user workflows.

HEXAGON

Accessibility & Hosting

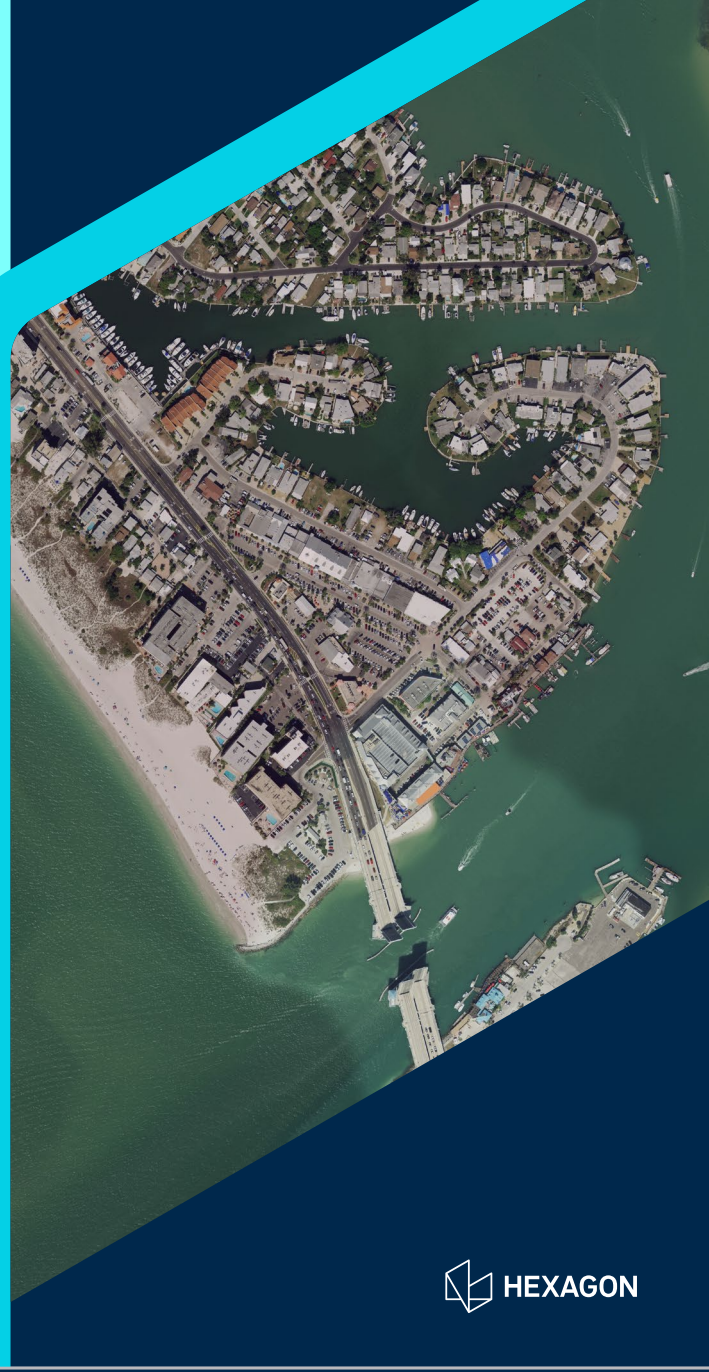
Streaming: Fast, reliable cloud-based WMS/WMTS service.

Compatibility: Supports major GIS platforms.

Public Access: State may visualize data in public-facing, non-commercial applications (non-downloadable format).

Storage: All streaming costs for stakeholder access are included during subscription term

The physical copy is delivered via cloud transfer or hard drive and remains accessible following the license term.



Technical Highlights

Collection: All data flown with Leica digital aerial sensors; single season collections with 4-band capture.

Processing: All data processed using the Leica suite of tools with photogrammetric ground control and radiometric correction.

Elevation Data: Generated using Semi-Global Matching (SGM) algorithms for ortho-quality DEMs.

- Optional photogrammetric DSM product also available statewide

Standard API: Streaming service standard that adhere to OGC protocols for compatibility with Esri, Bentley, AutoCAD, QGIS, etc.

Pricing Model

Basis: Per square mile pricing.

Deliverables: One hard copy of the latest imagery, streaming access for all authorized users (based on licensing option), and access to all refreshed data during the term.

Commitment: Refresh options available during the subscription term.

HEXAGON

Administrative & Compliance

End User Access Agreement: Governed by the End User Access Agreement and StateGov License Grant.

- Additional licensing and owned data options are available in a Content+ program

IT Compliance: Can work with state IT policies for alignment

- SLA options available

HEXAGON

Experience & Adoption

Track Record: Used by multiple U.S. states including Washington, North Dakota, Utah, California, Delaware, and Texas.

Support: Backed by decades of experience in federal, state, and local government geospatial programs.

Dedicated support team for setup and on-going assistance

HEXAGON

Serving various industries and applications

Government

Utilities

Telecommunications

Transportation

Insurance

Public Safety

Environmental

Automotive

Exceptional consistency over large areas makes our data ideal for large-volume analytics, feature extraction and training machine learning algorithms.

We provide for applications such as urban planning, asset management, public safety, utility mapping, app development, and many more.

HEXAGON

ESRI and Hexagon

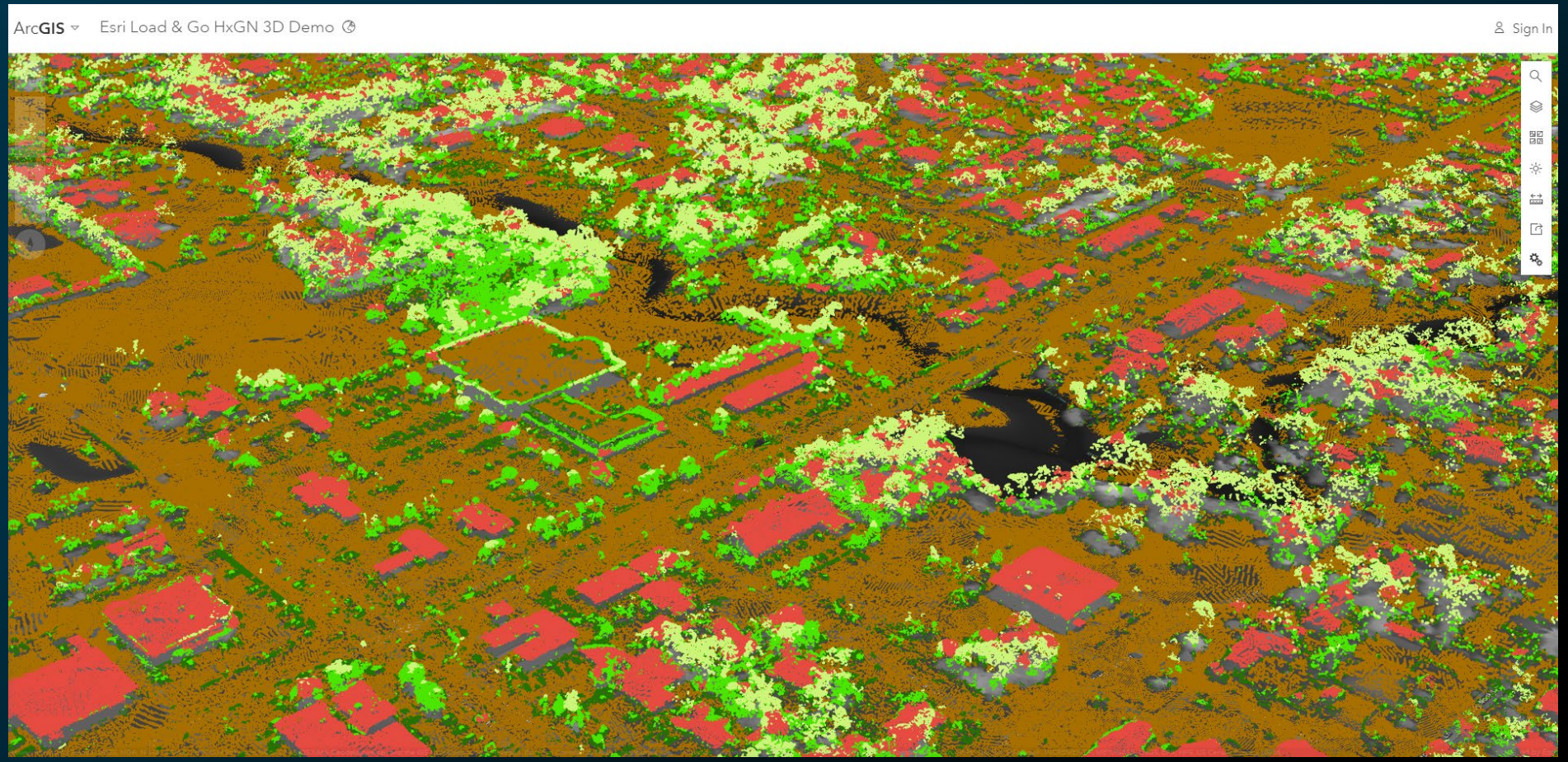
Geospatial Data Integration and Processing

In May of 2021 ESRI and the HxGN Content Program worked in conjunction to understand the possibilities with market leading software and imagery.

The results were presented as part of joint webinar delivered by Hexagon and ESRI.

ESRI Workflows

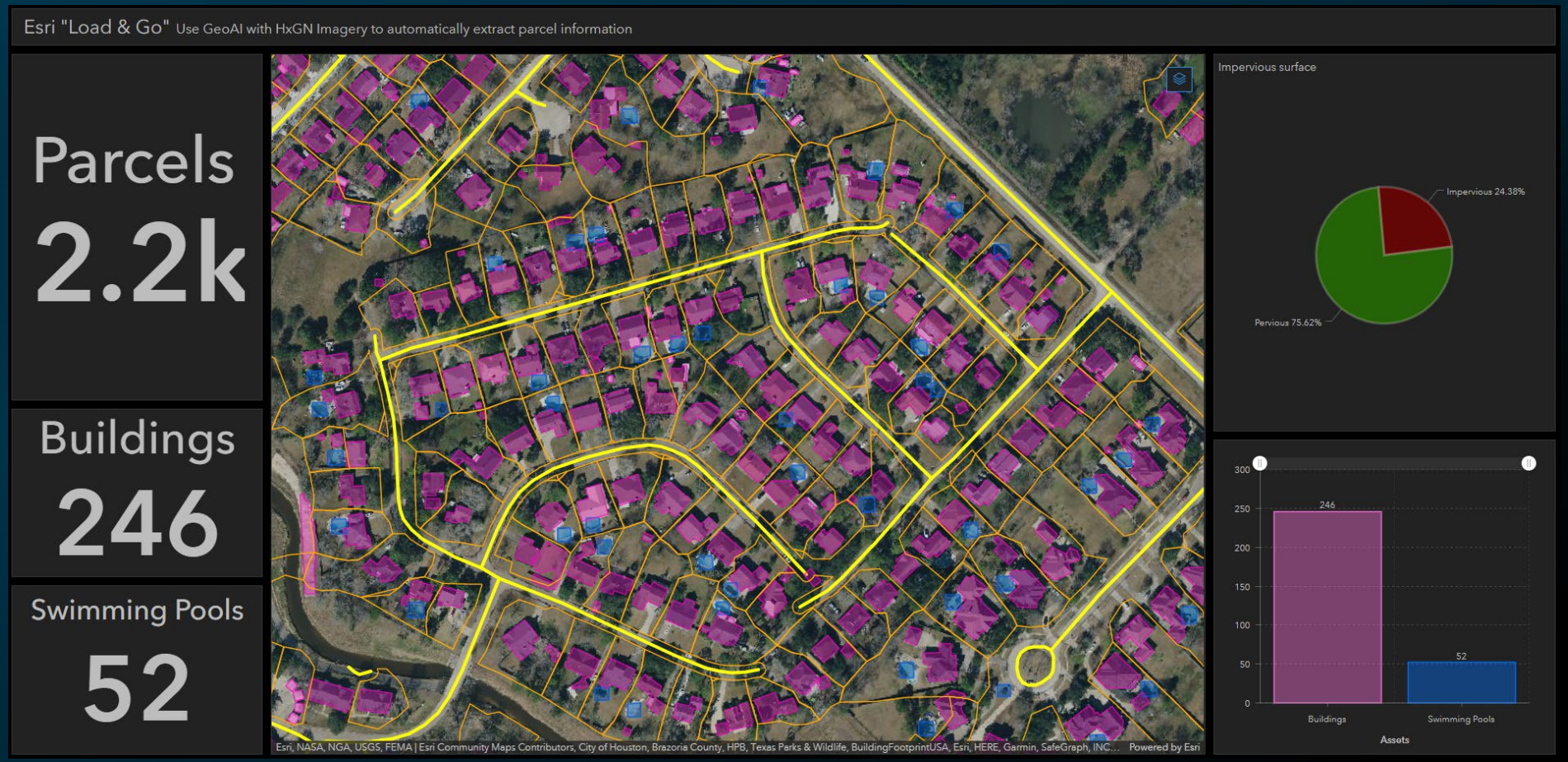
ArcGIS Pro and 3D Analyst – DSM Data Integration, Processing and Usage



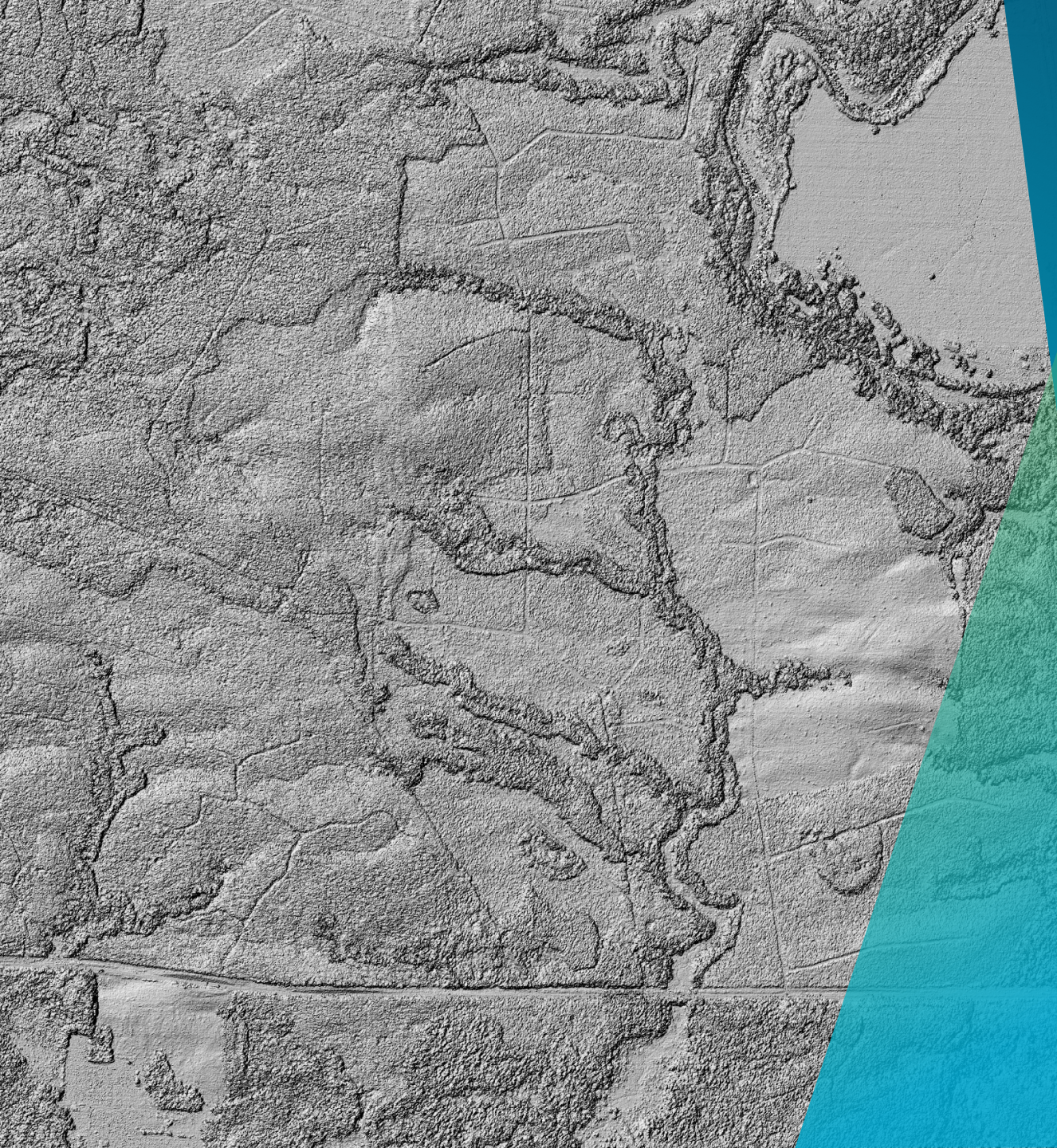
HEXAGON

ESRI Workflows

ArcGIS Pro Web Applications – Deep Learning Results from 4-band Imagery



HEXAGON



Elevation Data Gets Widespread Use

State of Washington Department of Natural Resources (WA DNR) using stereo imagery to derive elevation-based products

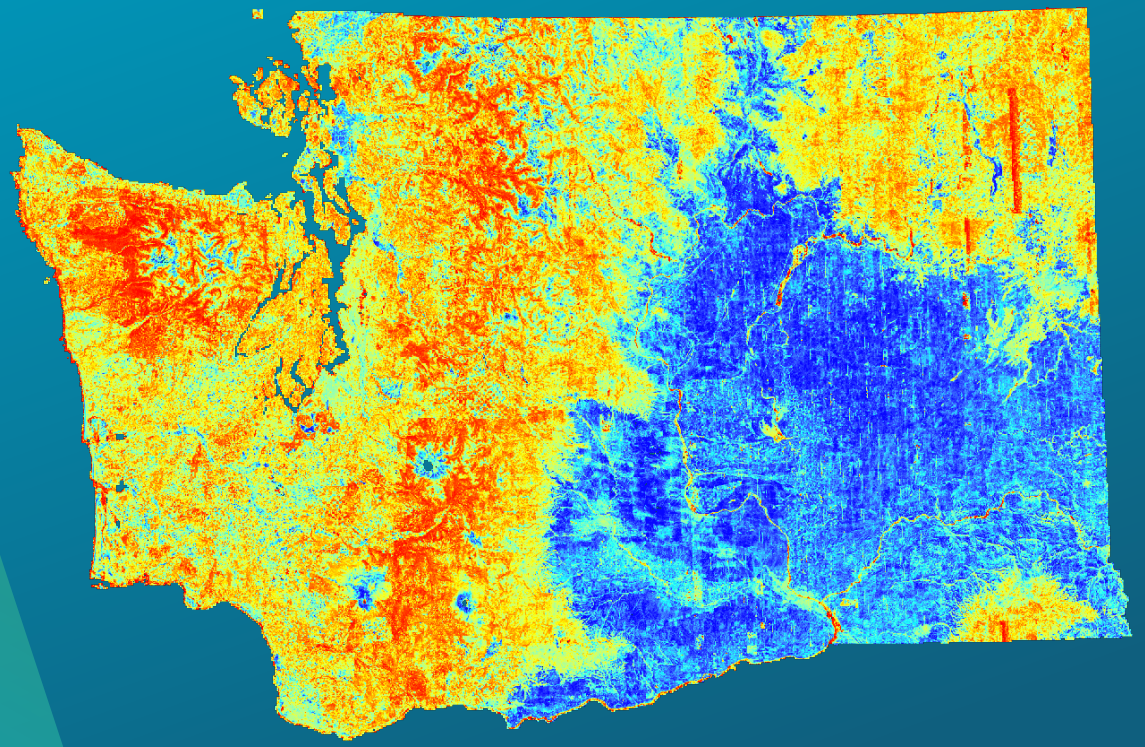
WA DNR generates a statewide pixel-to-pixel level DSM based on stereo data. The DSM data is shared with WA counties that are part of the Geospatial Orthophoto Program. This data is used for a variety of uses such as calculating land use coverage maps, vegetation heights, airport obstructions, and powerline corridor maintenance.

Elevation Data Help Forests Grow

United States Forest Service (USFS) Pacific Research Station partners with the WA DNR to aid forestry dynamics research

Digital Aerial Photogrammetry and the resultant DSM is emerging as the go-to resource for large scale mapping of forest structure.

Statistical analyses have Implications on forest inventory, habitat mapping, fire fuels mapping, growth rates, productivity and site index.



Jacob Strunk, PhD
Forest Service -- Statistician
Pacific Northwest Research Station
Resource Monitoring & Assessment/FIA Program
Vegetation Monitoring & Remote Sensing Team

P:360-218-4285
jstrunk@fs.fed.us
3625 93rd Ave SW
Olympia, WA 98512

www.fs.fed.us

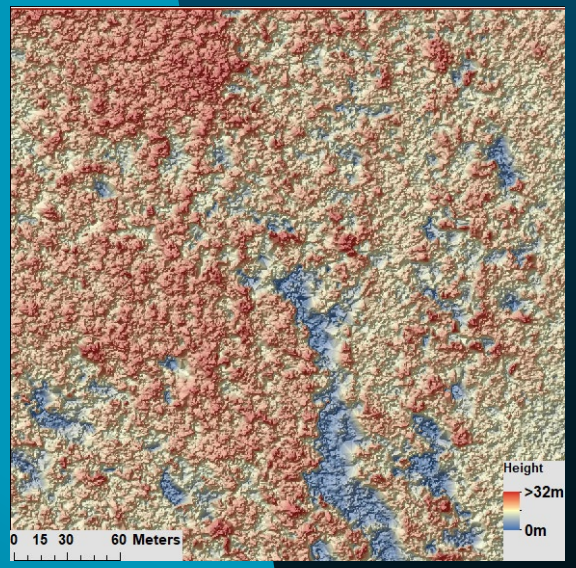
Caring for the land and serving people

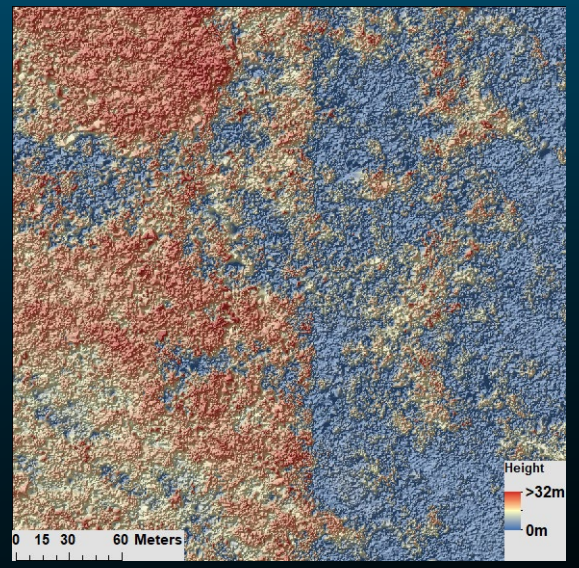
Elevation Data Assess Changes

The University of Washington partners with the WA DNR Wildfire Division to assess the impact of forest fires.

DSM data is used to calculate the landscape impact of wildfires. WA DNR works with the University of Washington to estimate vegetation loss following a wildfire event through a change detection analysis.

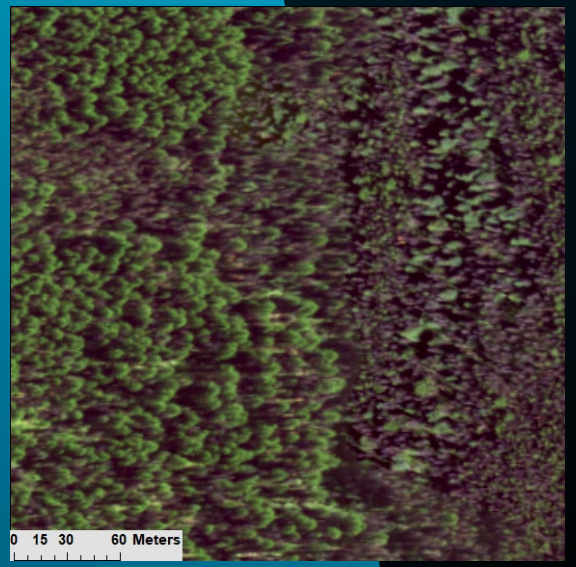
UW looks at the change in forest structure both at the site of the change and to analyze the cumulative distribution and effects of all changes across the landscape.

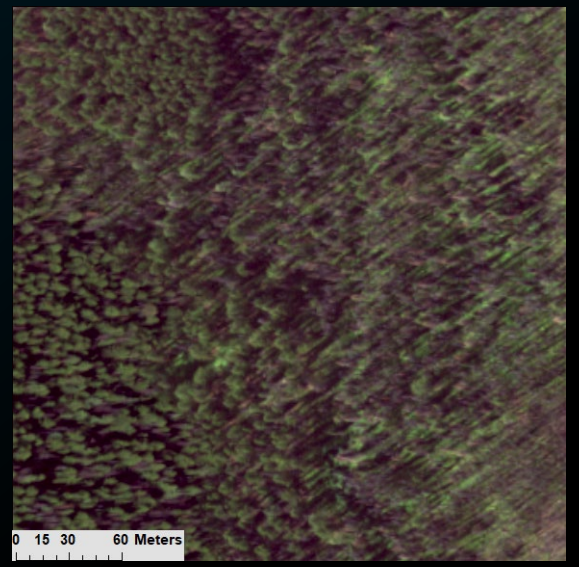




PRE-FIRE

POST-FIRE



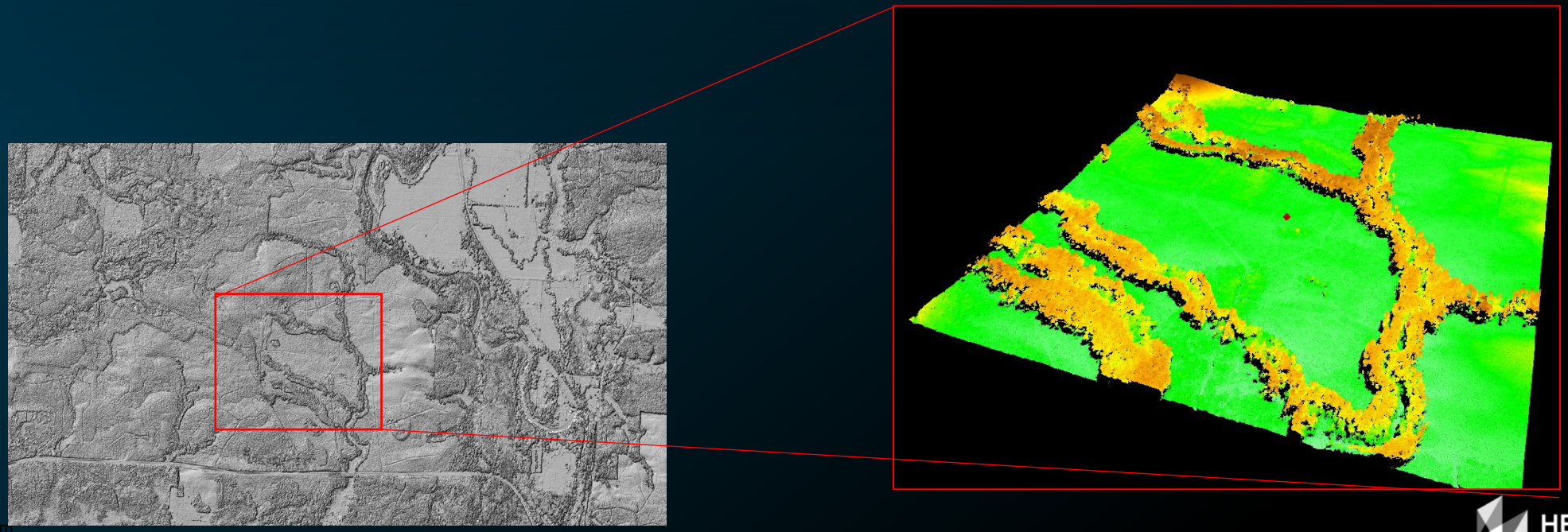


HEXAGON

Washington Department of Natural Resources

Stereo Imagery

- Forest Inventory and Wildfire Divisions
  - 2015 to 2020 acquired at 40 cm resolution
  - WA DNR GIS – A rasterized hill shade product is created, similar to top surface LiDAR for use in WA DNR's GIS system.
  - Due to interest from other state and federal agencies, WA DNR provides example data and workflow overview so that other agencies can utilize stereo imagery in their workflows.



HEXAGON

5G Network Implementation

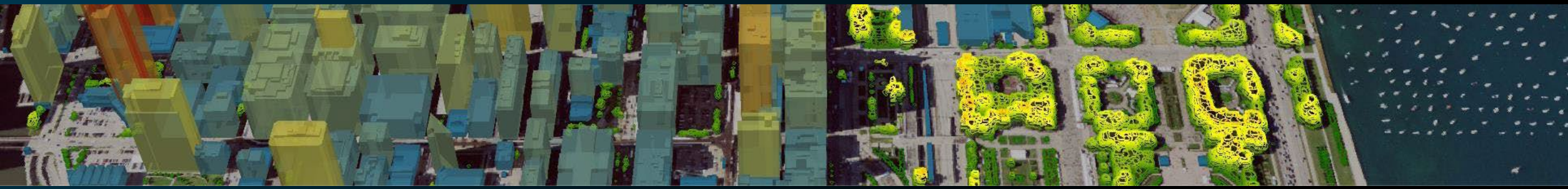
3D city models are providing infrastructure intelligence in the race for network coverage

5G networks require lots of small cells to be installed on city infrastructure like utility poles, lamp posts and buildings to ensure line of sight is maintained.

Large Network companies are using 3D data from the HxGN Content Program as base map for view shed analysis.

Benefits of Aerial/HxIP Content vs Satellite Source Data Inputs:

- Clutter (land use/land cover) generated from higher resolution multispectral imagery, to accurately capture detail and distinguish classes
- 100% leaf-on imagery for the best tree mapping results, including contouring (multiple levels of vector polygons for true 3D tree representation)
- Imagery of large areas (metros and larger) captured over short time frames gives consistent seasonality for improved classification, aerial also offers better cloud mitigation.
- 3d multi-tiered building and contoured tree vectors produced from higher resolution elevation inputs (better edge definition) to best simulate real-world fine detail, including small roof features, all with higher accuracy (supplemental flight lines added where needed)
- Aerial nadir (looking straight down) vs. satellite multi-view data to map features in complex urban environments
- Accuracy (ground control), turn-around time, value proposition and partner-centric model



HxIP Aerial Content Enables our Success in 5G Wireless

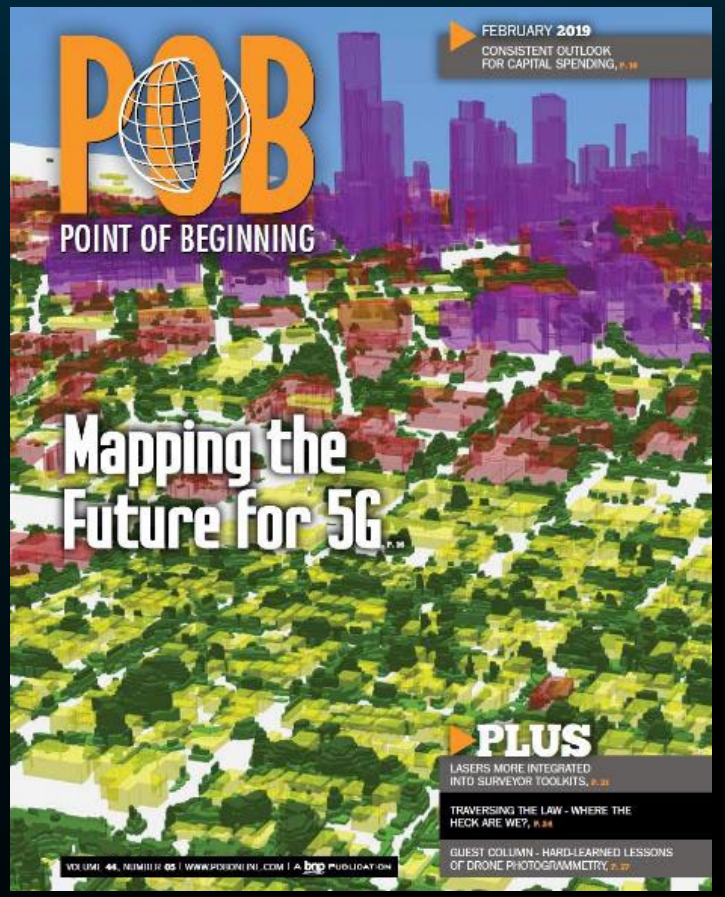
Successful commercial production at scale for multiple USA nation-wide wireless operators:

- **Over 100,000 km2 of 1m datasets for mid-band and high-band 5G wireless**
- **USA county-wide 10m dataset for low-band 5G wireless**

Pioneering R&D on multiple new geodata layers for 5G RF engineering.

Industry-leading mapping work for 5G wireless mapping featured on the cover of POB Magazine.

Multiple awards including Inc. 5000 and Denver Fast 50



HEXAGON


Cincinnati, Ohio (3D vector modeling)
Cincinnati, Ohio (10m clutter)
Cincinnati, Ohio (1m clutter)


Boston, Massachusetts (Building Segmentation)

Land Info Tree Mapping – Optimized for Demanding Uses:

- 5G & Fixed Wireless Access (FWA)
- Overhead line encroachment vegetation management & danger tree identification
- Urban forestry and tree inventory assessment
- Greenspace equity, parks & sustainability
- Solar potential energy mapping
- Wildland fire risk analysis mitigation
- Flood management & climate resiliency
- Visualization/Simulation
- Additional uses customizable per project needs

LAND INFO Tree Mapping – Multi-Step Process:

- Crowns (individual trees)
- Estimated trunk locations, height & diameter
- Contouring contained inside each crown
- Unique IDs assigned to all output layers
- Optional understory modeling calculated with proprietary formulae based on tree crown dimensions & heights

HEXAGON