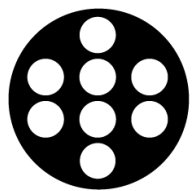




Sensors from Vexcel and their use in large-scale mapping



VEXCEL
IMAGING

bernhard.schachinger@vexcel-imaging.com

Head of Applied Photogrammetry

Data and Workflow

EuroSDR-Workshop, 29th January 2025

Where we come from

GET TO KNOW US



1992

Vexcel was
founded

2003

First UltraCam
introduced

2006

Part of
Microsoft

2010

First UltraMap
version

2016

Privately owned
again

2017

Vexcel Data
Program

2020

Verisk
Acquisition



What we do

OUR PRODUCT LINE-UP

ULTRACAM



ULTRAMAP



ULTRAMOUNT
&
ULTRANAV



UltraCam 4th Generation Line-Up

TAILORED FOR MAPPING EXCELLENCE

CAMERA SYSTEMS



Provide imaging capabilities from photogrammetric nadir & photogrammetric oblique to wide area mapping

HYBRID SYSTEMS



Combine the power of both image and LiDAR sensors



Camera systems

PAN-BASED MODELS

WIDE-AREA MAPPING

UltraCam Condor 4.1

Capture large regions in record-time for automated DSM, DTM and ortho image generation as well as for classification needs



PHOTOGRAMMETRIC OBLIQUE

UltraCam Osprey 4.1

Urban mapping 3D city modeling and photogrammetric applications (cadastre, infrastructure planning, etc.)

PHOTOGRAMMETRIC NADIR

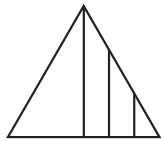
UltraCam Eagle 4.1

From lower altitude engineering applications to high-altitude orthophotography projects

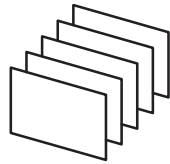


UltraCam Eagle 4.1

SENSOR SYSTEM



>83 dB at
base ISO



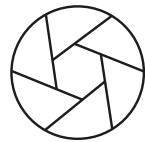
1 frame per
0.7 seconds



14 bits at
4 bands



Adaptive Motion
Compensation
(multi-directional)



Prontor magnetic-0
HS2 shutter
(field exchangeable)



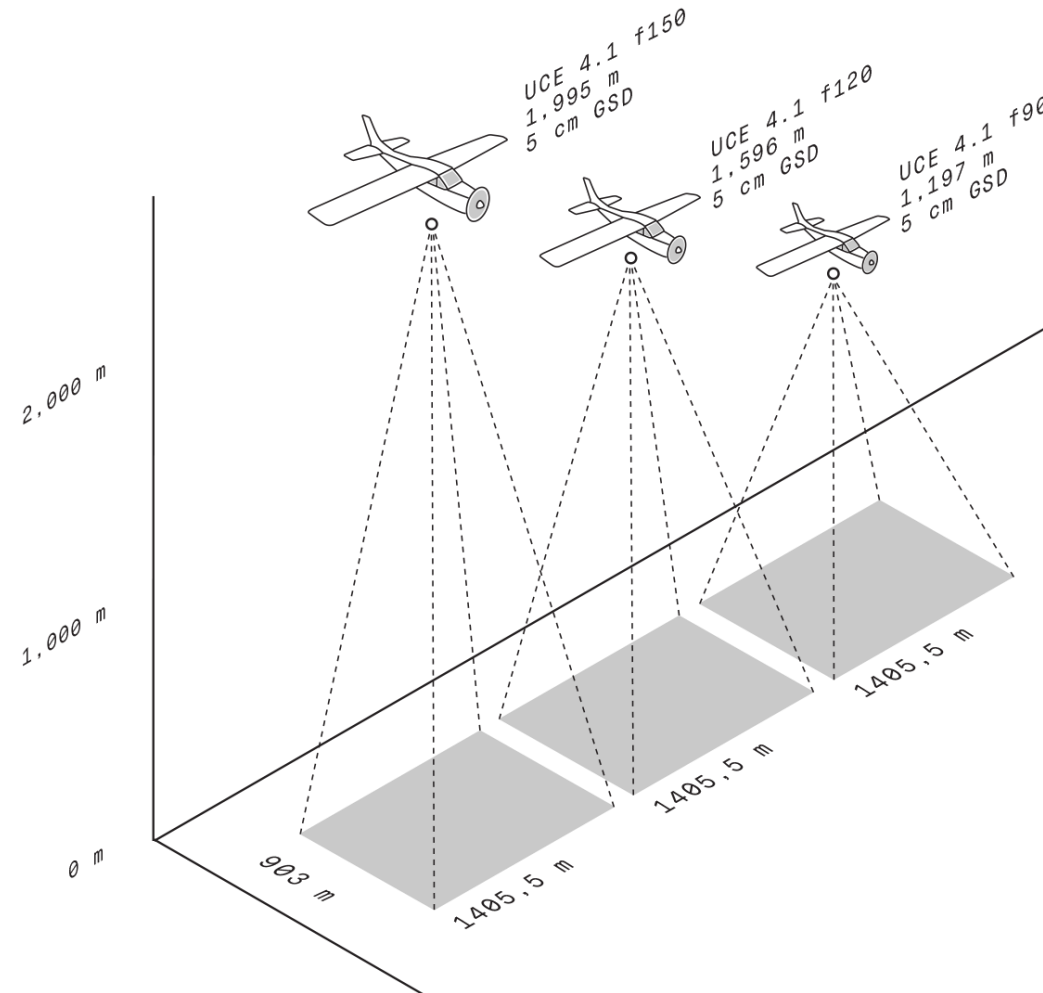
True Pixel
Processing
approach





UltraCam Eagle 4.1

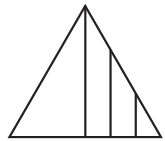
PUSH THE LIMITS OF YOUR AERIAL MISSION



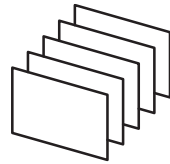


UltraCam Osprey 4.1

SENSOR SYSTEM



>83 dB at
base ISO



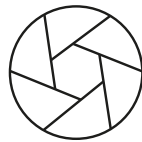
1 frame per
0.7 seconds



14 bits at
4 bands



Adaptive Motion
Compensation
(multi-directional)



Prontor magnetic-0
HS shutter
(field exchangeable)



True Pixel
Processing
approach





UltraCam Osprey 4.1

SPECIFICATIONS

NADIR

290 MP high-resolution native PAN

20,544 x 14,016 pixels

3.76 μ m CMOS

80 mm focal length

2x 150 MP RGB & NIR

12,840 x 8,760 pixels

3.76 μ m CMOS

50 mm focal length

1:1.6 Pansharpen ratio



OBLIQUE

4 x 150 MP RGB Color

14,144 x 10,560 pixels

3.76 μ m CMOS

120 mm focal length

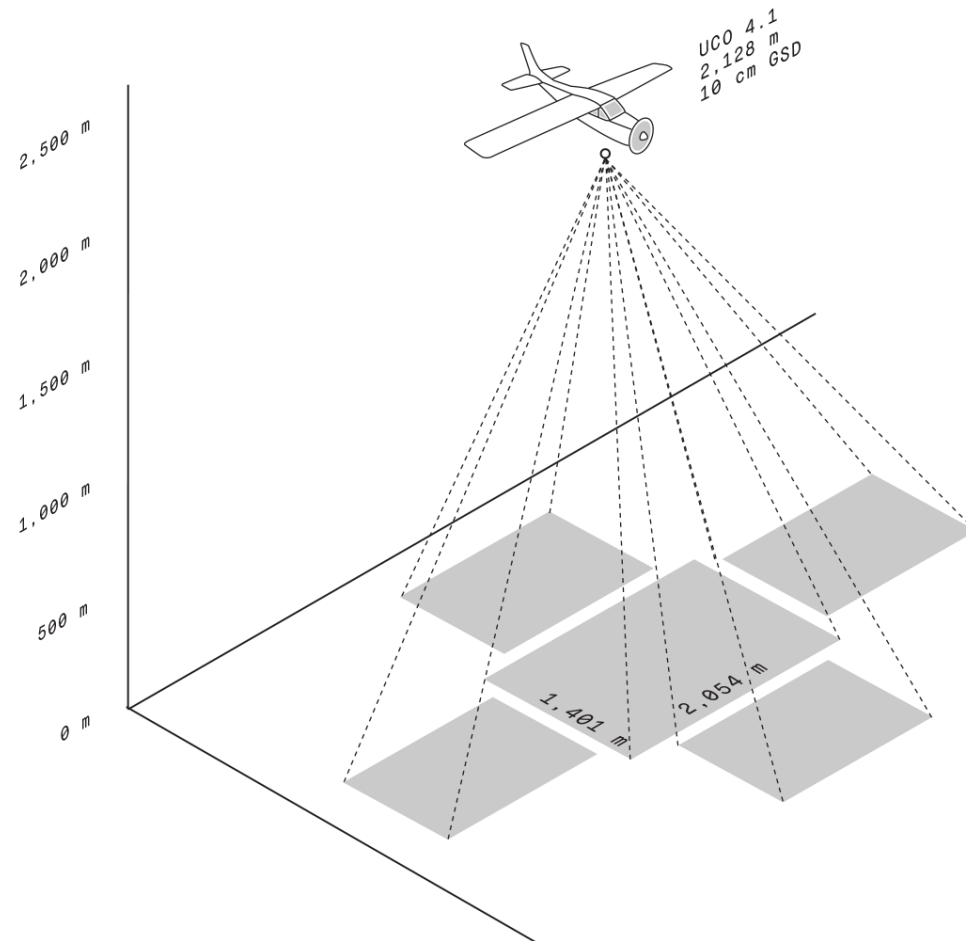
Forward/backward:
Landscape oriented

Left/right: Portrait oriented



UltraCam Osprey 4.1

UNPRECEDENTED FLIGHT COLLECTION EFFICIENCY





Camera systems

BAYER-PATTERN BASED MODELS

UltraCam Merlin 4.1 2010

20,544 x 14,016 pixels

Cost-effective solution

Empowers smaller mapping companies to venture into the aerial services market or diversify their offerings



UltraCam Merlin 4.1 3020

31,300 x 14,016 pixels

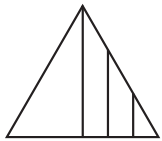
Boosts flight collection efficiency

Ideal for companies seeking an affordable system for larger projects with standard accuracy requirements

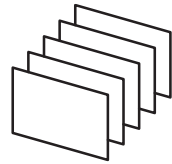


UltraCam Merlin 4.1

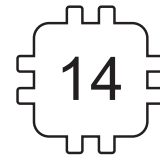
SENSOR SYSTEM



>83 dB at
base ISO



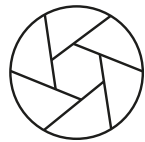
1 frame per
0.7 seconds



14 bits at
4 bands



Adaptive Motion
Compensation
(multi-directional)



Prontor magnetic-0
HS2 shutter
(field exchangeable)



True Pixel
Processing
approach





UltraCam Merlin 4.1 models

LAYOUT AND LENS SYSTEM

2010



2 RGB sensors, focal length of 80 mm
1 NIR sensor, focal length of 50 mm
20,544 x 14,016 pixels

3020

3 RGB sensors, focal length of 120 mm
2 NIR sensors, focal length of 80 mm
31,300 x 14,016 pixels



Hybrid systems

ULTRACAM DRAGON 4.1

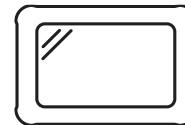


System Components

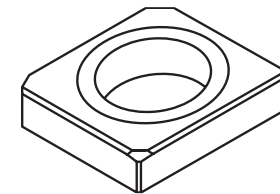
Cameras

LiDAR scanner

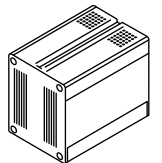
UltraNav v7 (610 level)



3 Vexcel IPTs for camera,
LiDAR scanner & UltraNav
plus 1 pilot display



UltraMount
GSM 4000



4th generation
data units
(16, 32 TB)



UltraCam Dragon 4.1

SYSTEM DESIGN





UltraCam Dragon 4.1

SYSTEM DESIGN

3.76 μm CMOS
Custom lenses

1 x 150 MP NIR nadir
14,144 x 10,560 pixels



1 x 150 MP RGB nadir
14,144 x 10,560 pixels

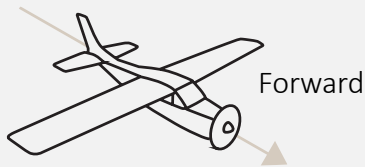
4 x 150 MP RGB oblique
14,144 x 10,560 pixels



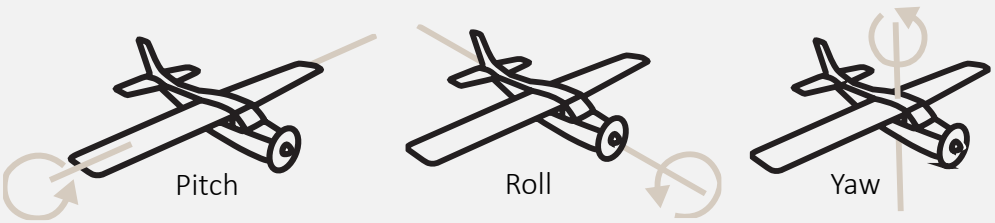
Challenging image motion compensation

DIFFERENT TYPES OF MOTION BLUR IN AERIAL IMAGERY

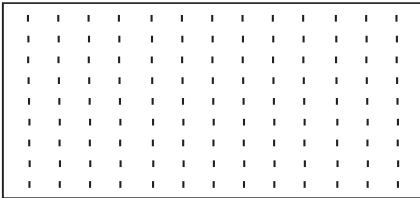
TRANSLATIONAL MOTION



ROTATIONAL MOTION

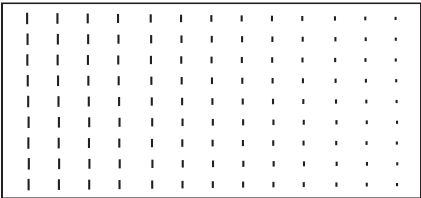


UNIFORM FORWARD MOTION BLUR



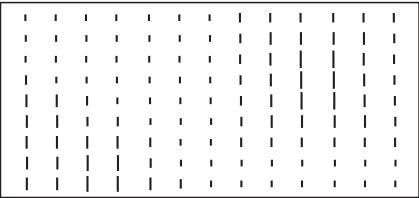
Constant image scale
and flat terrain (nadir)

NON-UNIFORM FORWARD MOTION BLUR



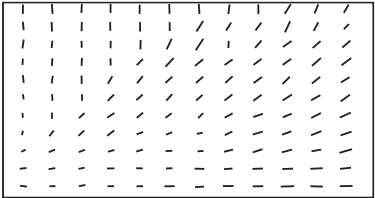
Varying image scale
and flat terrain
(oblique)

NON-UNIFORM FORWARD MOTION BLUR



Constant image scale
and mountainous
terrain

NON-UNIFORM MOTION BLUR IN DIFFERENT DIRECTIONS



Turbulences etc



Adaptive Motion Compensation (AMC)

PROCESSING OVERVIEW

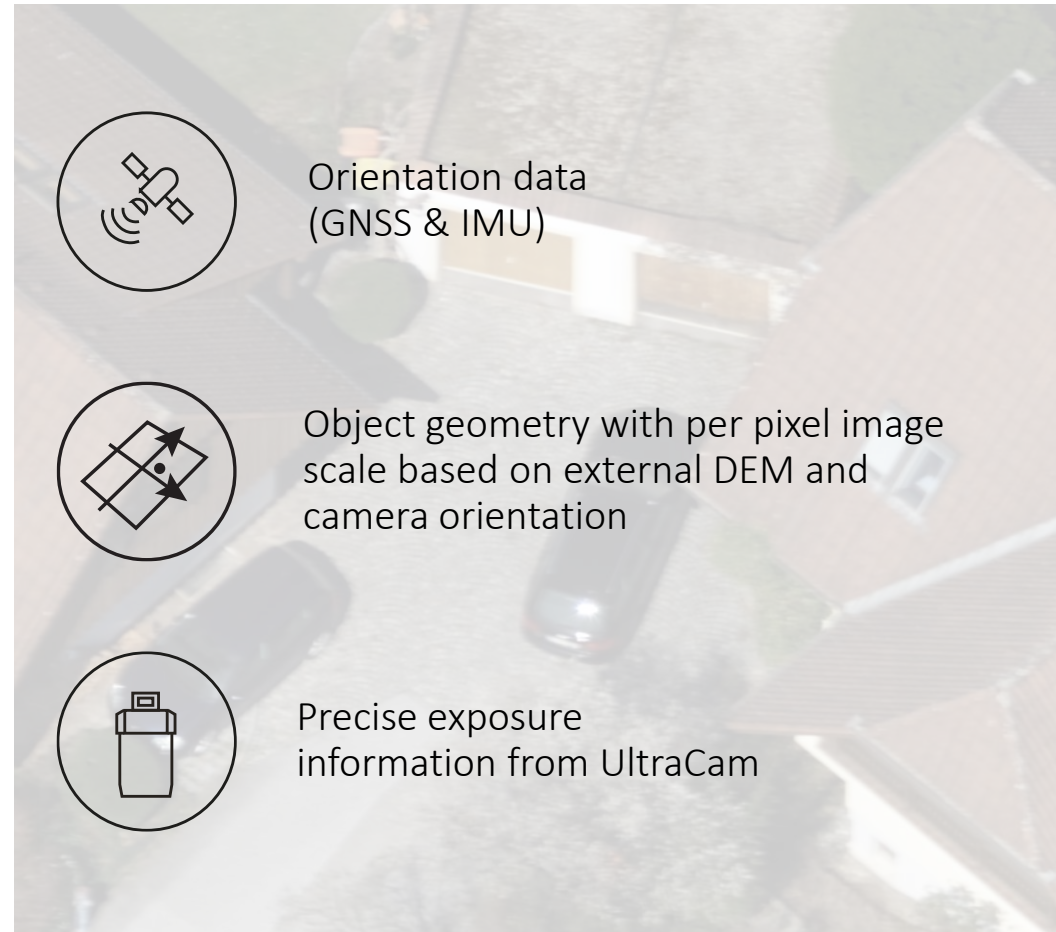


Blurry
Image



Adaptive Motion Compensation (AMC)

PROCESSING OVERVIEW



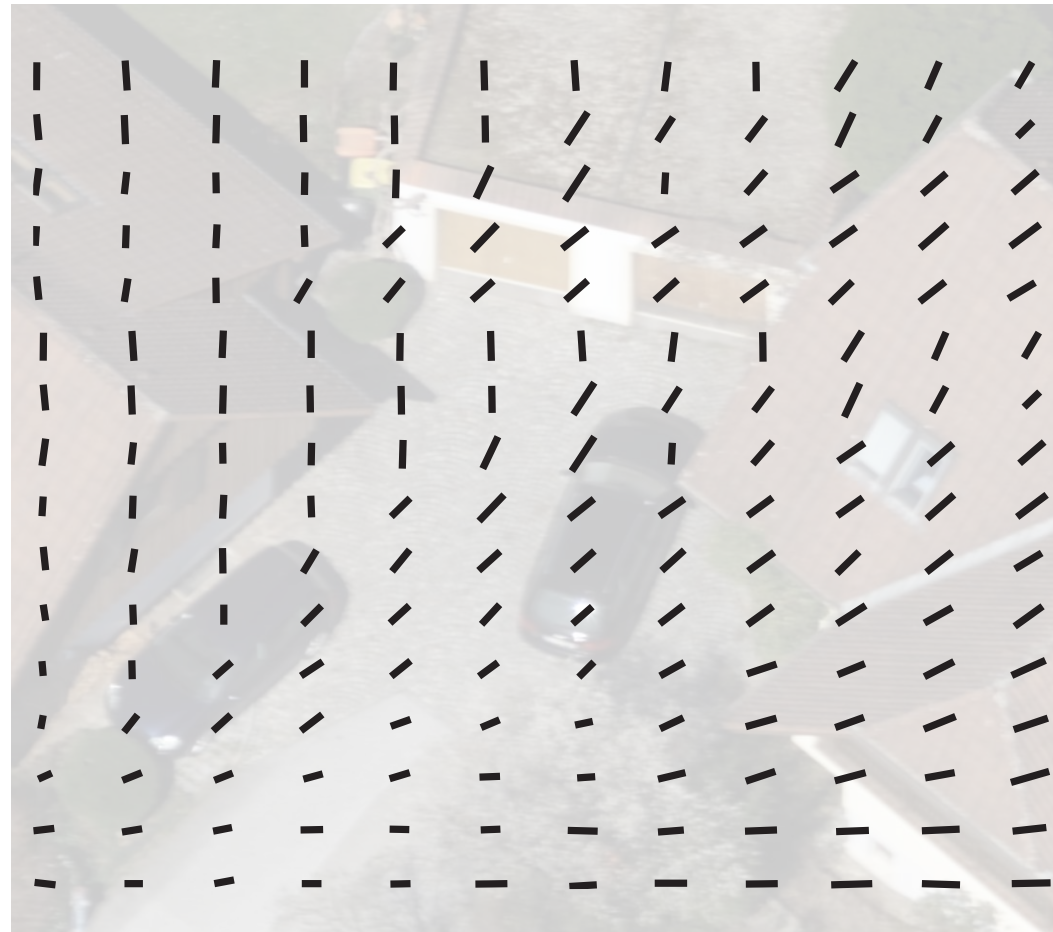
Raw
Image

Three
Known
Factors



Adaptive Motion Compensation (AMC)

PROCESSING OVERVIEW



Raw
Image

Three
Known
Factors

Compute
PSFs



Adaptive Motion Compensation (AMC)

PROCESSING OVERVIEW



Raw
Image

Three
Known
Factors

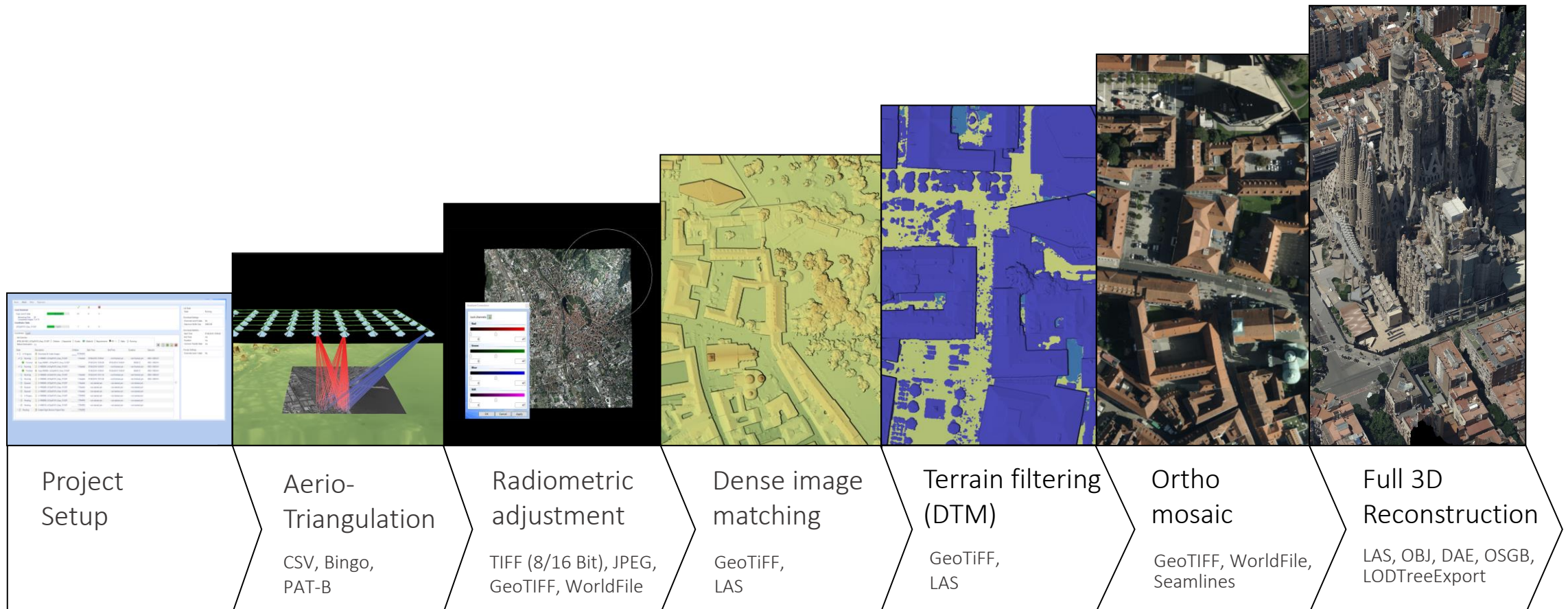
Compute
PSFs

Solve
Blur
Model



UltraMap

PHOTOGRAMMETRIC WORKFLOW FULLY INTEGRATED IN ONE APPLICATION





Modul #1

ULTRAMAP

ESSENTIALS

Apply camera calibration to raw data

Image postprocessing (ACM)

Automated project setup

Automated colour balancing

Radiometric adjustment of images

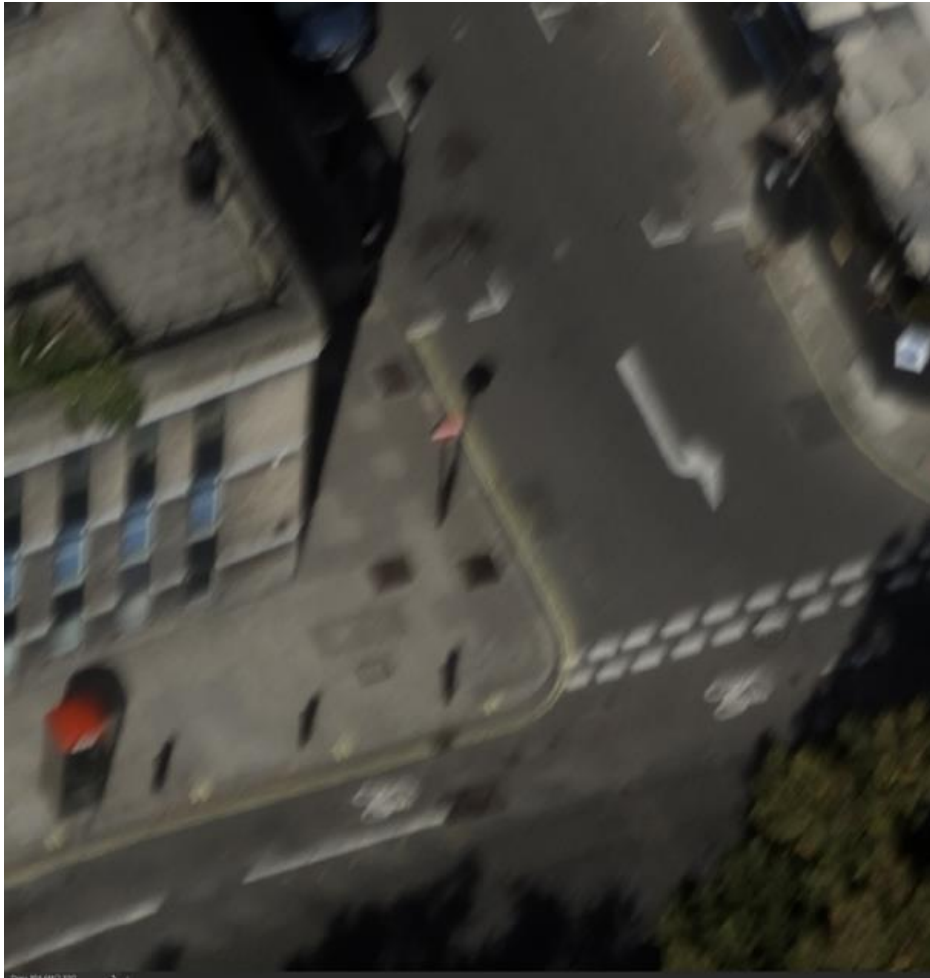
Image export



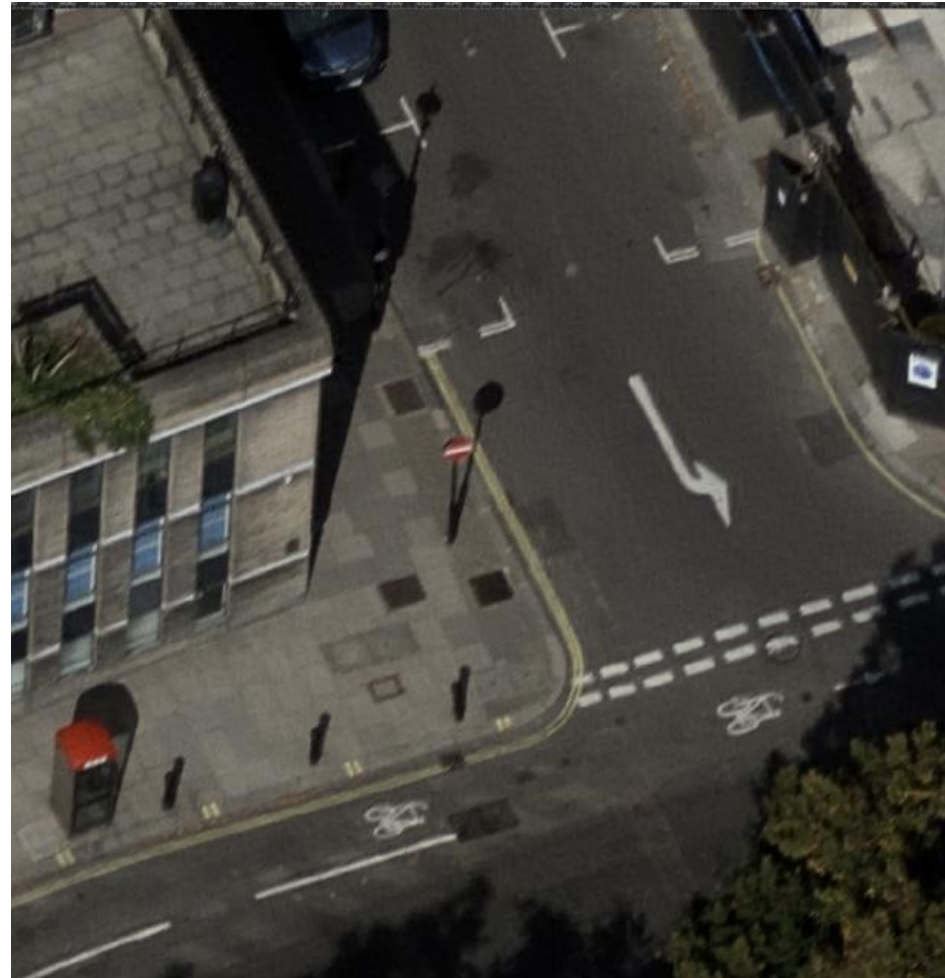


ULTRAMAP

ESSENTIALS



AMC OFF



AMC ON

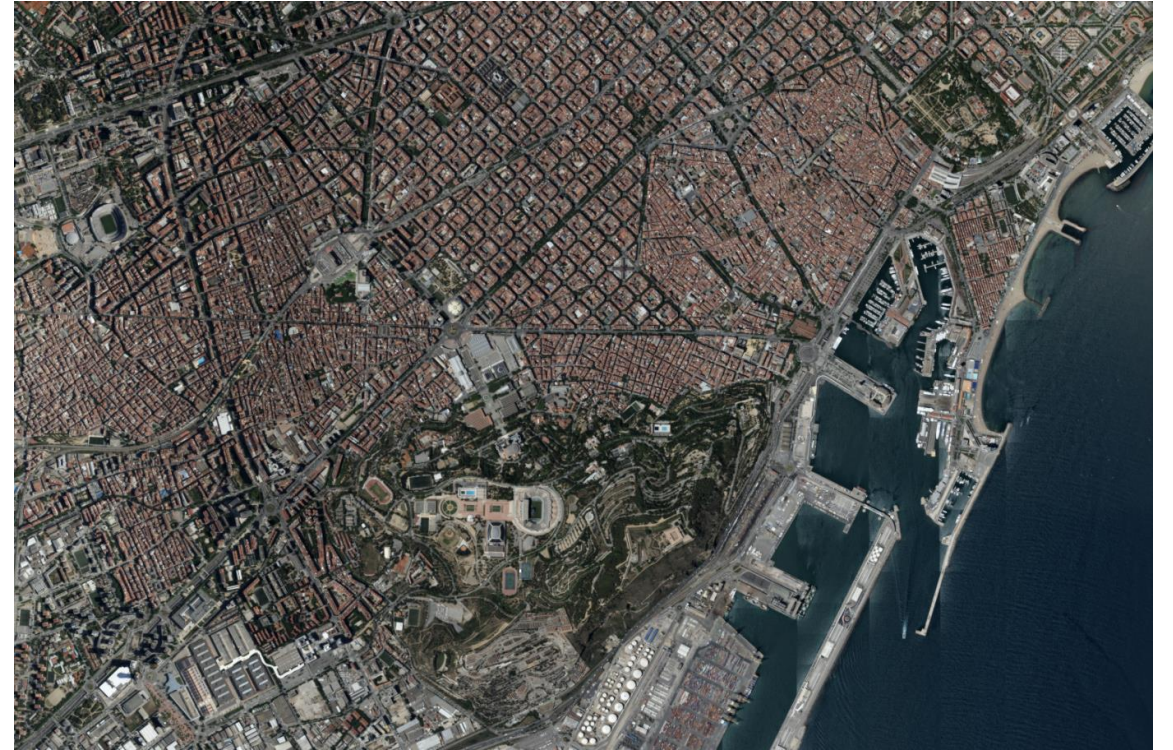


ULTRAMAP

ESSENTIALS



without color balancing



with color balancing



Modul #2

ULTRAMAP

AT

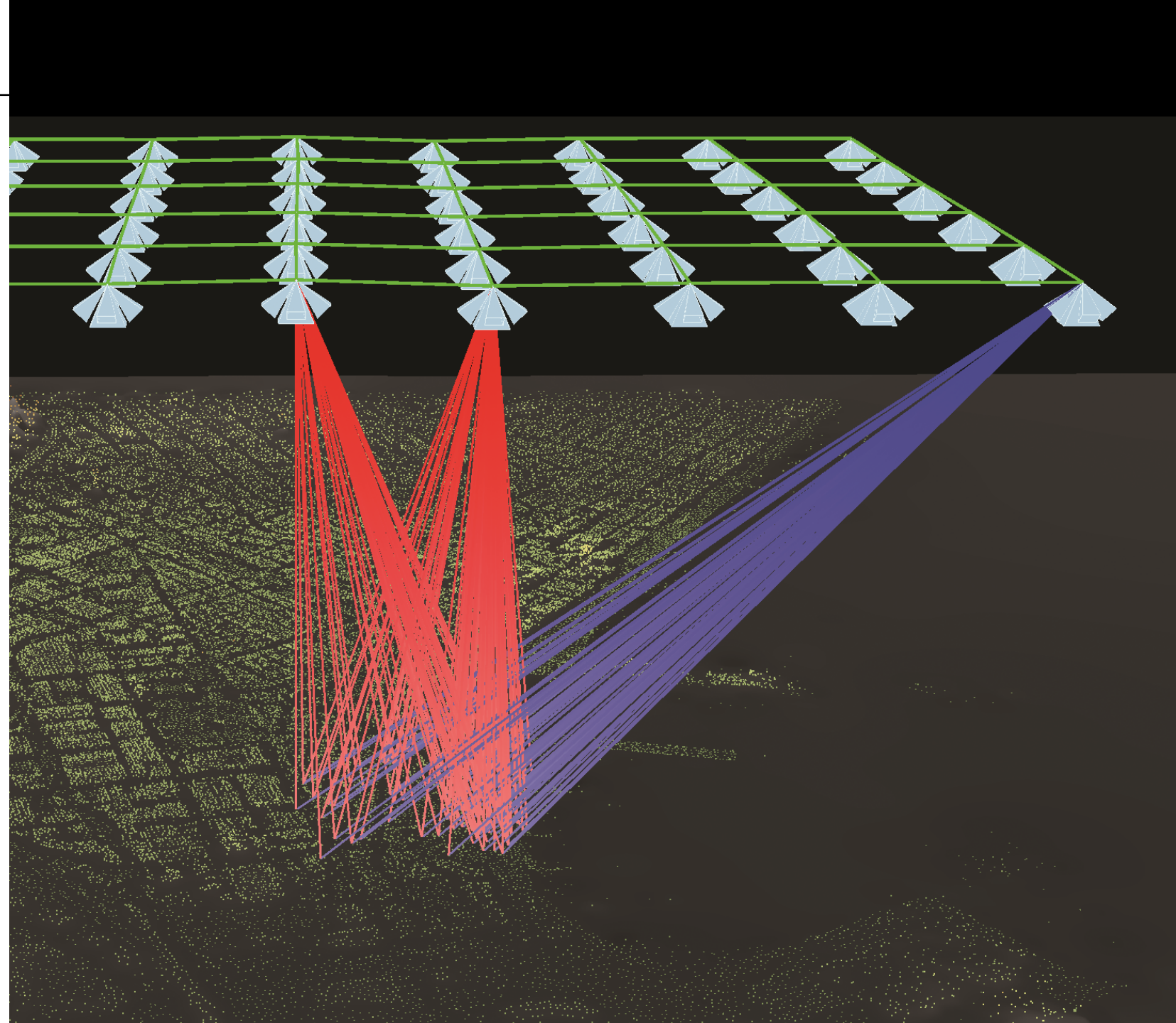
Automated extraction of tie points
(nadir & oblique)

Optional: Ground control point
measurement

Optional: Import GPS/IMU

Bundle adjustment

Analysis, reporting and exporting





Modul #3

ULTRAMAP

DENSE MATCHER

Dense image matching

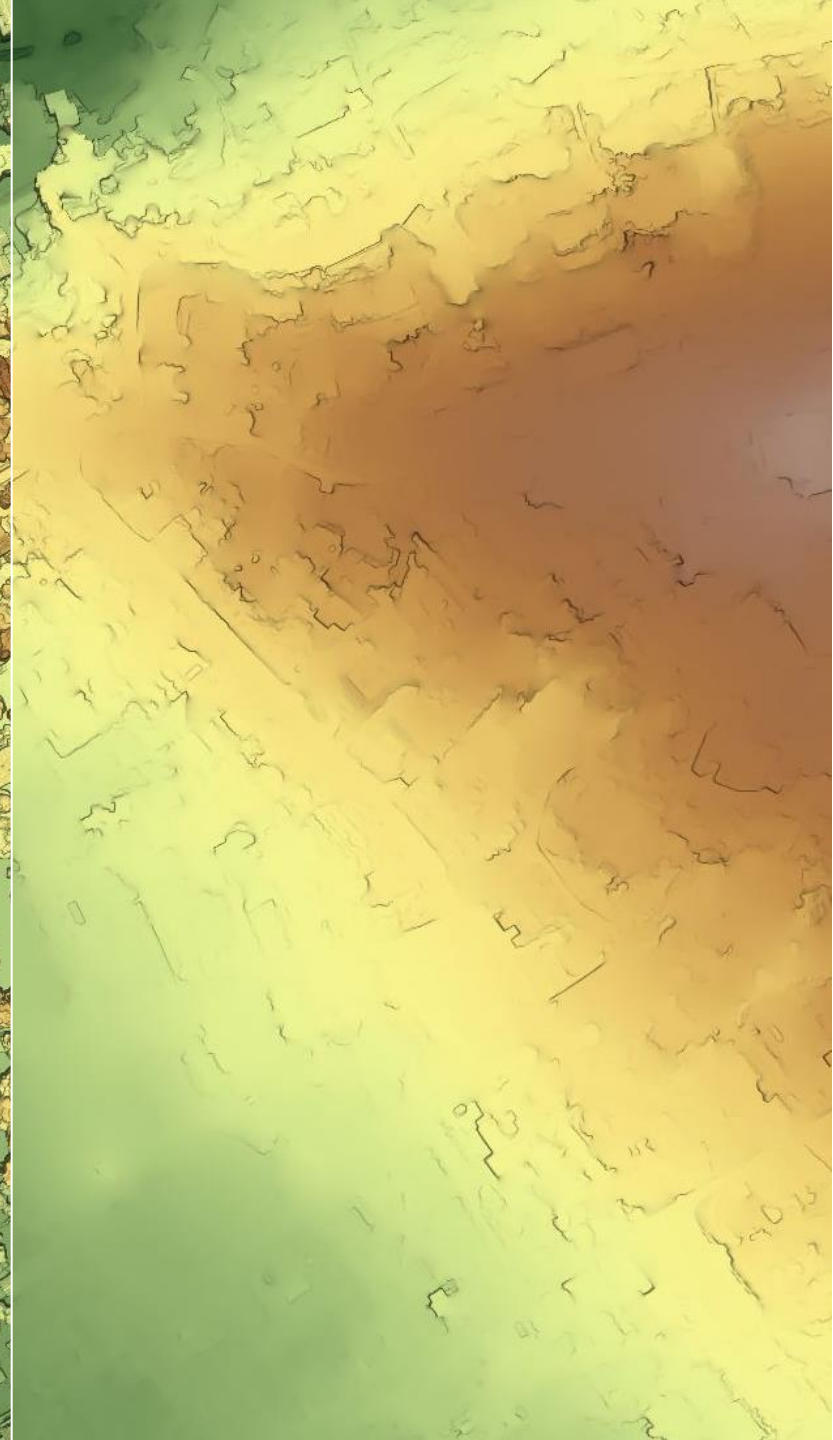
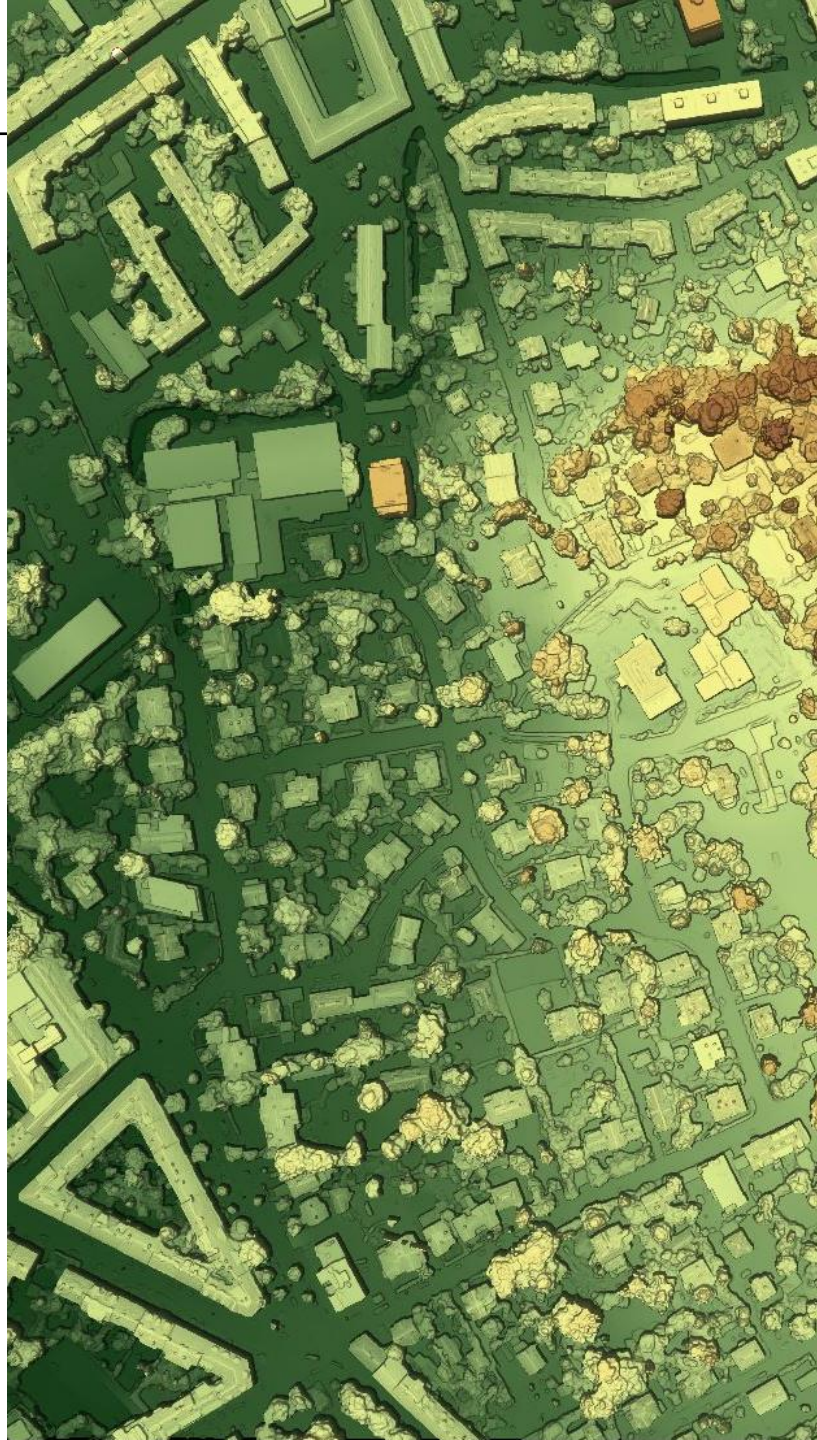
Semantic image classification

Digital Surface Model (DSM)

Digital Terrain Model (DTM)

Optional: editing of DSM/DTM

Export





Modul #4

ULTRAMAP

ORTHO PIPELINE

Dense image matching

Semantic image classification

Digital Surface Model (DSM)

Digital Terrain Model (DTM)

Optional: editing of DSM/DTM

Export





ULTRAMAP

ORTHO PIPELINE



DSM Ortho RGB



DSM Ortho CIR



ULTRAMAP

ORTHO PIPELINE



DTM Ortho RGB



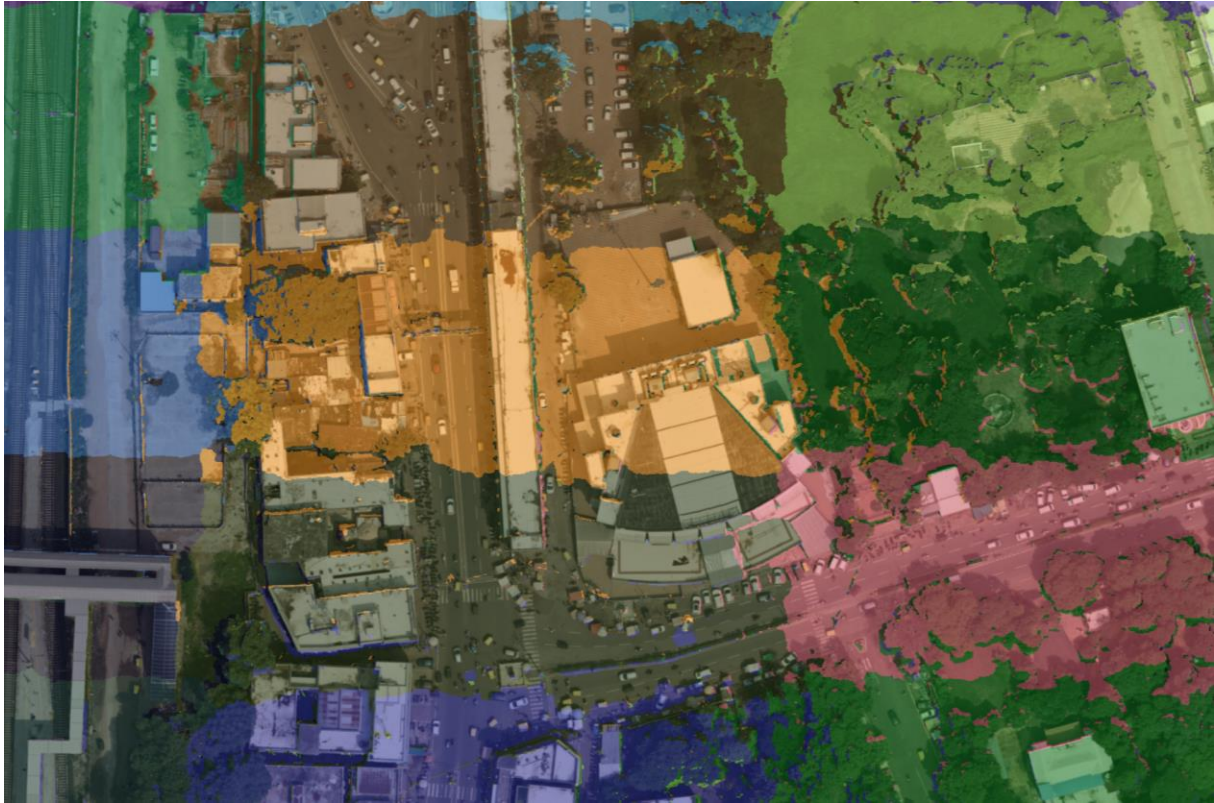
DTM Ortho CIR



ULTRAMAP

ORTHO PIPELINE

Seamlines DSMOrtho



Seamlines DTMOrtho





Modul #5

ULTRAMAP

3D

Fully automated 3D reconstruction

All UltraCams (nadir only or nadir & obliques)

3D mesh and pointcloud

Export





Global Aerial Imagery Program



VEXCEL
DATA PROGRAM



Miami Beach, FL

Global Footprint

40+ Countries



Imagery Products



Nadir & Oblique images

- Collected at 45°, multiple views (north, south, east, west)
- Detailed view of properties and neighborhoods
- Urban area collection
- 7.5cm resolution



DSMOrtho

- No building lean or seamlines; color balanced; top-down
- Urban area collection
- Insight for rooftops and property surroundings
- 7.5cm resolution



DTMOrtho

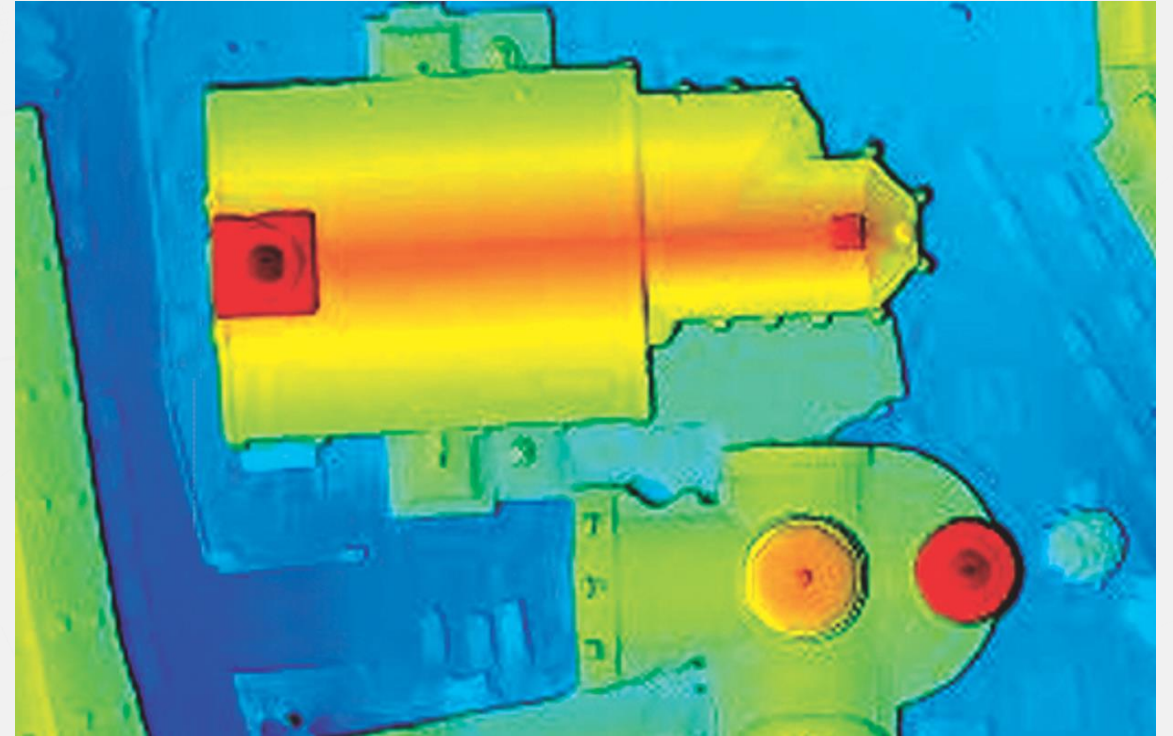
- Straight-down aerial view of buildings, parcels, and farmlands
- Urban and rural collection
- Insight for rooftops and property surroundings
- 15-20 cm resolution

Imagery Products



RGB + NIR/CIR

- Near-infrared channel on camera sensors
- Optimal for classification on vegetation and fire risk
- Wide and Urban Area collection programs



Elevation

- Digital Surface Models (DSM)
 - Urban and Wide Area collection programs
- Digital Terrain Models (DTM)
 - Wide Area collection programs

Imagery Products

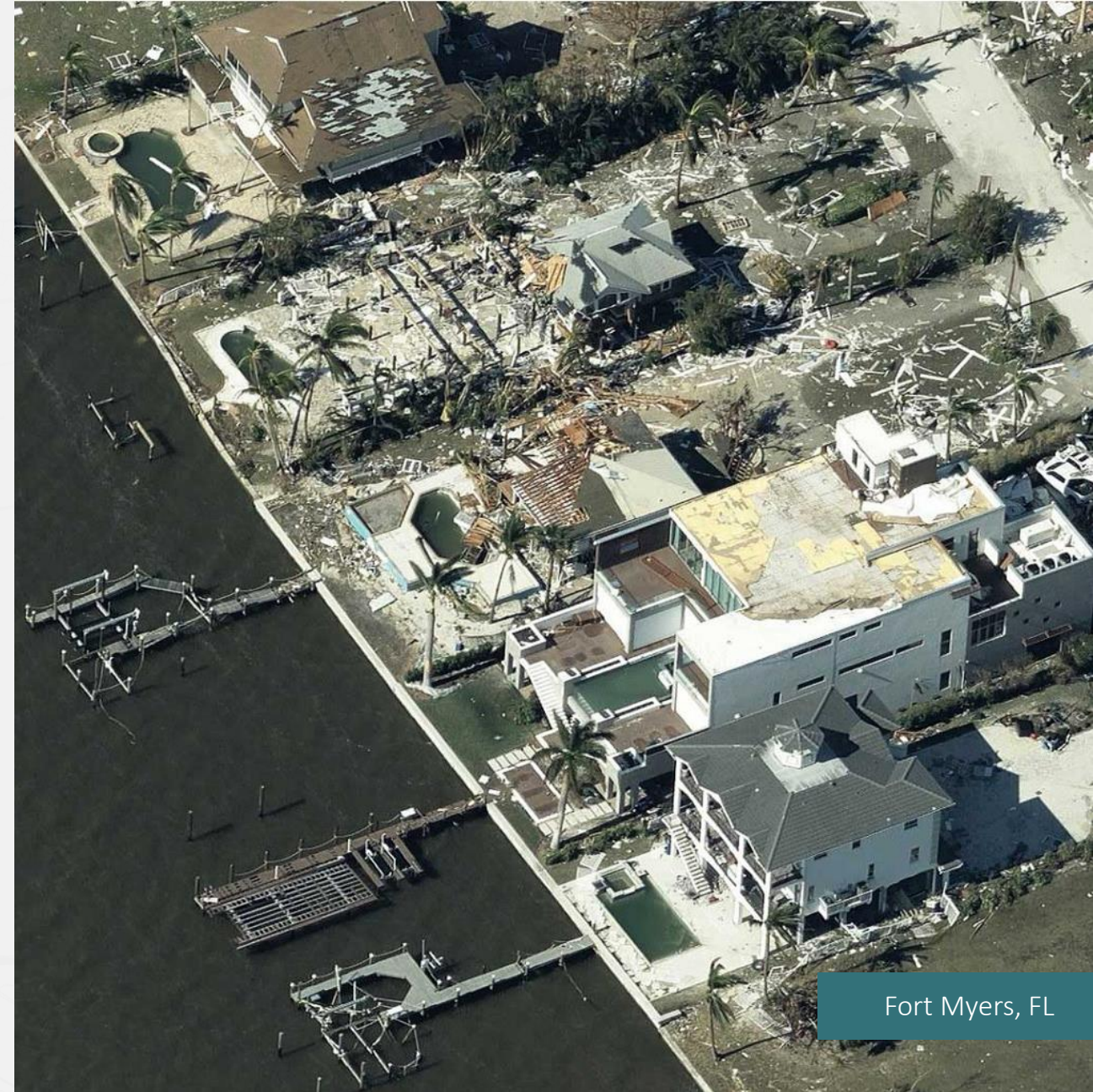


3D Mesh

- 3D models of more than 60 metro areas
- Further areas in 3D on demand

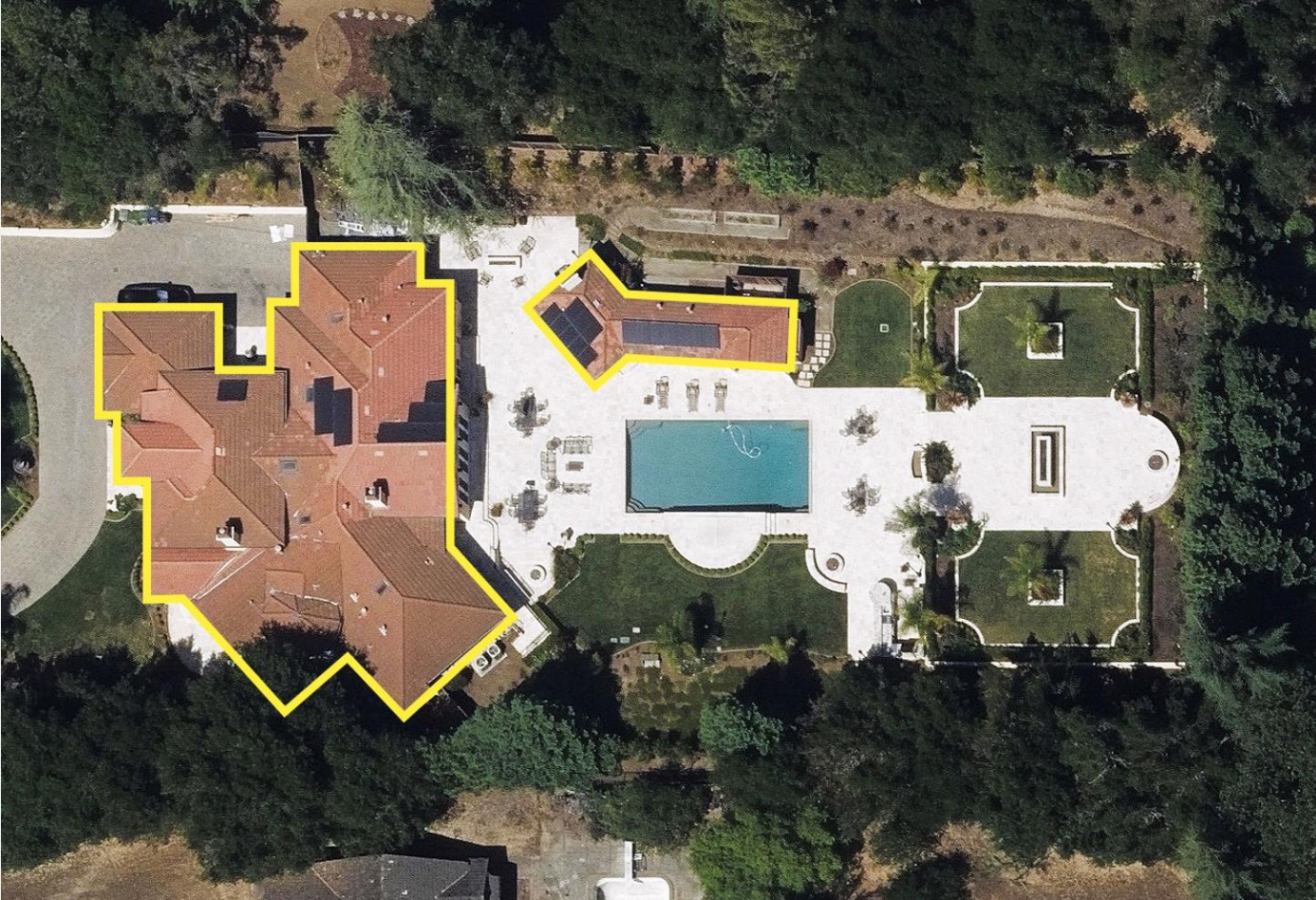
Gray Sky

- Collecting post-CAT imagery since 2017
- Dedicated program to monitor weather and major disasters
- Collecting imagery of impacted properties after wildfires, tornadoes, and hurricanes in the U.S.
- On-demand Gray Sky collections in other countries
- Imagery published ASAP; usually within 24 hours of wheels down on aircraft
- AI-derived damage assessments on Gray Sky imagery
- Before/after comparisons
- Vexcel has historical imagery of urban/rural areas across U.S.



Fort Myers, FL

AI-Derived Products at Scale



Building Footprints

- Geometry of building footprint

Building Attributes

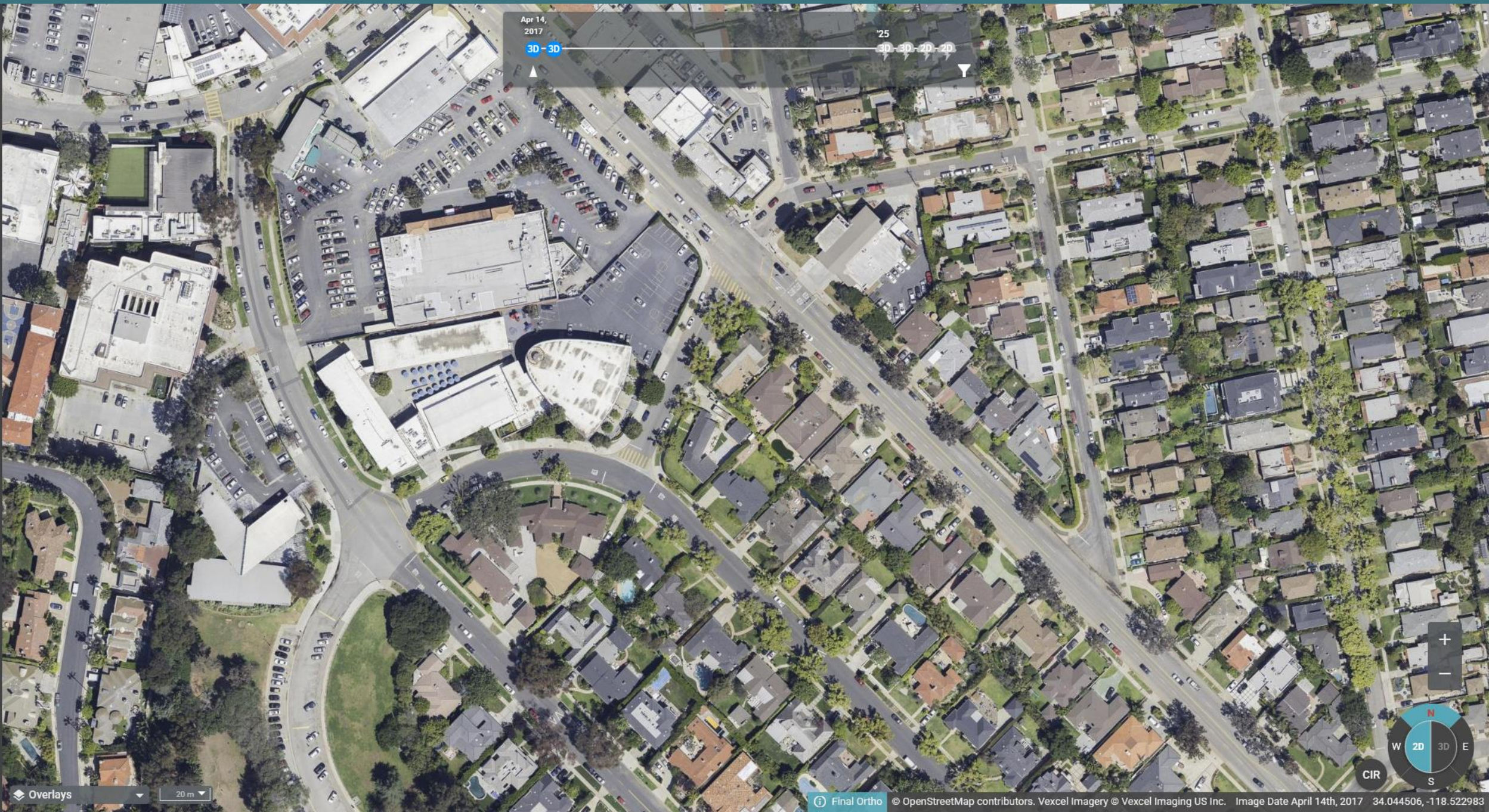
- 20+ building and structure attributes
- Available for current and historical imagery

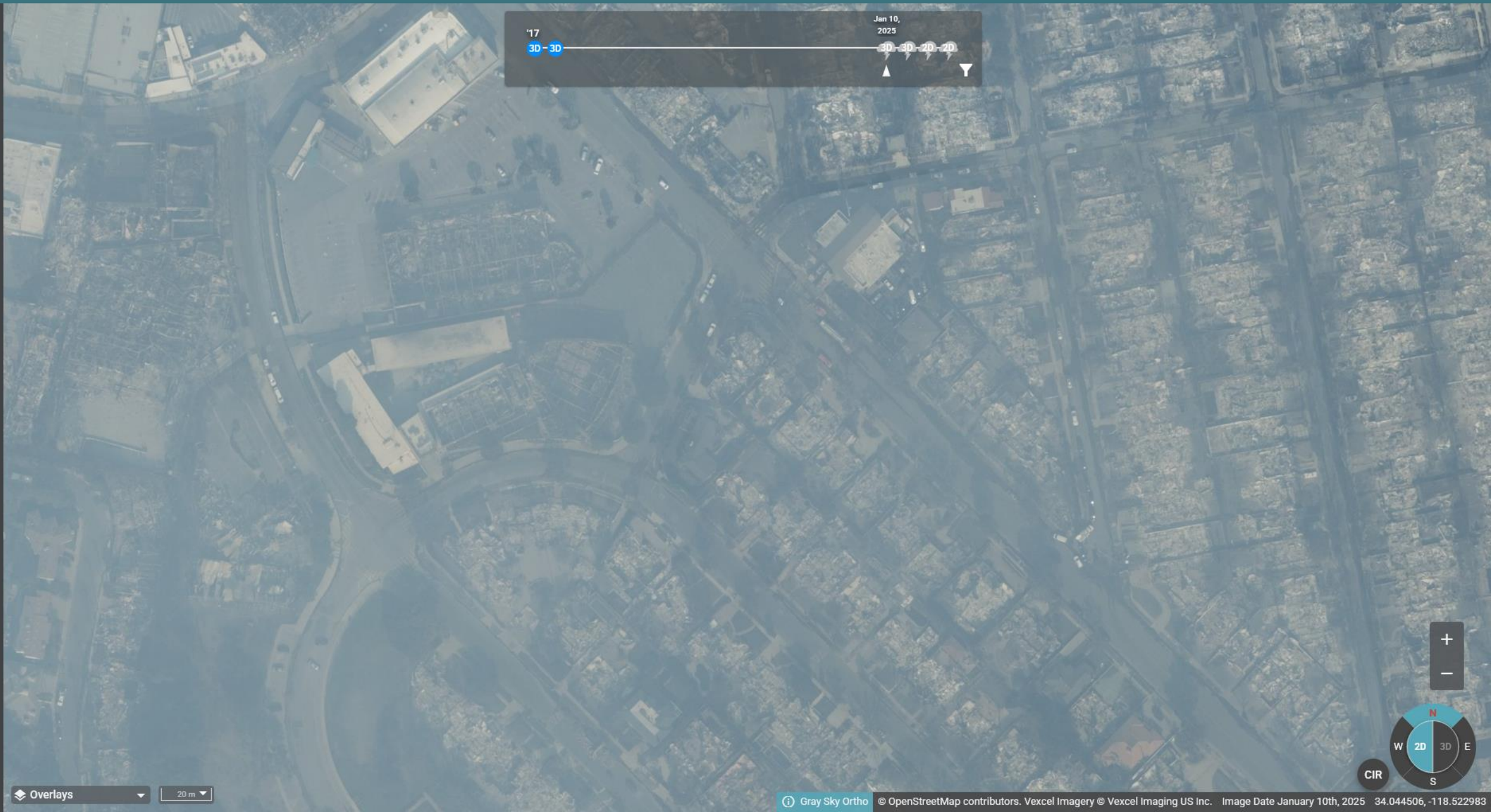
Property Attributes & Reports

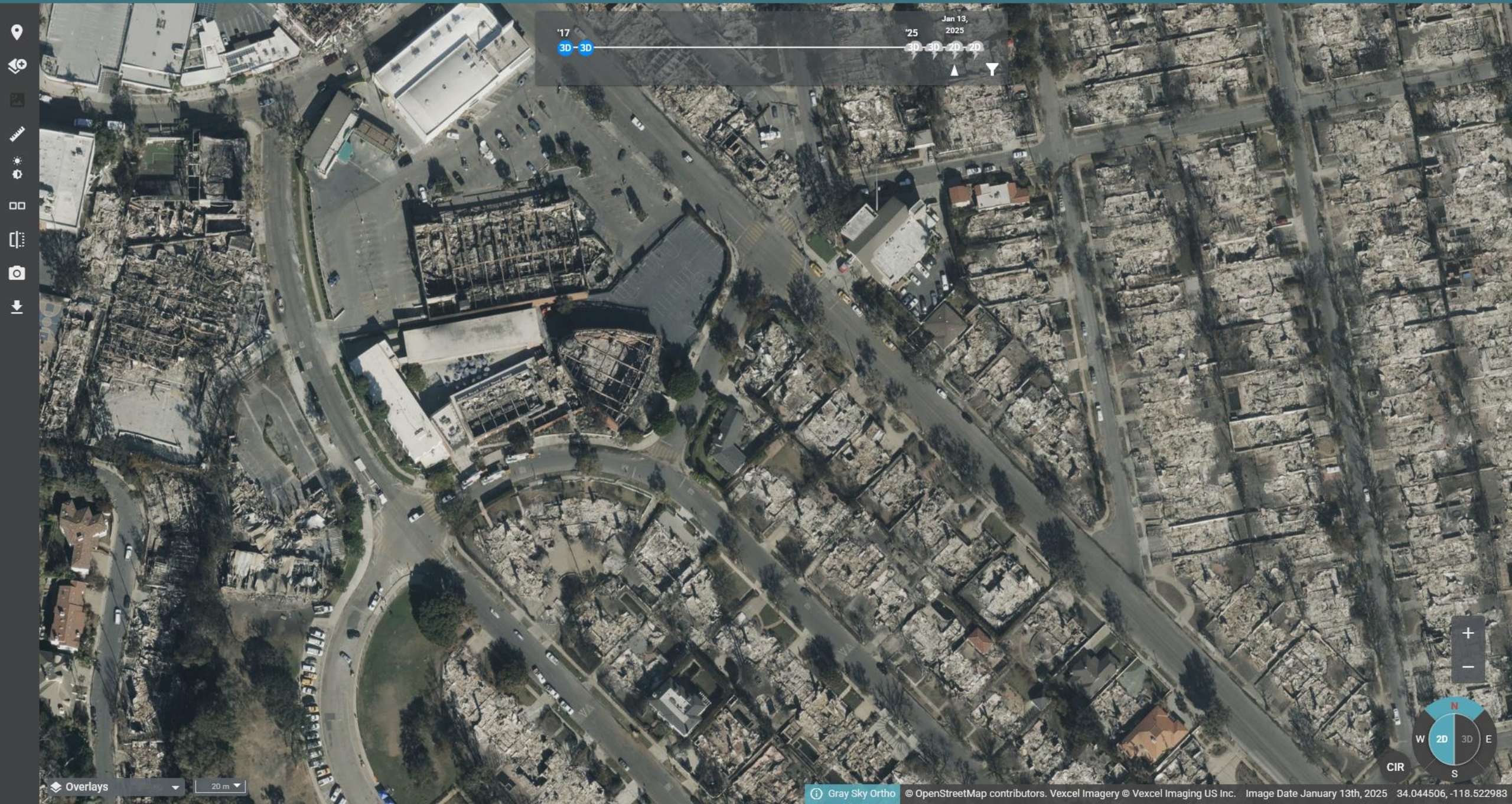
- 20+ attributes for properties
- See footprint area, roof condition, solar panels, pools, hardscape information, and more
- 100 million properties in U.S.; buildings in 40+ countries

Damage Assessment & Reports

- Post-disaster analysis on impacted properties
- Available for all Gray Sky disaster collection from 2022 and forward

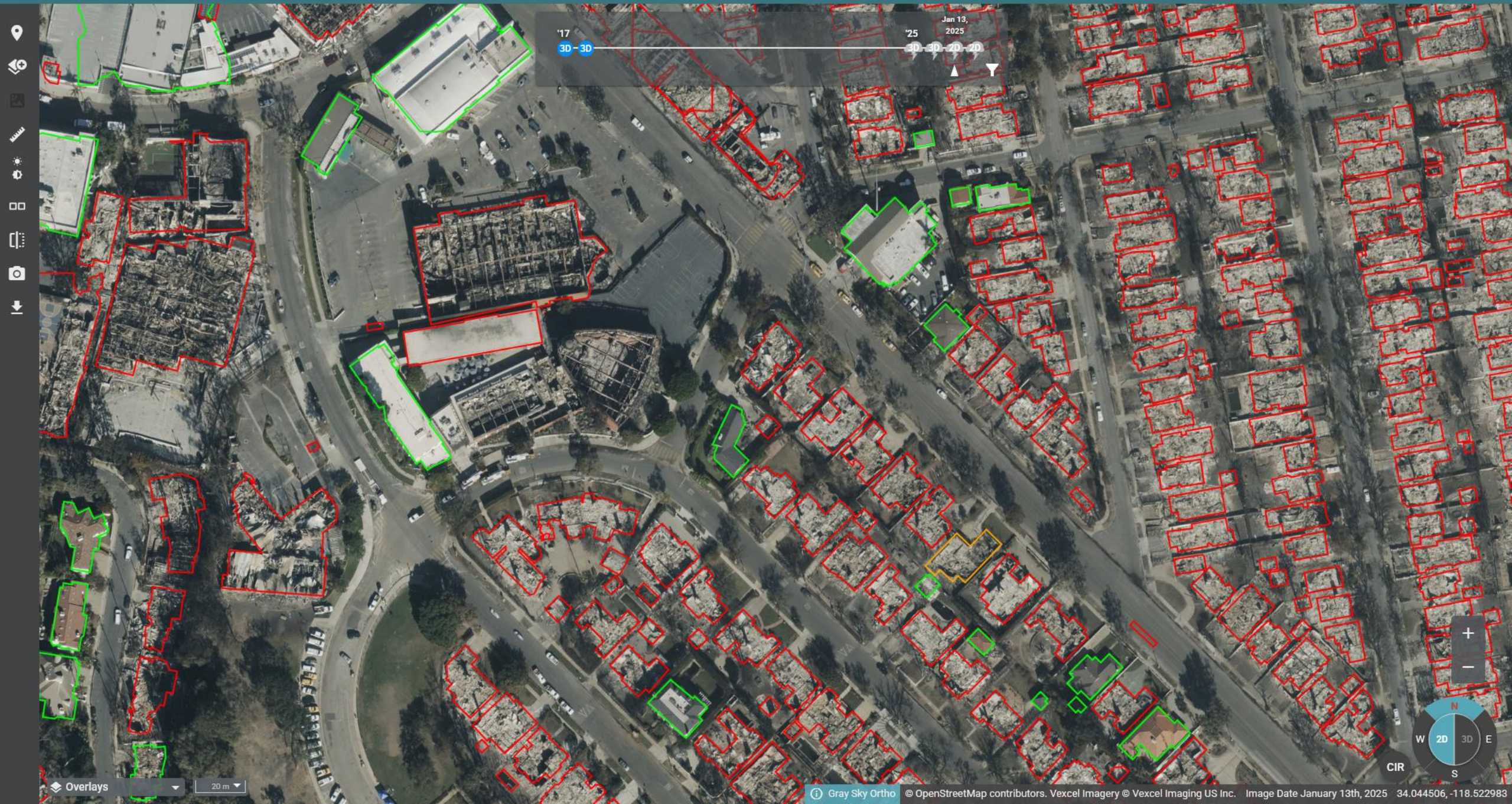




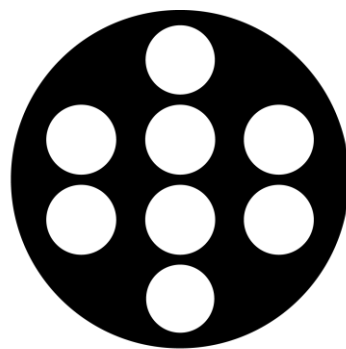


Timeline and 3D view controls:

- '17
- 3D - 3D
- 25
- Jan 13, 2025
- 3D - 3D - 2D - 2D



Timeline: '17 3D-3D | '25 Jan 13, 2025 3D-3D-2D-2D



VEXCEL
IMAGING

Thank you!