Teledyne Geospatial

Peter Pallos, 2023

Teledyne:

Enabling Technologies
to Sense, Transmit and Analyze
Information

Everywhere**you**look™

TELEDYNE TECHNOLOGIES
Reporting Segments

Instrumentation
Oscilloscopes, Protocol Analyzers
Air and Water Quality Analyzers
Marine Instrumentation, Sonar,
Acoustic Doppler Current Profilers, AUVs

Digital Imaging
Image Sensors, Cameras, Image
Processors, Software,
X-Ray and RF Systems, Lidar, GIS,
MEMS, Chipsets, FLIR

Aerospace & Defense Electronics
Avionics, Communication Components and
Subsystems, Interconnects
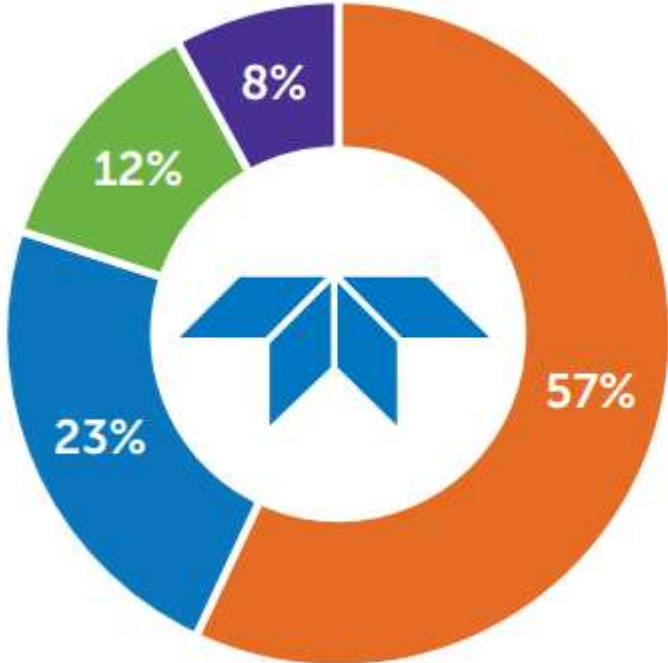
Engineered Systems
System Engineering, Advanced
Manufacturing, Energy Systems, Turbines

TELEDYNE TECHNOLOGIES
Revenue Breakdown

2022 Revenue: $5.458 billion*

Instrumentation ▮ (blue)

Imaging* ▮ (orange)

Engineered Systems ▮ (purple)

Aerospace & Defense Electronics ▮ (green)

* Includes FLIR & Geospatial
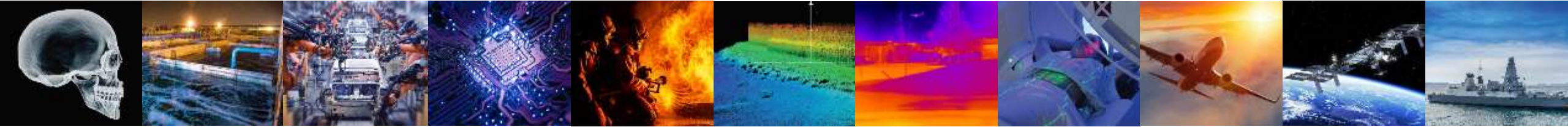

57%
23%
12%
8%

WHERE WE ARE

Legend:
- 🔴 Corporate Services & Finance
- 🔵 R&D and Manufacturing
- 🟡 Sales and Technical Customer Support
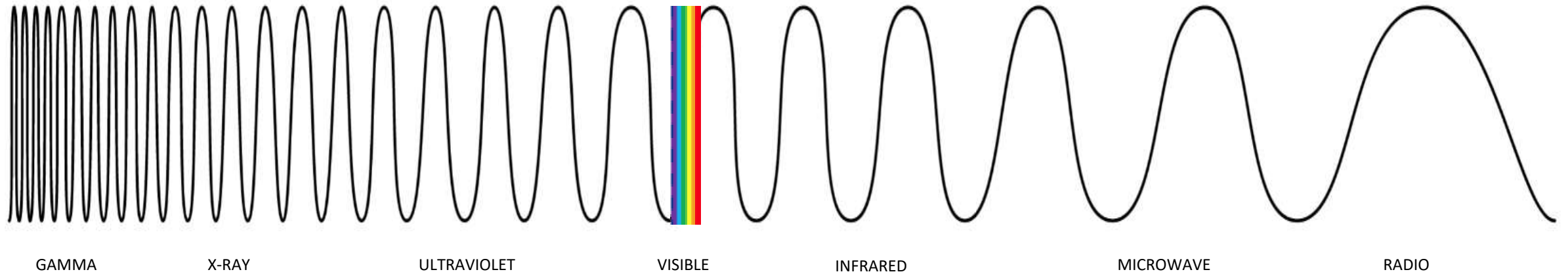
14,700 employees worldwide across 37 countries

TELEDYNE IMAGING

Full Spectrum of Imaging Technology

All Wavelengths, All Applications: From Deep Sea to Deep Space

GAMMA   X-RAY   ULTRAVIOLET   VISIBLE   INFRARED   MICROWAVE   RADIO

MORE THAN THE SUM OF OUR PARTS

Teledyne Digital Imaging

Teledyne DALSA
Teledyne e2V
Teledyne ICM
Teledyne Lumenera

Teledyne Geospatial (Optech + Caris)
Teledyne Photometrics
Teledyne Princeton Instruments
Teledyne Acton Optics

Teledyne Imaging Sensors
Teledyne Scientific
Teledyne Judson
Teledyne FLIR

Teledyne Geospatial

- A Business Unit of Teledyne Imaging, part of Teledyne Technologies
- Built on core from two leading companies with expertise in both software and hardware solutions
- Global presence offices in North America, Europe and Asia ~250 employees
- Evolving from products to solutions to meet growing needs of Geospatial Industry
- Solutions covering data capture, processing, analytics, product generation and distribution
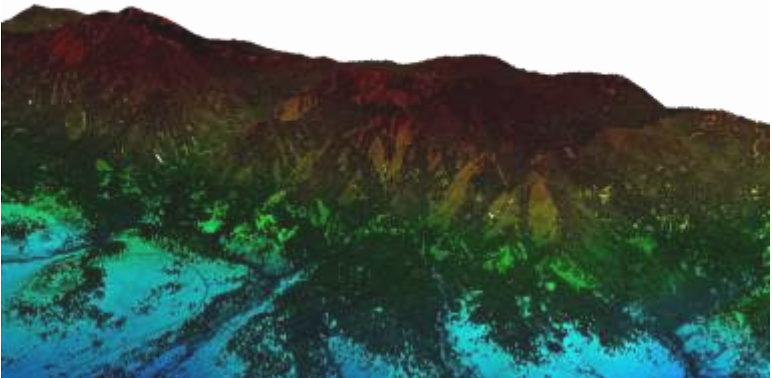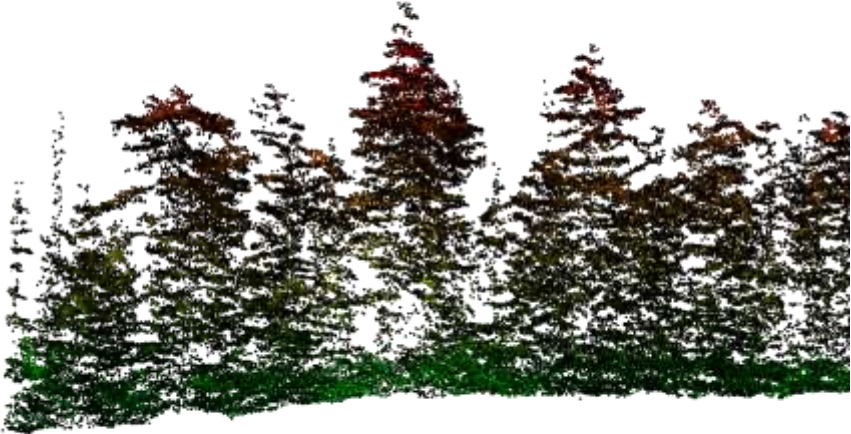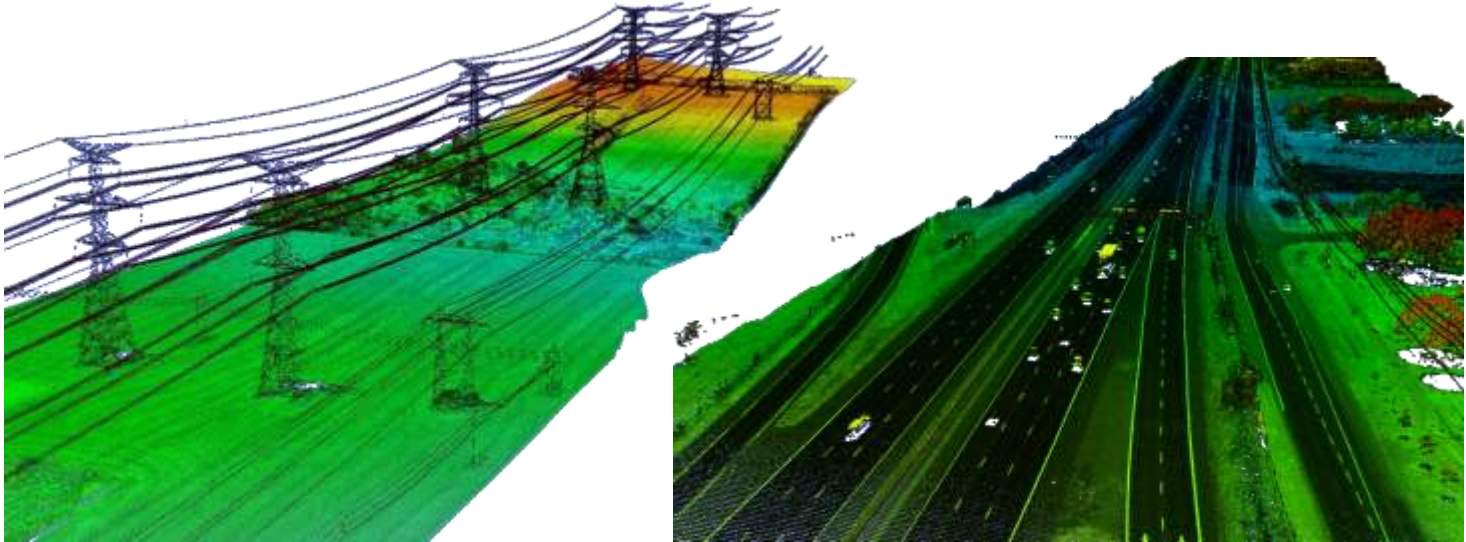
A full portfolio for Land & Sea applications
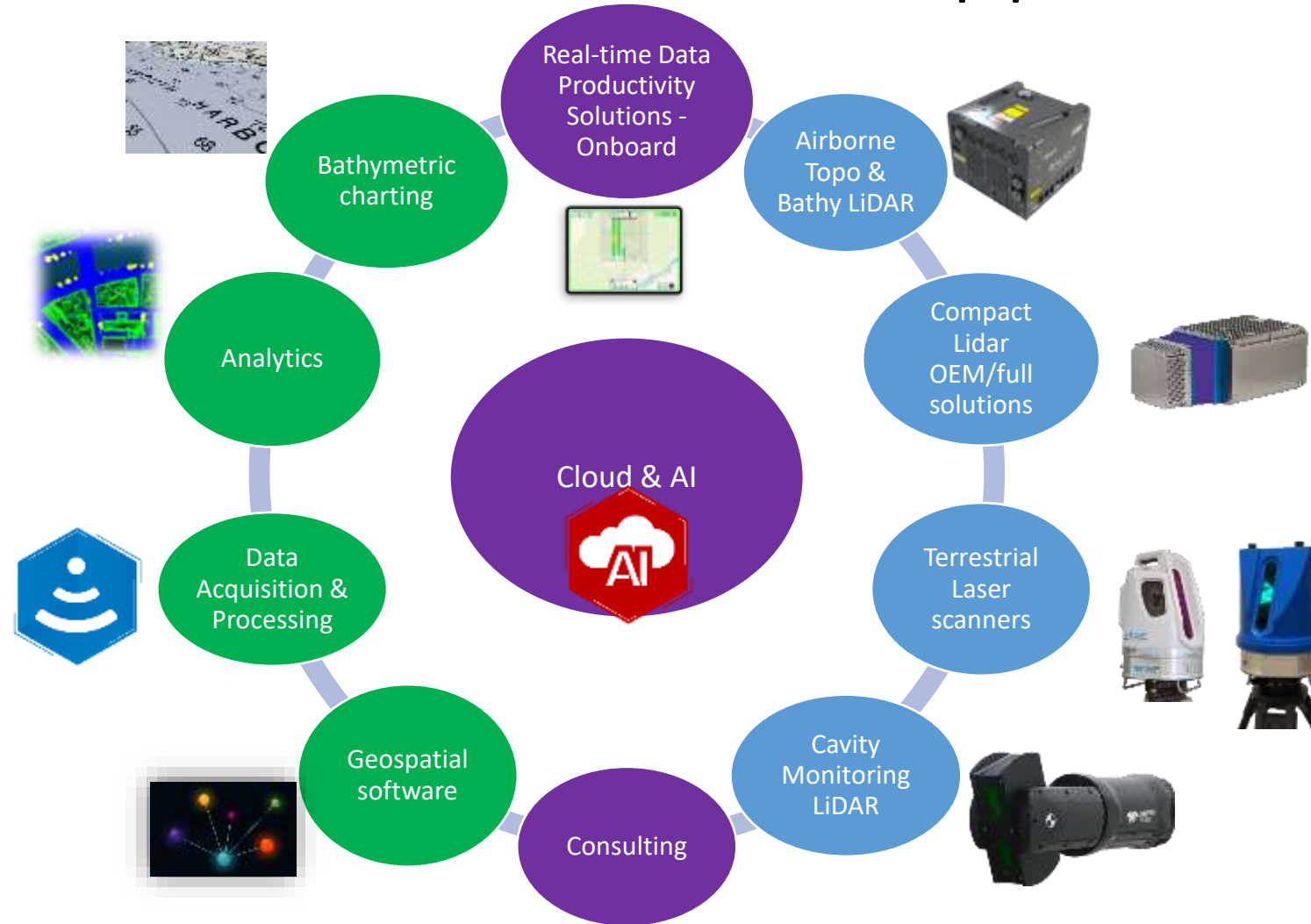
What is lidar?

- stands for **Li**ght **D**etection **A**nd **R**anging
- laser-based imaging technology
- results in 3D measurements of physical targets
- traditionally for "surveying and mapping", although changing
- deployed on tripods, cars, trains, drones, airplanes, space

Lidar system

=

Laser range-finder

+

Scanning mirror

+

GPS (position)

+

IMU (orientation)

Results in a 3D model – a 'point cloud'

What makes lidar data unique?

i.e. a 3D point cloud. So what?

- **Three dimensional:** Can derive shape, size, volume, proximity, etc.

- **Vertically rich**: can see through vegetation

- **'Colorized'**: inherently has intensity color, but can be multispectral (for bathymetry to) and can utilize camera image color fusion

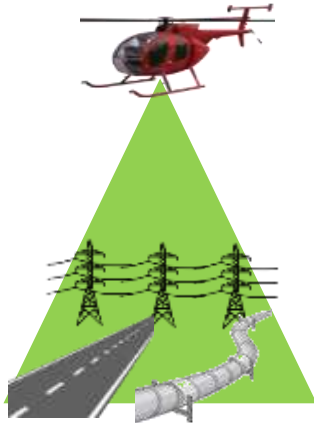- **Accurate:** centimetric accuracy to detect (positional) change

What the camera sees
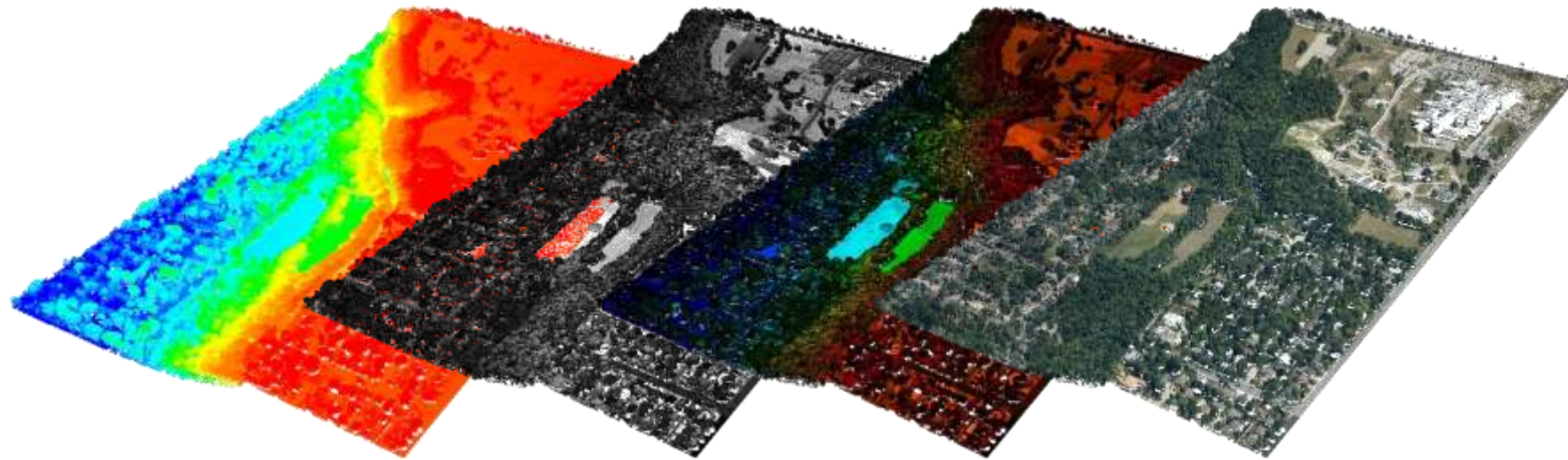
Lidar – elevation, i.e. "depth" of features & intensity, i.e. "color" of features

AIRBORNE LIDAR

Airborne Market Segments

ISR
(5000-7000m)

WIDE AREA
(1000-2500m)

Corridor
(300-500m)

25-35+ points/m2 → 100 points/m2
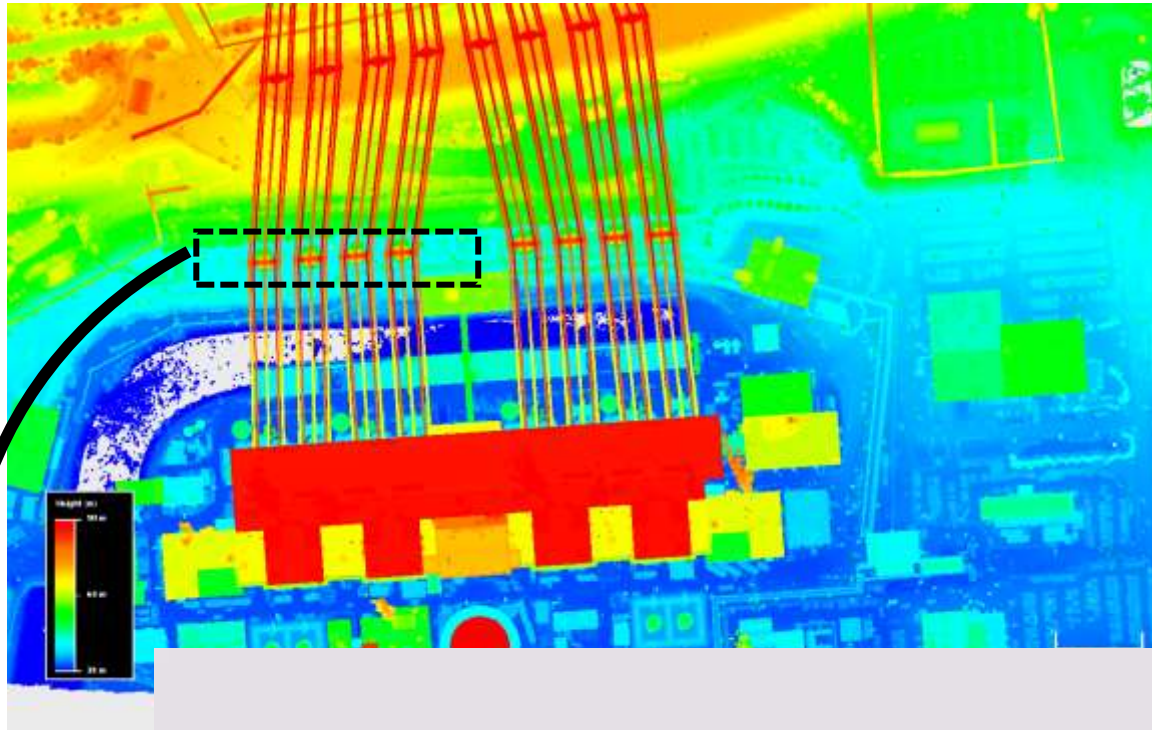
2-8 points/m2 → 10-12 points/2
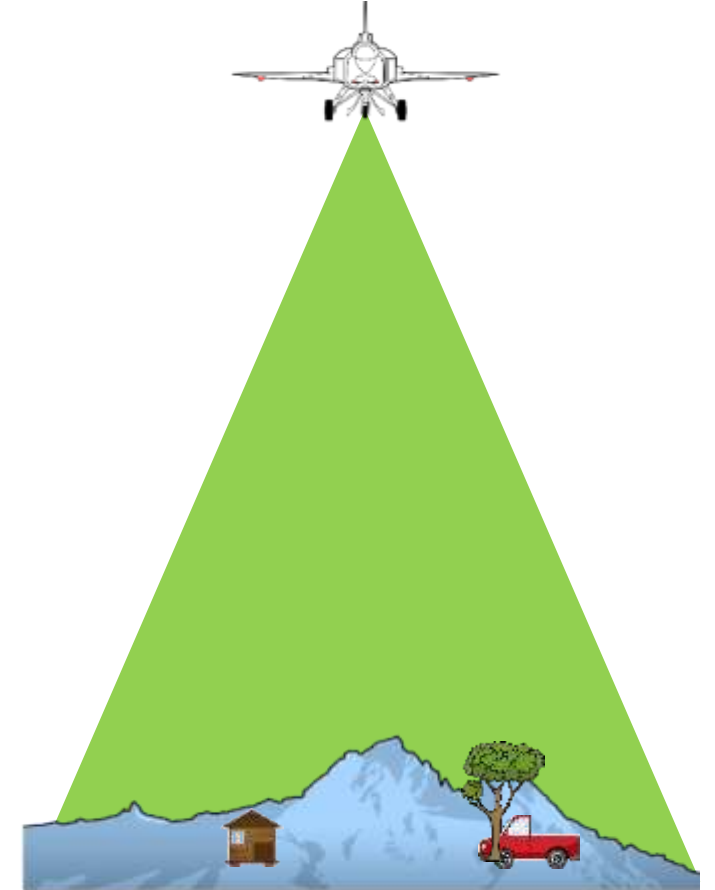
2-4 points/m2

(excluding persistent target mapping)

Three dimensional & Vertically rich

Satellite

Lidar - Height

Wire

Car
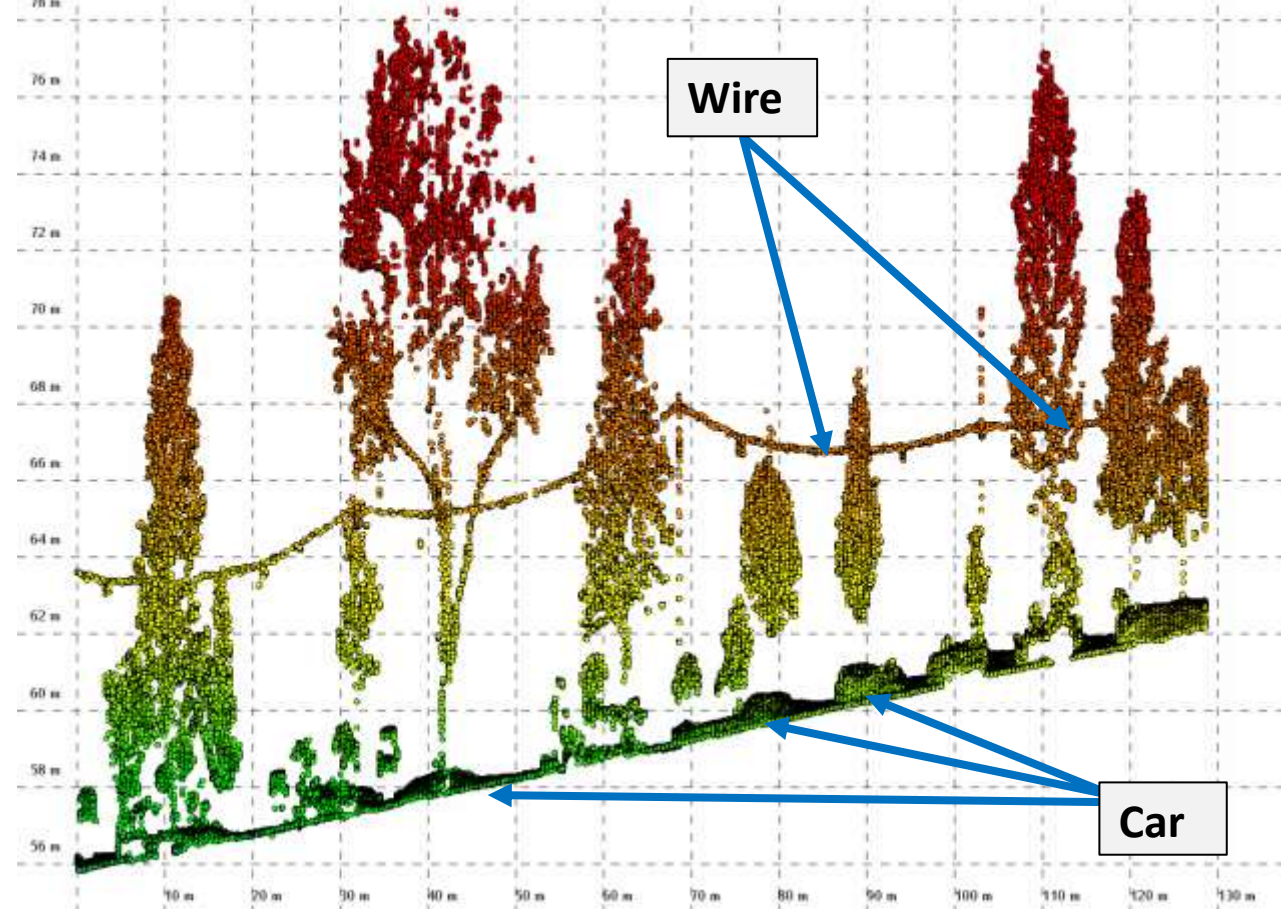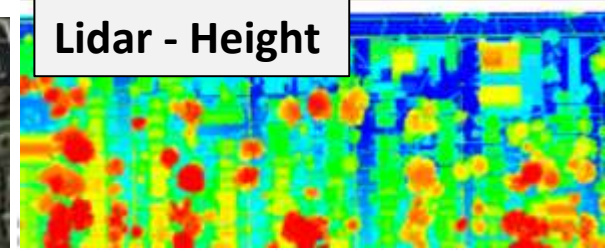
Every transmitted shot can have multiple returns, so

Compared to Imagery, Lidar can *see through* trees
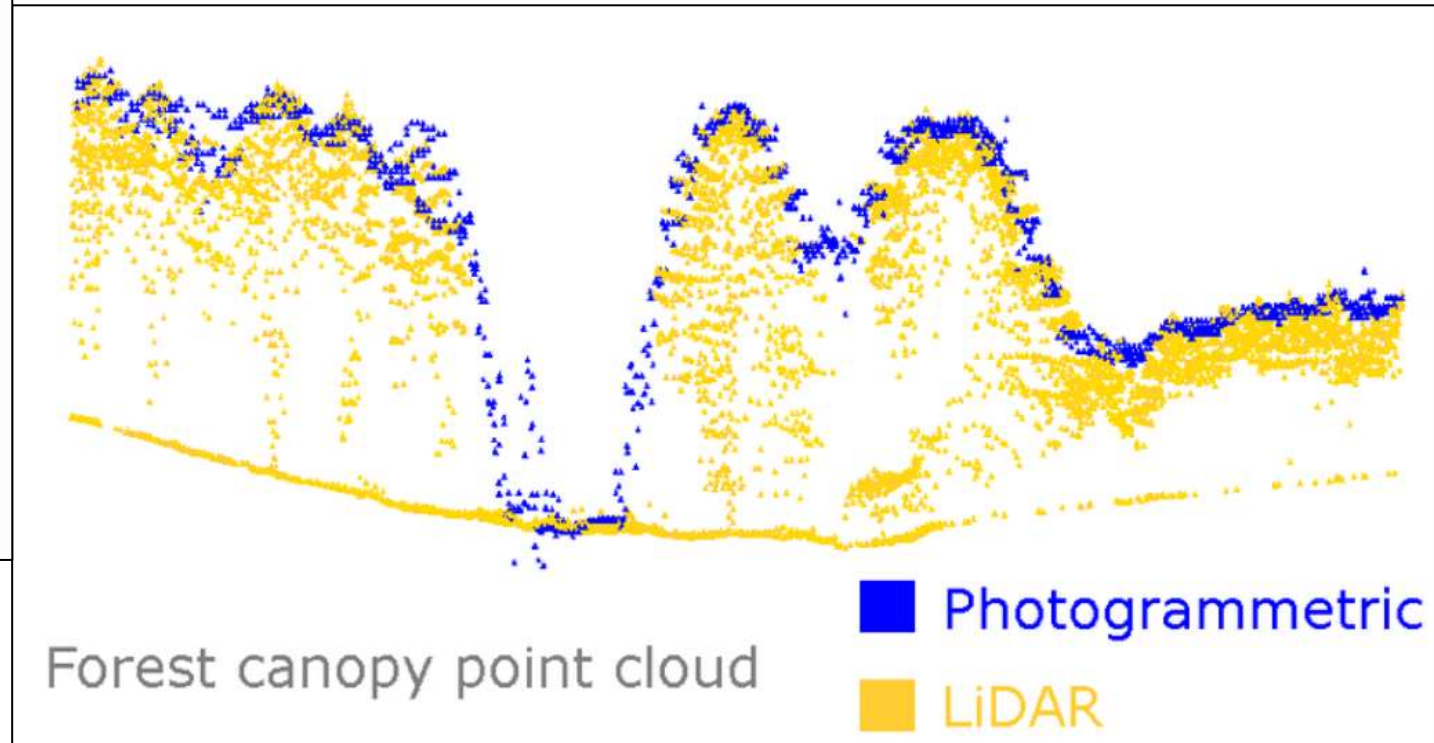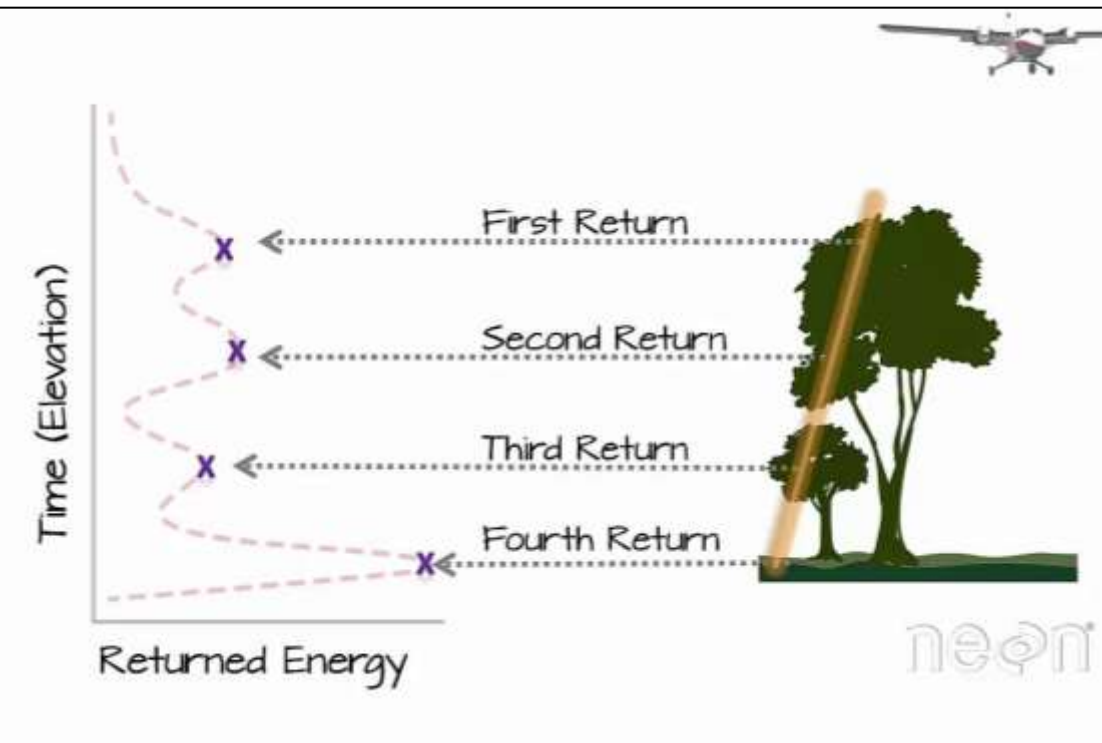
Forest canopy point cloud

Photogrammetric

LiDAR

Our Portfolio for airborne Lidar

Galaxy ALTM

Compact, all terrain sensor that leverages unique, high-productivity features for maximum collection efficiency.

- 100% effective pulse rate
- Programmable FOV
- Built-in Swath Compensation

- Excellent small target detection
- Upgradable
- 2Mhz > 4Mhz in G2 config
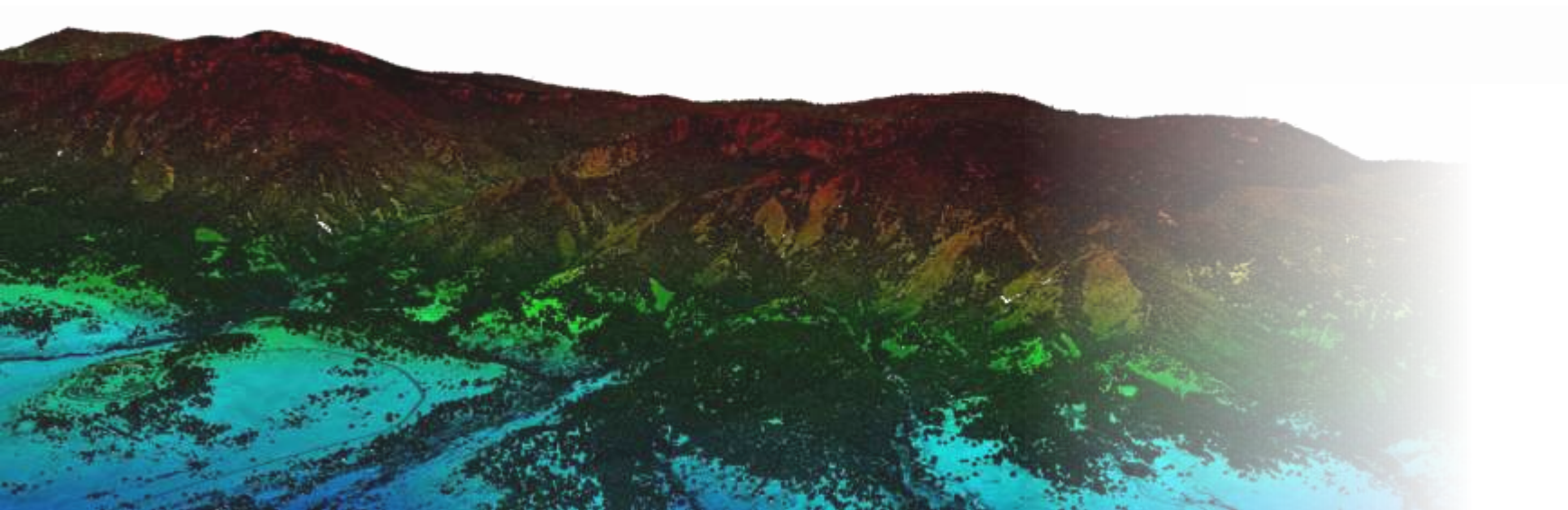
Galaxy Onboard- Real-time Productivity solution

- Workflow-focused solution

- real time processing

- real time quality control

- airplane to office acceleration

- confidence in data integrity

→ increase ROI with the ability to produce and deliver projects faster and applications that demand real-time data.

CZMIL SuperNova

The most powerful Topo Bathy Lidar on the market

- Deepest water penetration ~70m

- Best performance in Turbid waters

- 8ppm Bathy, 12ppm Topo

- Uniform point spacing

- Integrated CARIS workflow with AI

- Meets IHO survey specifications
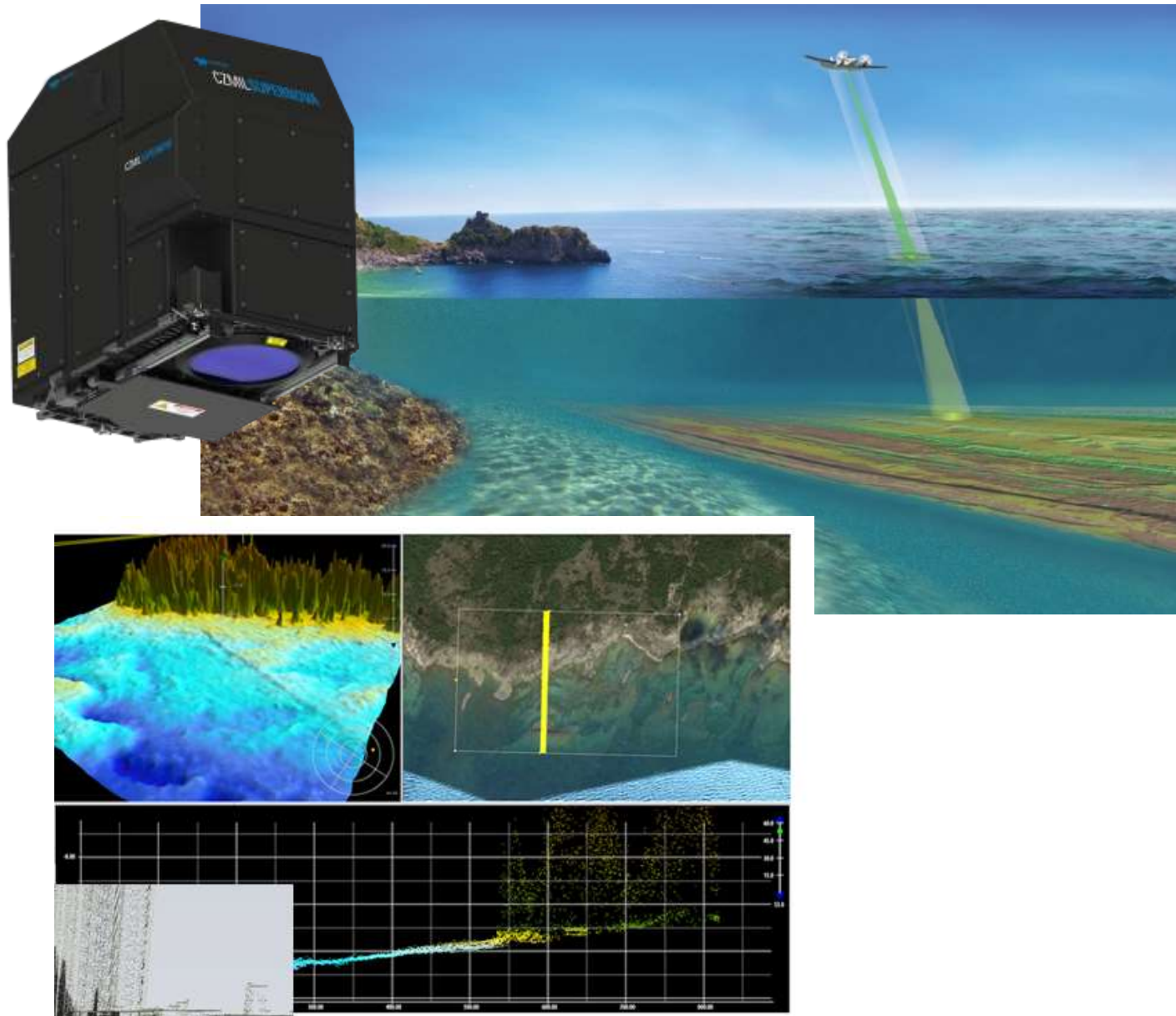
CLS-A – Full solution with IMU- POS- Camera

Survey Grade Lidar Point Clouds from UAV Platforms

UAV ready

Teledyne Optech CLS-A captures **survey grade** point clouds from **UAV** platforms. It couples **high accuracy and precision** data with a proven **workflow** and **support**.

CL360

OEM Survey Grade Lidar for All Applications

- Mobile Mapping (HD) version
- UAV ready (XR) version
- Payload version coming soon, with integrated POS and Camera

- Returns from fresh pavement <10% intensity at 120m altitude
- Powerlines from long distance
- Can be used for Marine applications

Teledyne
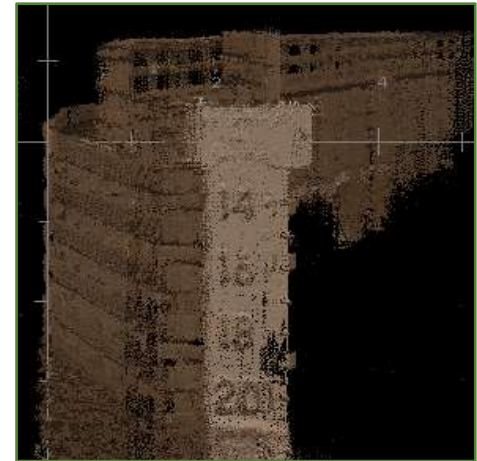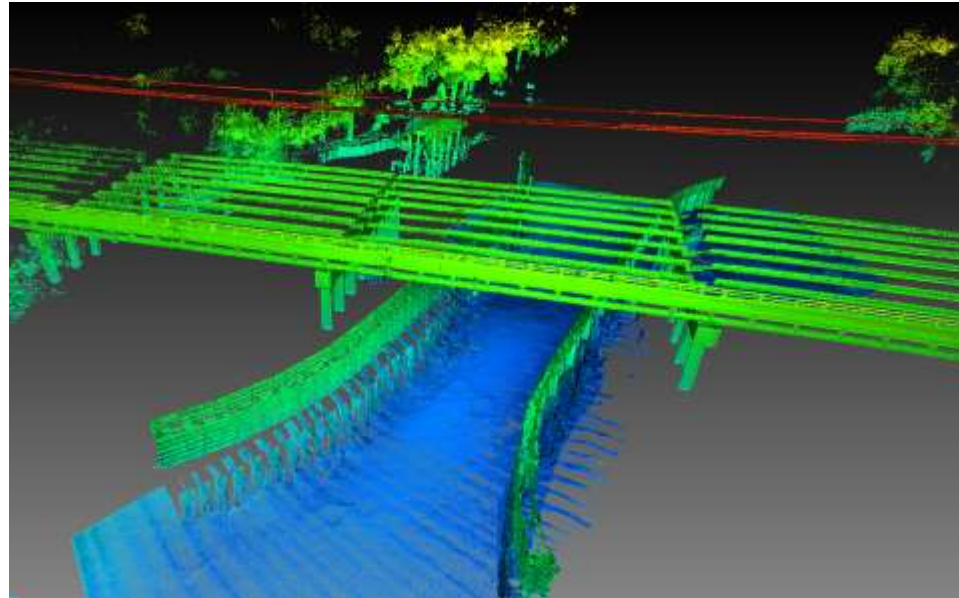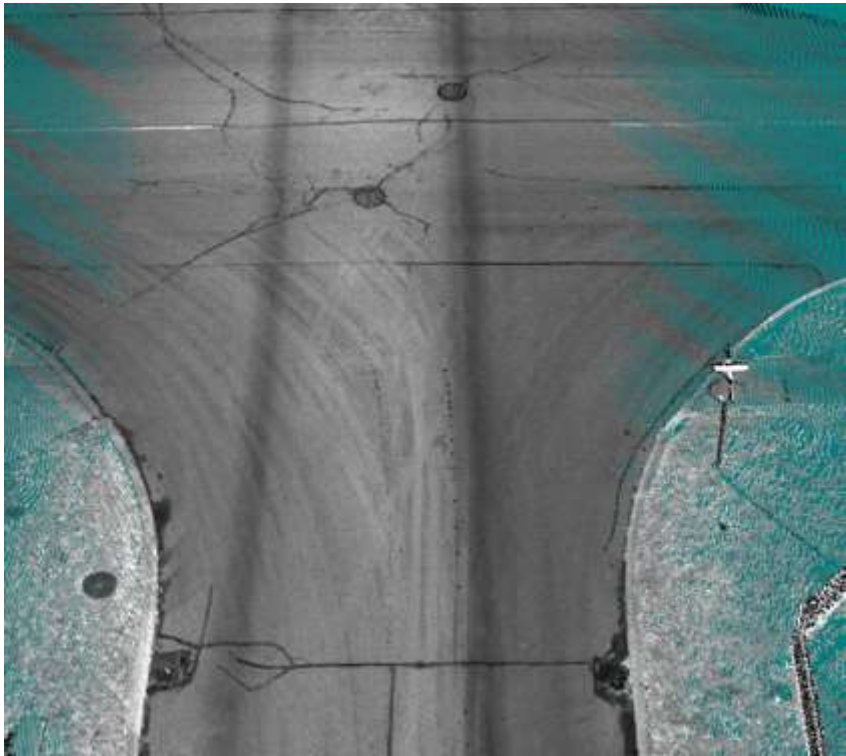
Commercial Applications

Utilities

Accurately, Rapidly, and Cost Effectively Locates, Maps & Enables Inspection of Assets
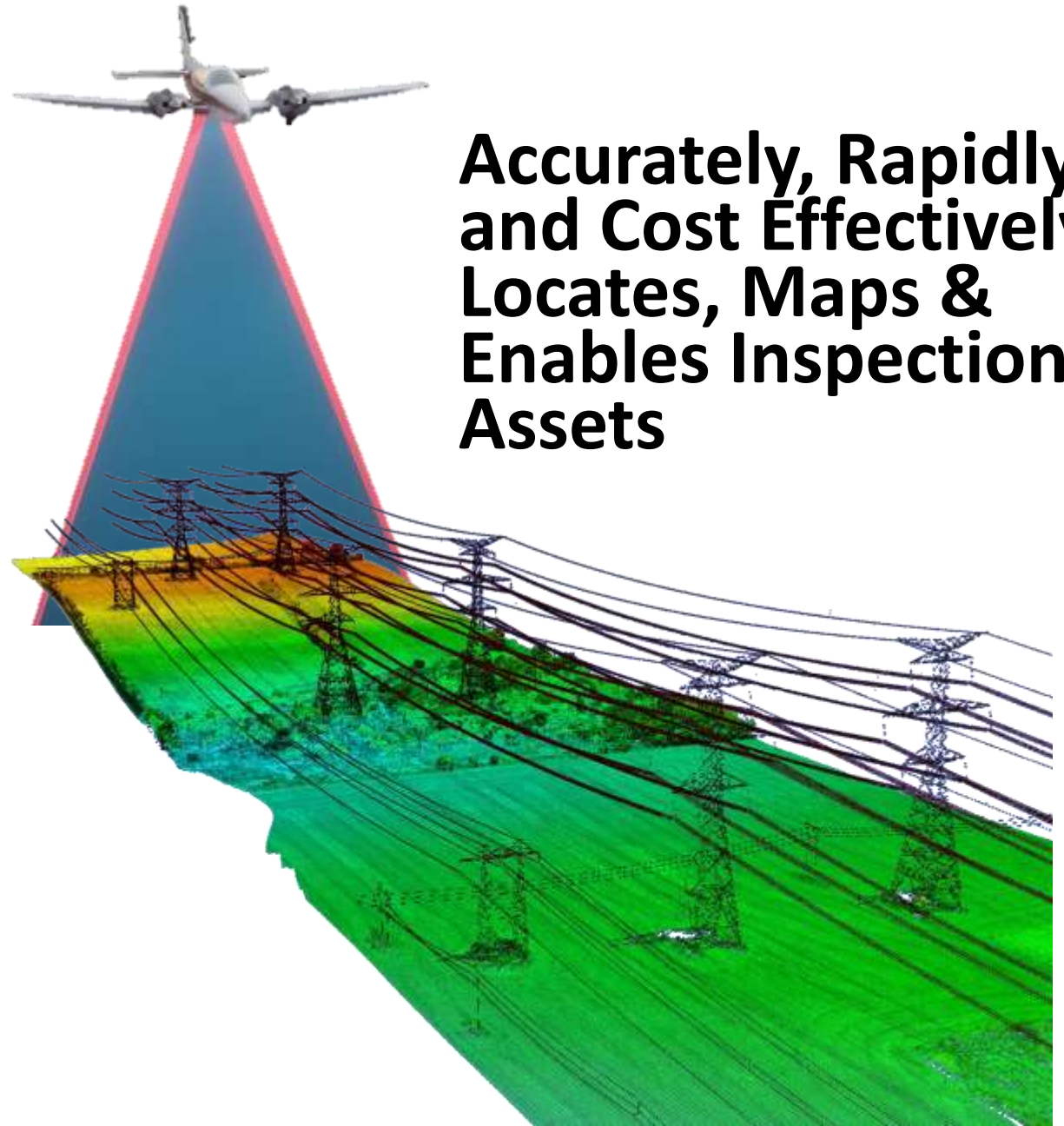
Asset Mapping

Where are my assets?

- We are told that not all providers have updated 'maps' of where their pipeline assets are

- Positional accuracy is out of date
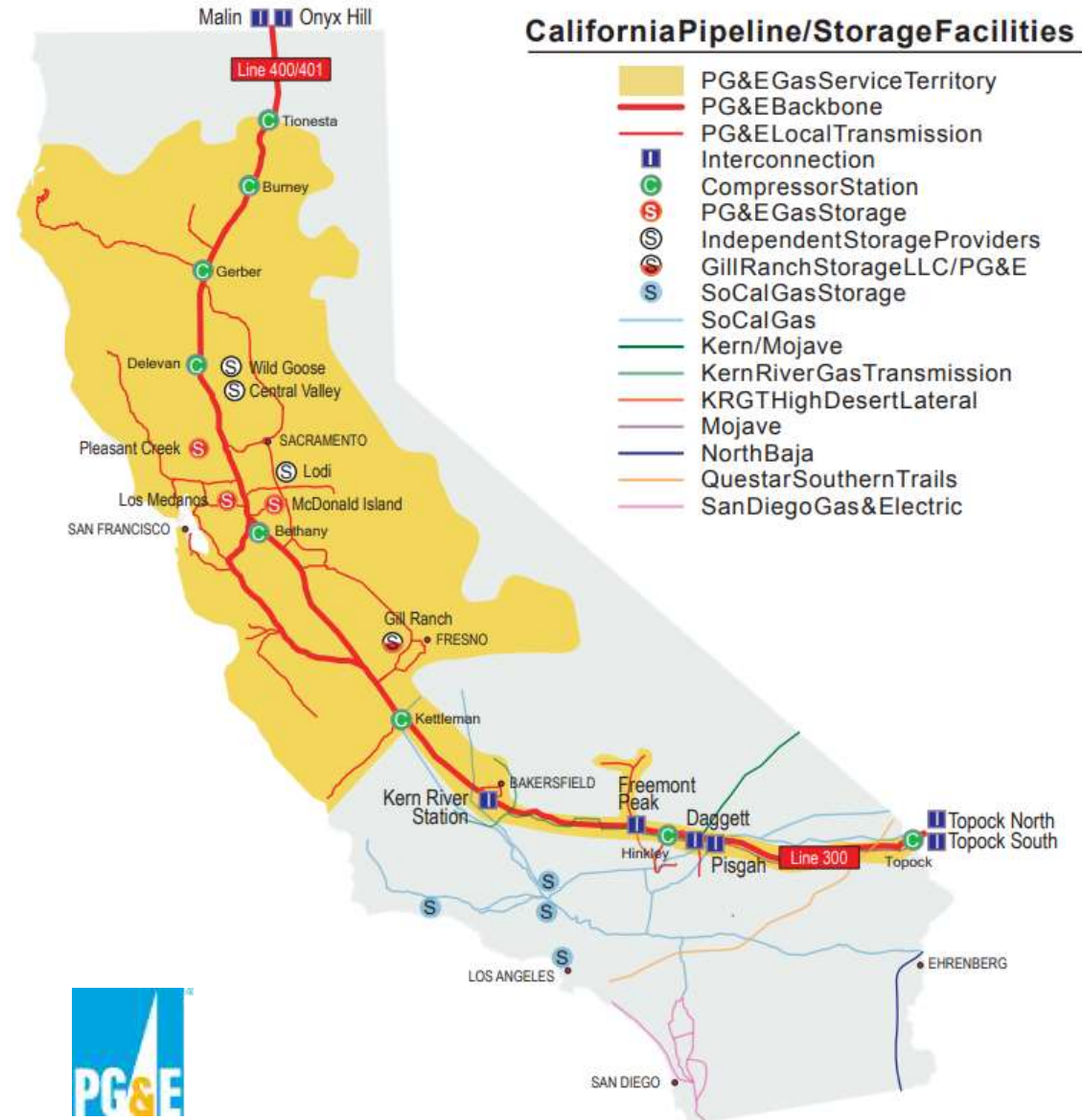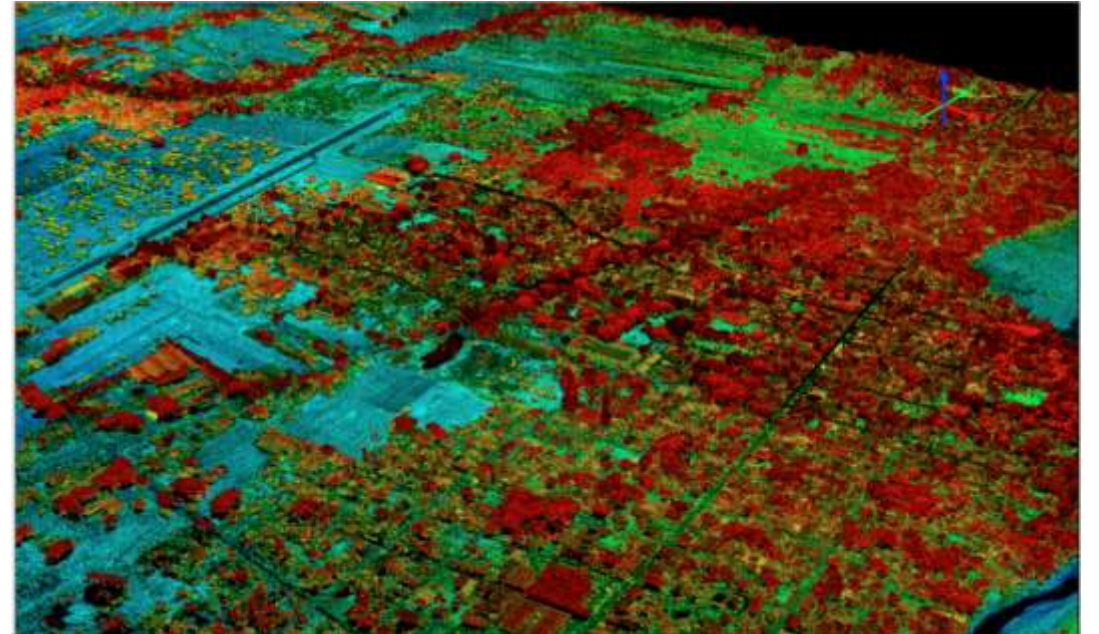
Geohazard & Change Detection

Inspection & (real time) Action

- Airborne lidar & image system that detects (close to pipeline infra)
  - Hazards (trucks., excavators, etc)
  - Ground change (excavation, erosion, landslide, etc)
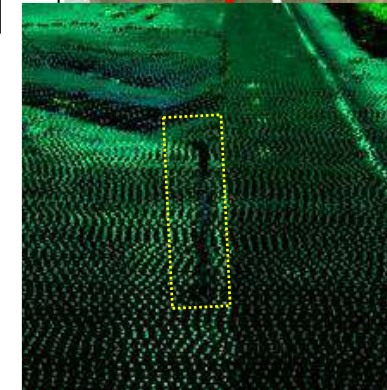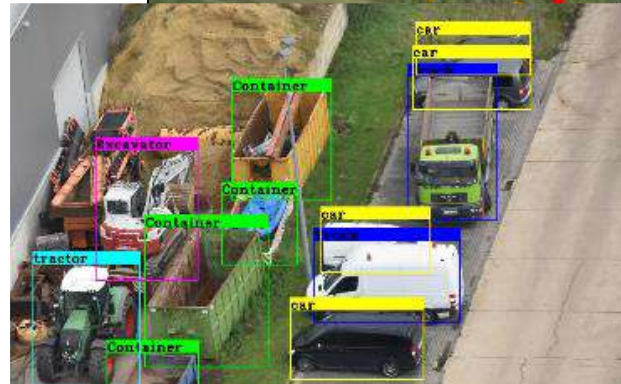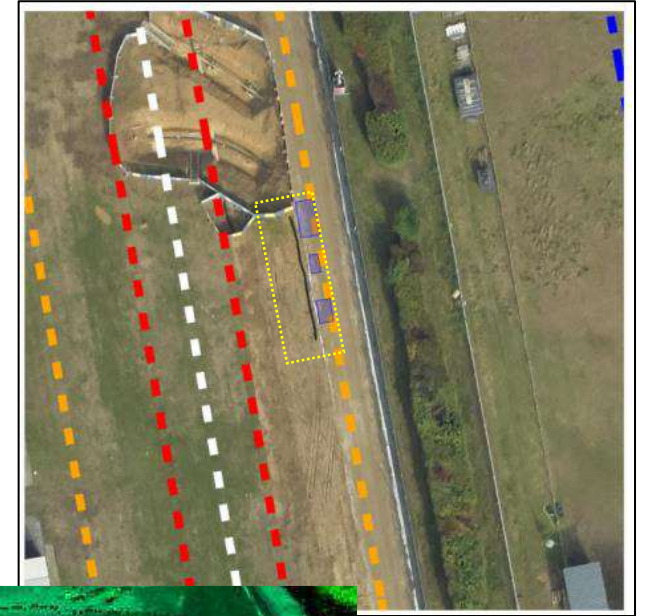
Emergency response
Disaster relief

Provide accurate data in real time after storms, earthquakes, landslides, floods...

Real-time Storm Response

Why Hurricane Ida crippled the New Orleans power grid

→ **Real-time in air processing**

→ **Real-time damage detection**

→ **Real-time decision making**

Digital Twin

Create a digital twin of a city, a region, a country, a construction site, infrastructures

(Urban mapping, country wide mapping)

Country Mapping

HEIGHTS 2017
Efficient Surveying in Colorado's Rugged Landscape

Elevation (m)
High : 3442
Low : 1546

MERRICK & COMPANY
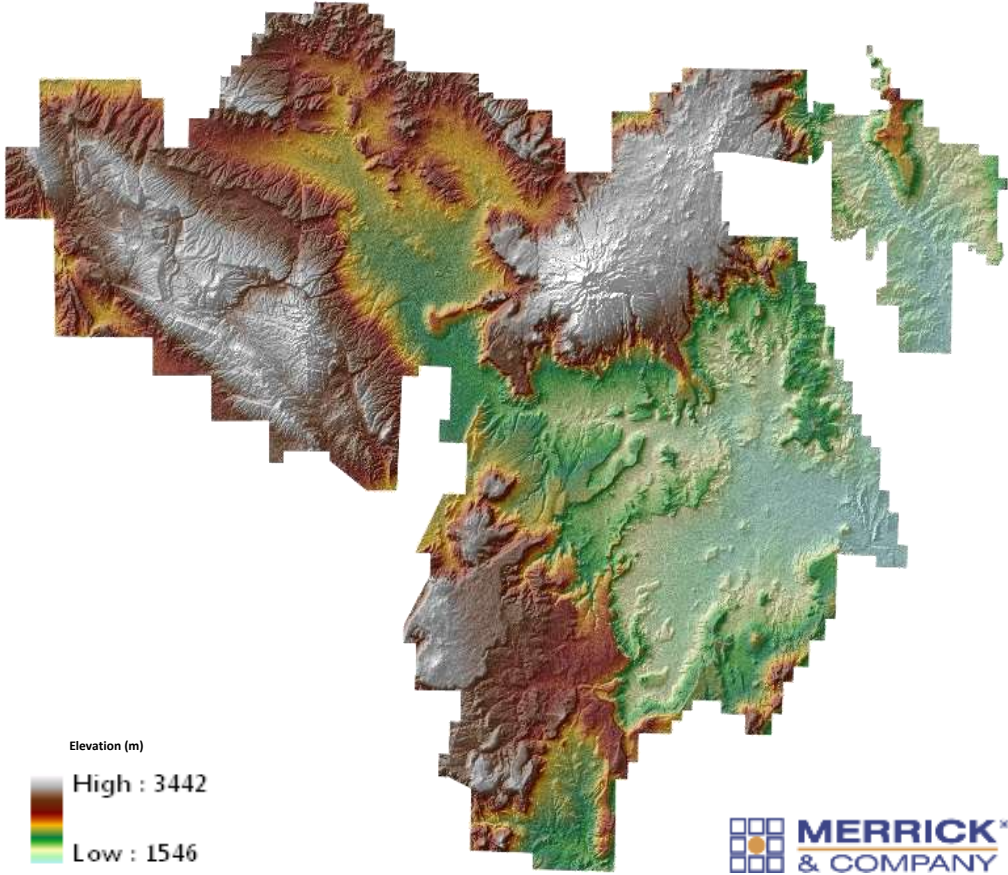
UK Environmental Agency National Flood map

Urban Mapping

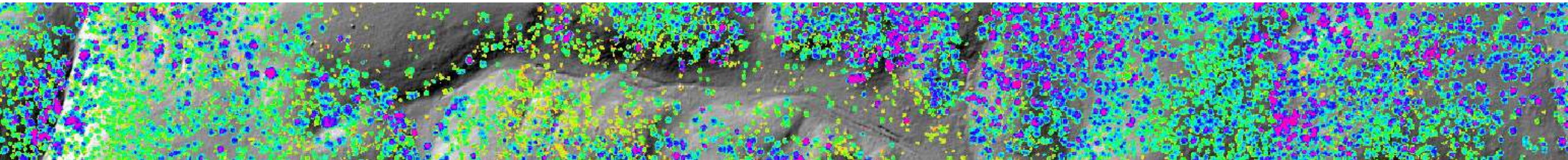No shadowing, detection of all building facets
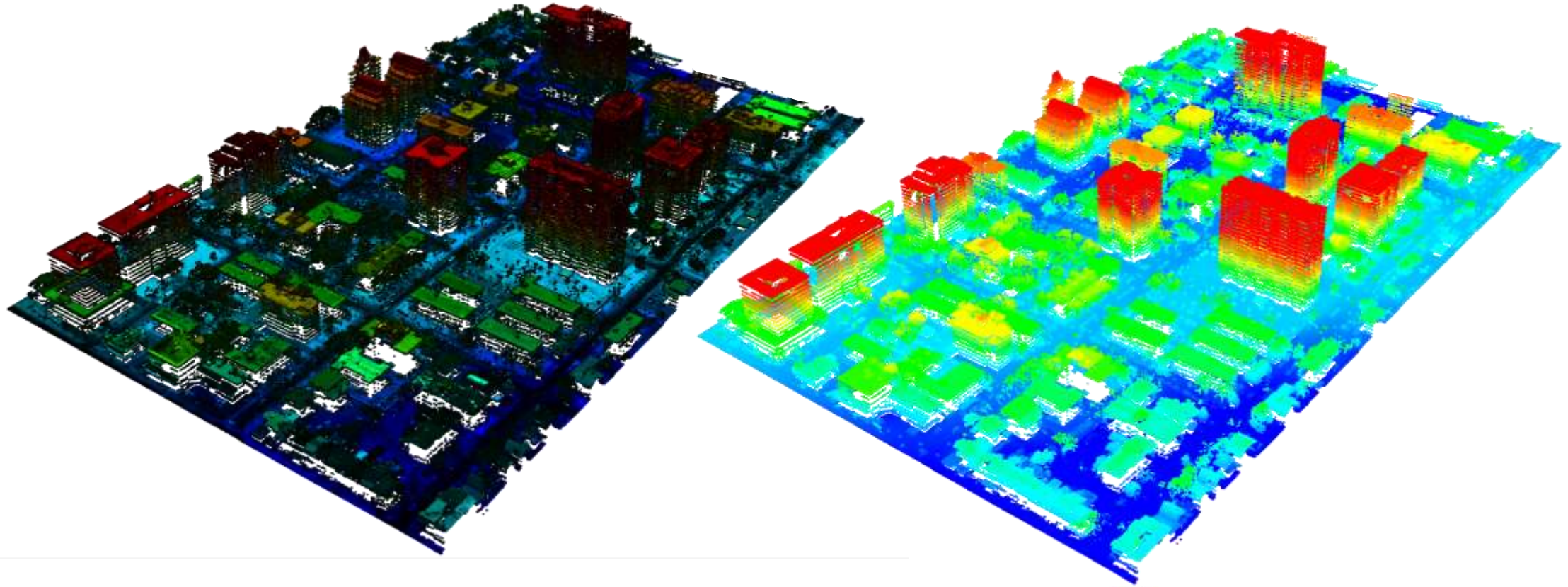
1600 kHz, 40 FOV°, 1600 m AGL

Forestry

a solution that

Accurately, Rapidly, and Cost Effectively Maps the Forest (Floor AND Trees)

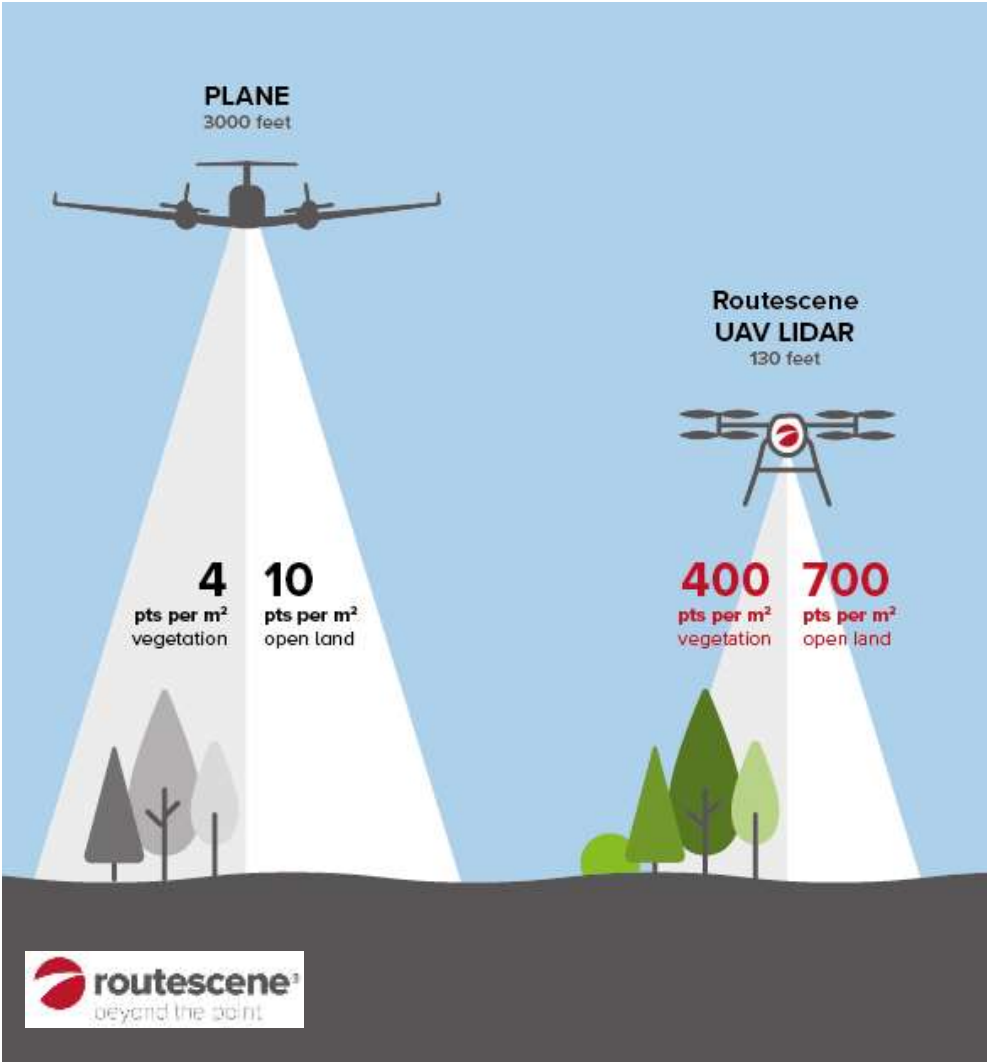**Enables Routing, Volume Estimation, and Species Identification**

Solutions for All Scales – From Plot to State

UAV vs Airplane

- **Smaller Area**
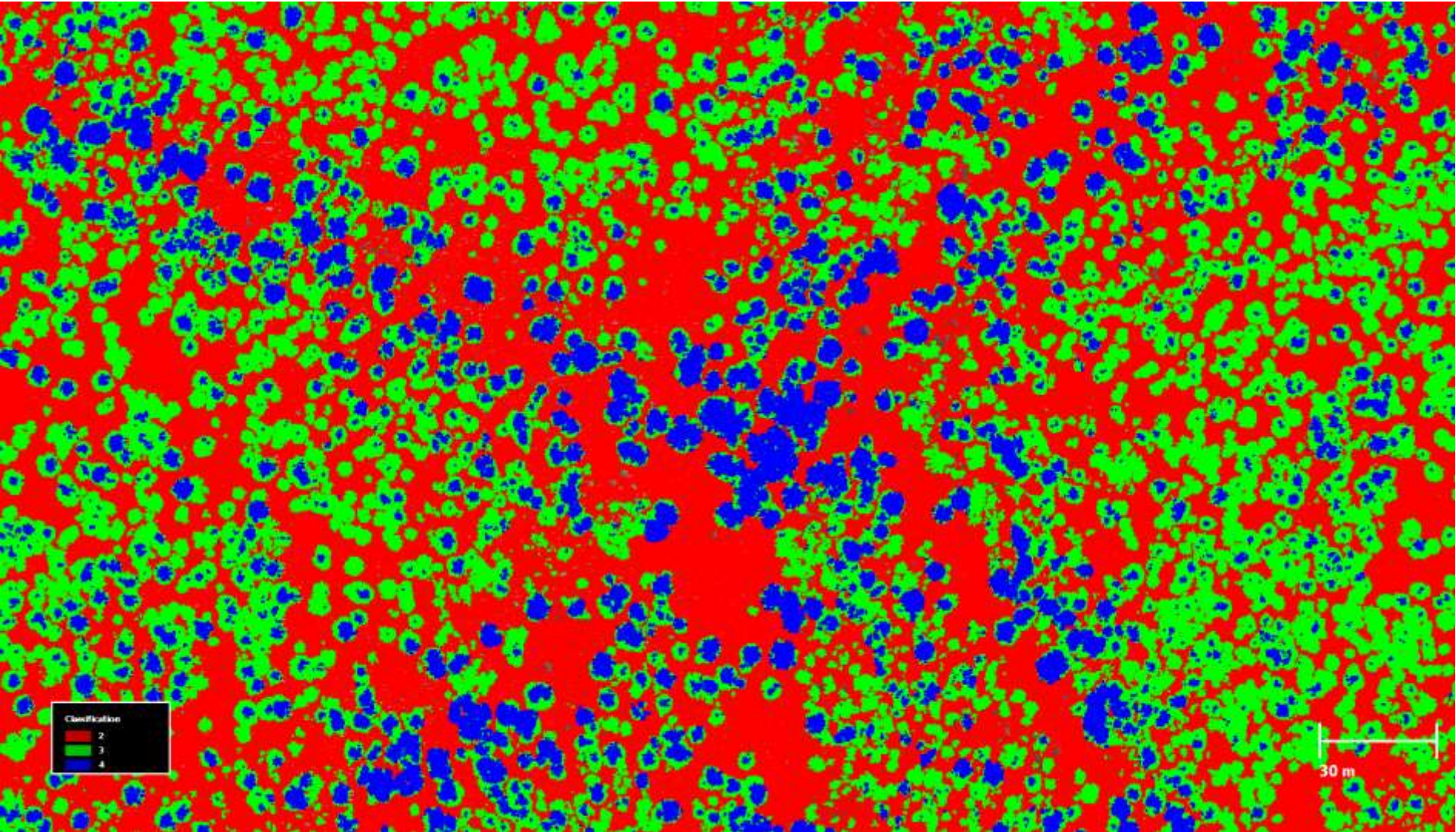- **Higher Resolution**
- **More Frequent**
- **Lower Cost**

- **Larger Area**
- **Lower Resolution**
- **Less Frequent**
- **Higher Cost**

Base imagery

...lly Sensitive Business Data
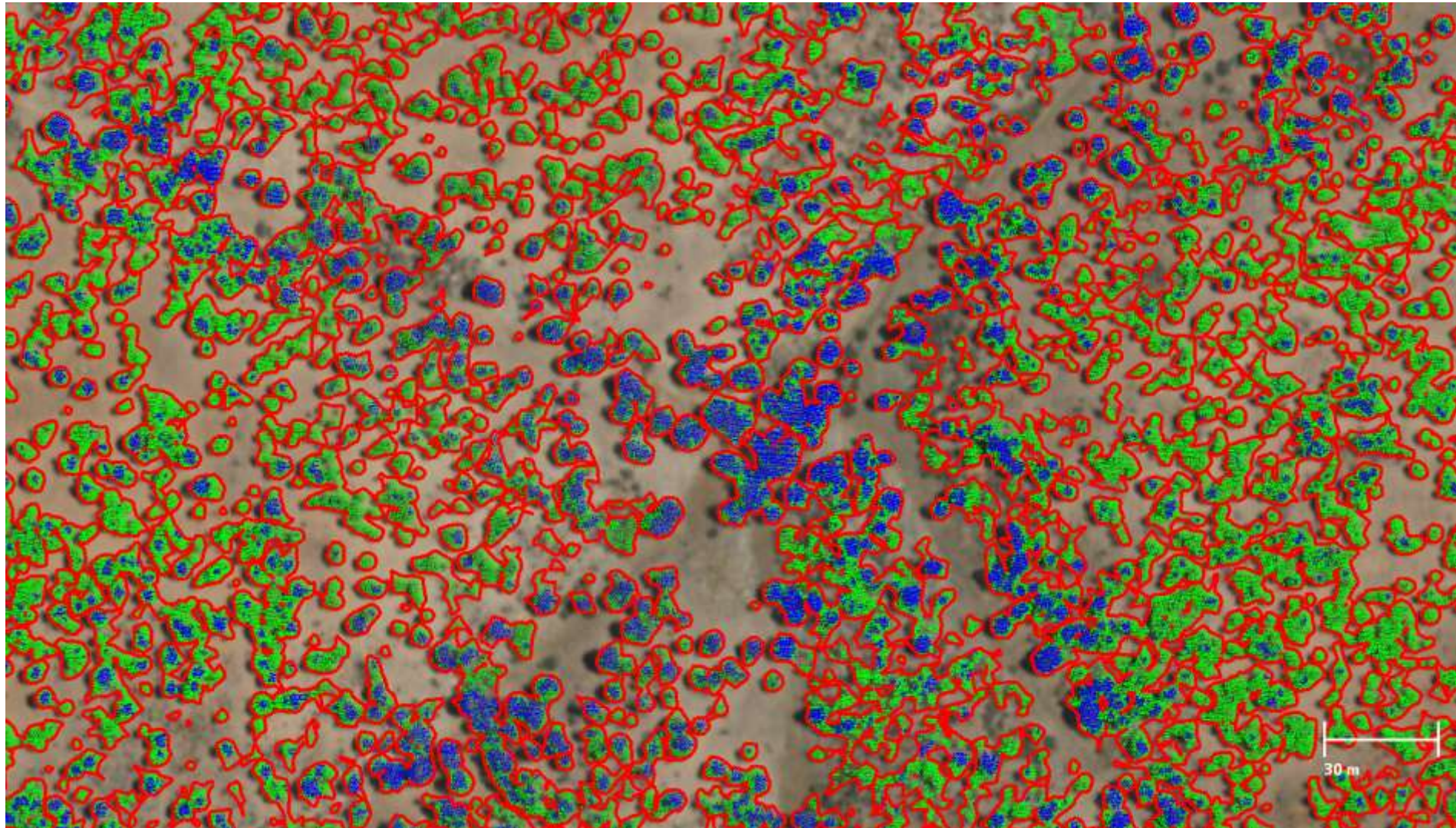
Classified lidar data (ground, medium trees, tall trees)

Classified lidar veg over imagery + veg polygons
→ Enables tree counting and volume estimation)

Mining

Accurate Volumes

Change Management

Slope Stability

Dangerous Cavities

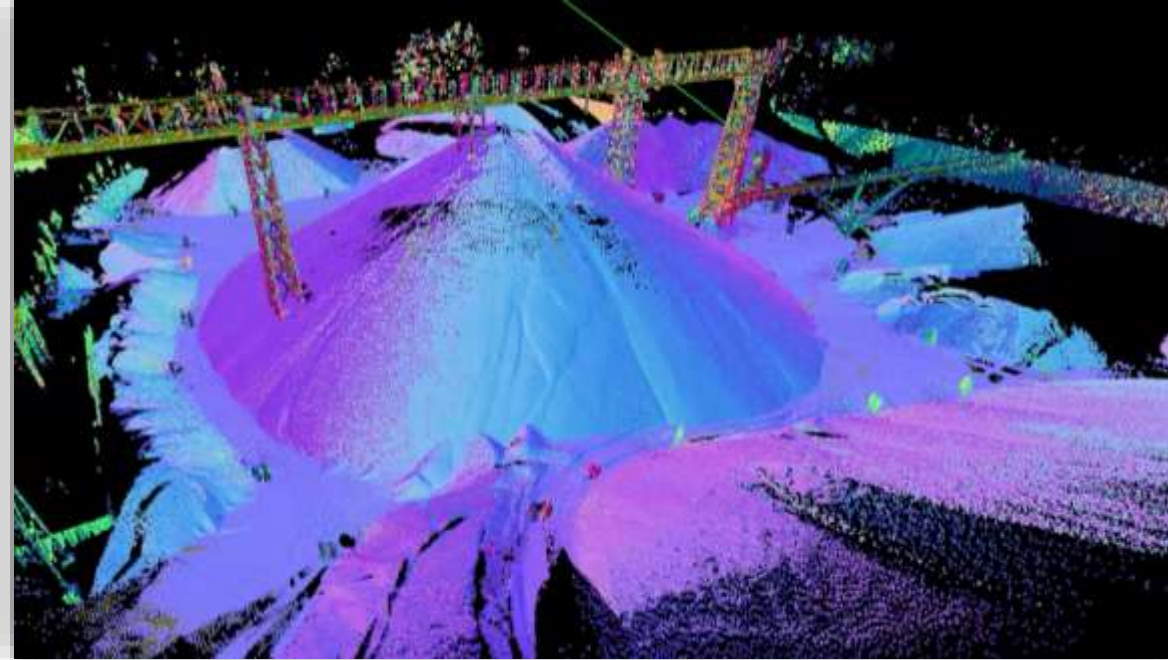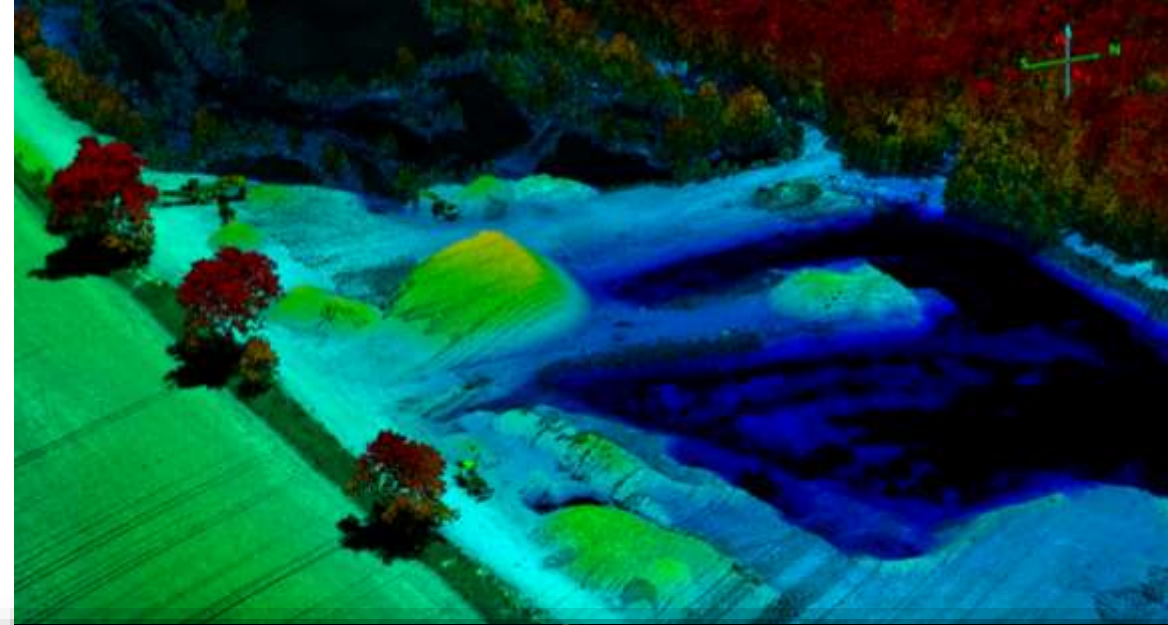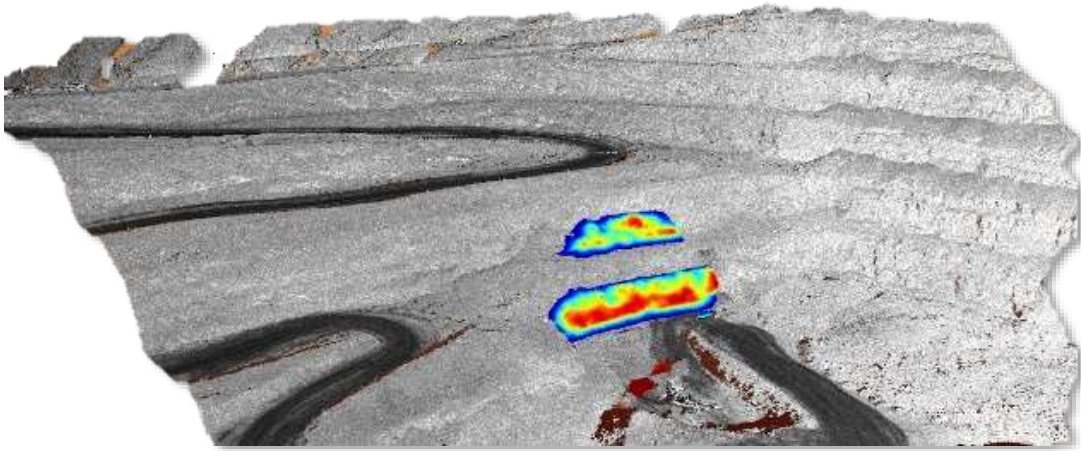# Full Range of Sensors from Airborne to Underground

Fast and Accurate measurement

Change detection / volume analysis

Automated slope monitoring / Alerting

Rugged underground systems

Airborne solution partner in India

Terrestrial Laser Scanners

Laser Scanners
For Sea and Land
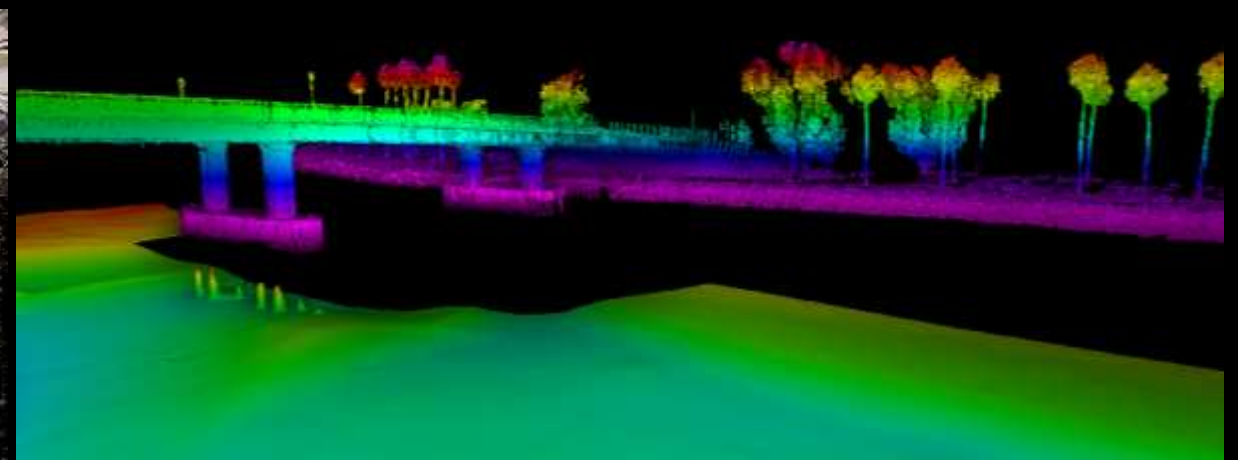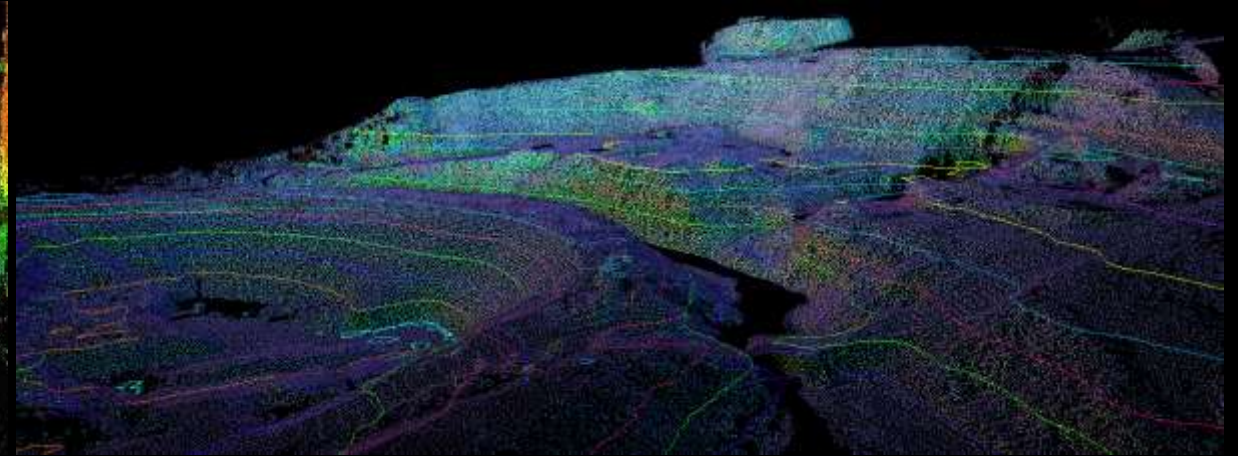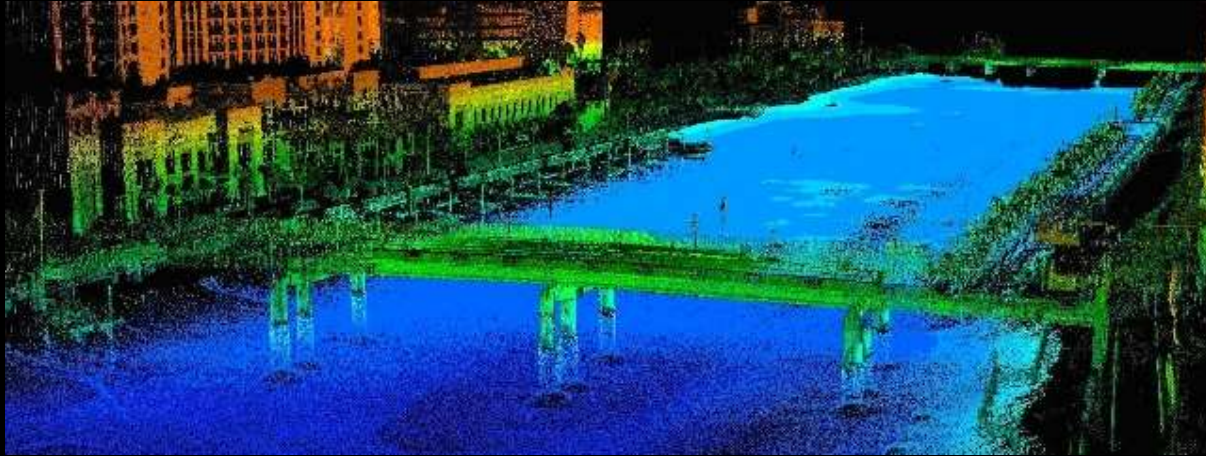
Polaris and M3

Survey Grade Laser Scanner for Land and Marine Applications

- High Resolution 2mm at 100m

- Long Range up to 2000m

- Adjustable vertical field of view

- Mine Monitoring, Marine application, Infrastructure

- ATLAScan for georeferencing & QC

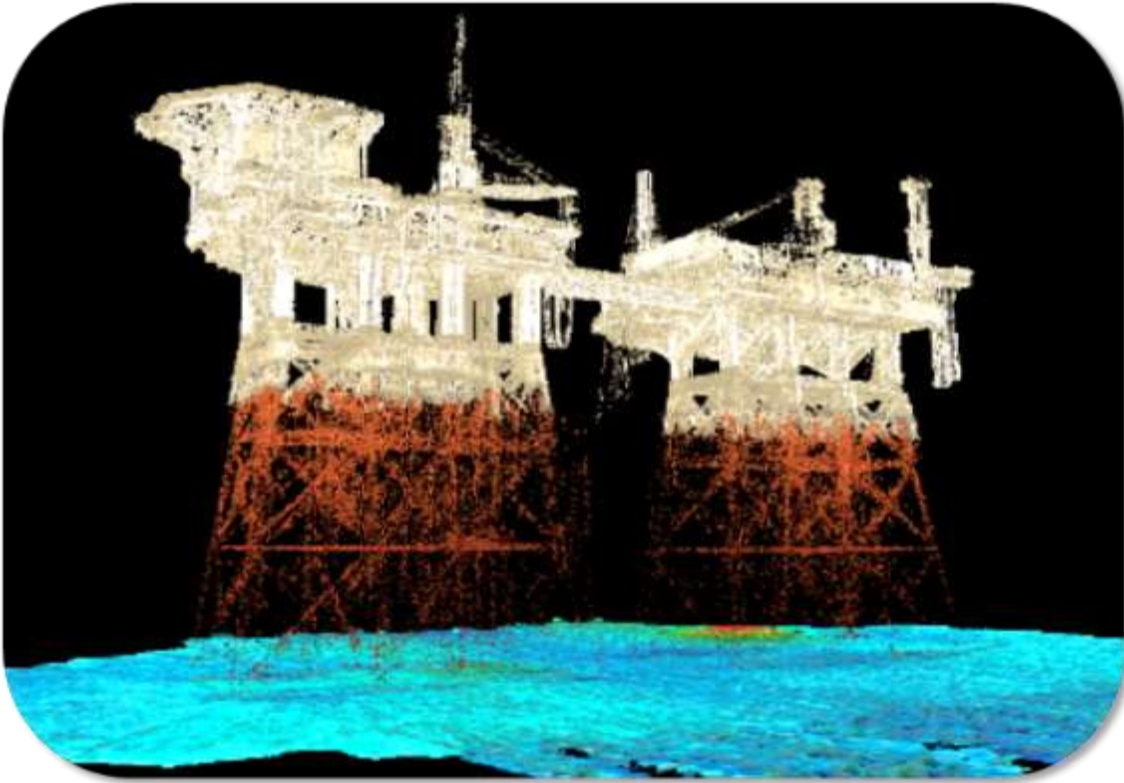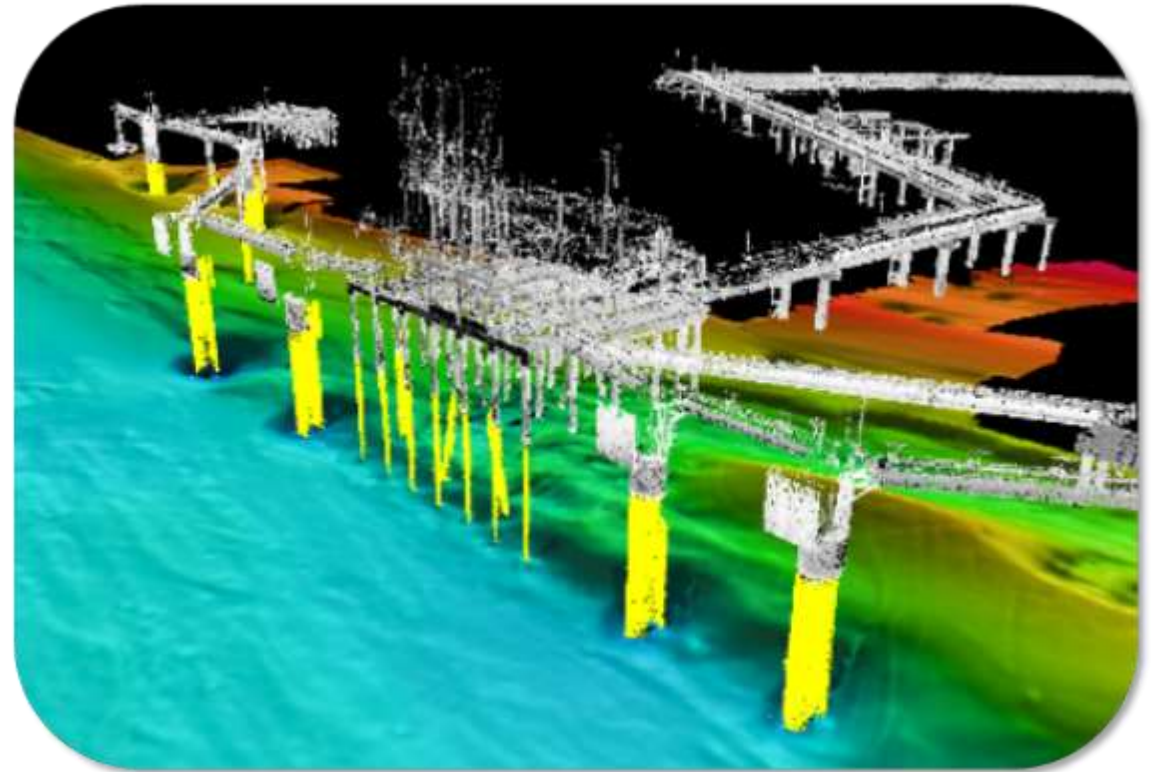- Tripod, Vehicle, Boat mountable

M3

Terrestrial Laser Scanner-M3

» Survey-grade data accuracy
» High resolution: up to 2 mm @ 100 m
» Long range: up to 2000 m
» Designed to IP56
» Wide, adjustable field of view
» Up to 4 returns
» Up to 500.000 pts/s
» Designed for Marine, Monitoring and Mobile applications

Marine Applications

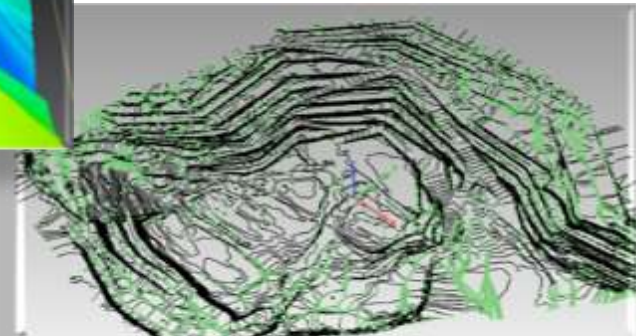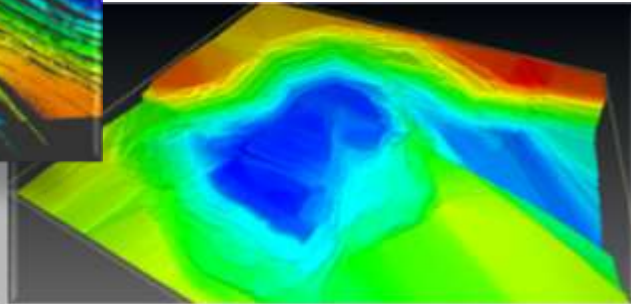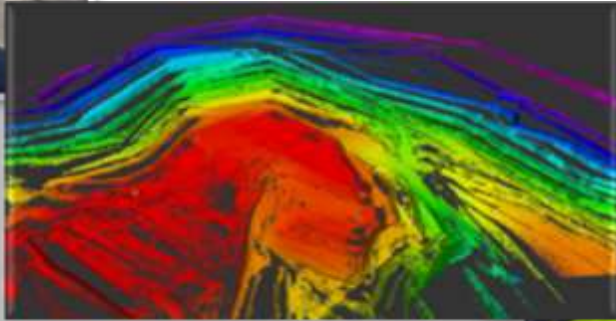**Oil platforms**

Harbours and LNG terminals

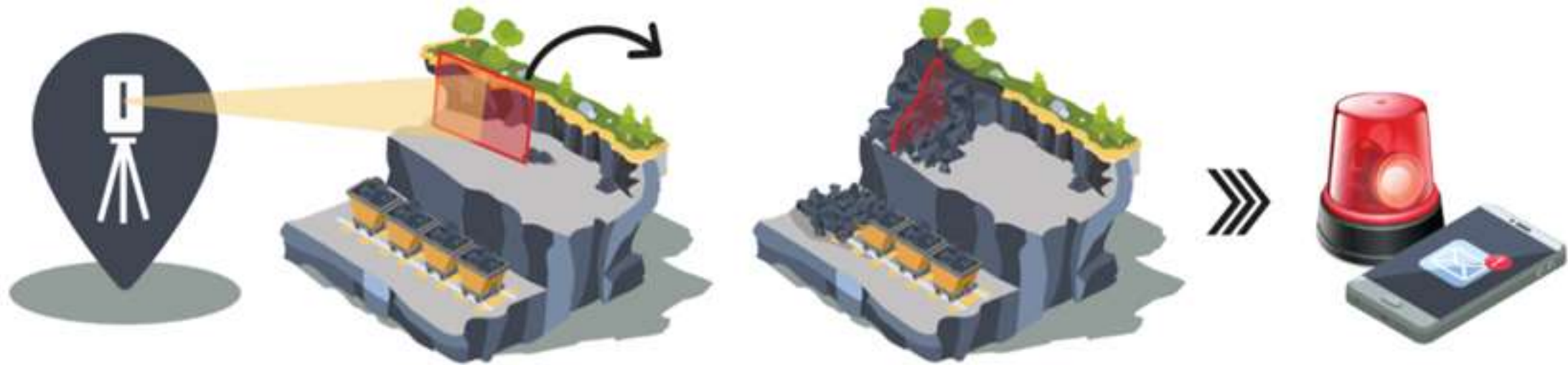Courtesy of NetSurvey UK

Terrestrial applications

- Open Pit mining
- Heritage, archeology
- Infrastructure
- Monitoring
- Construction

TLS-M3 MONITORING
Permanent installation with dedicated monitoring software
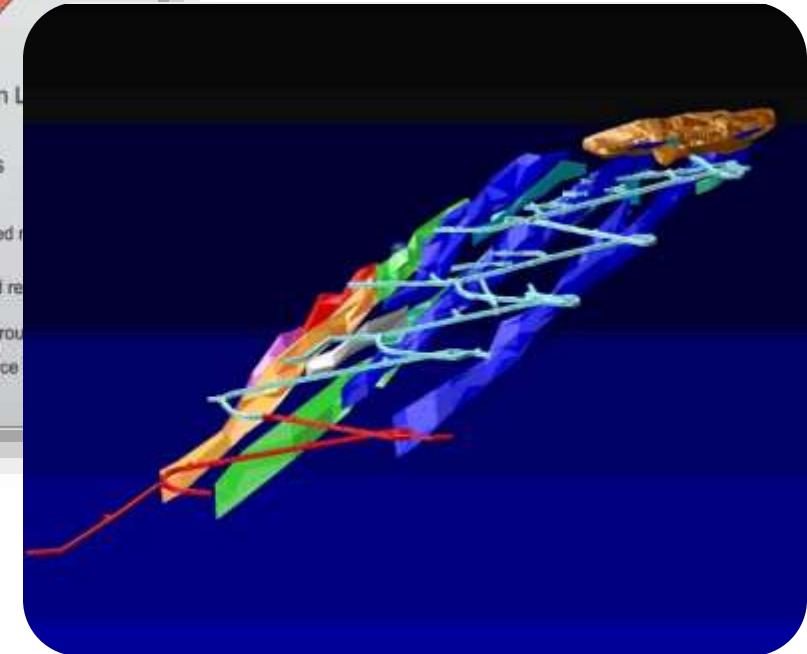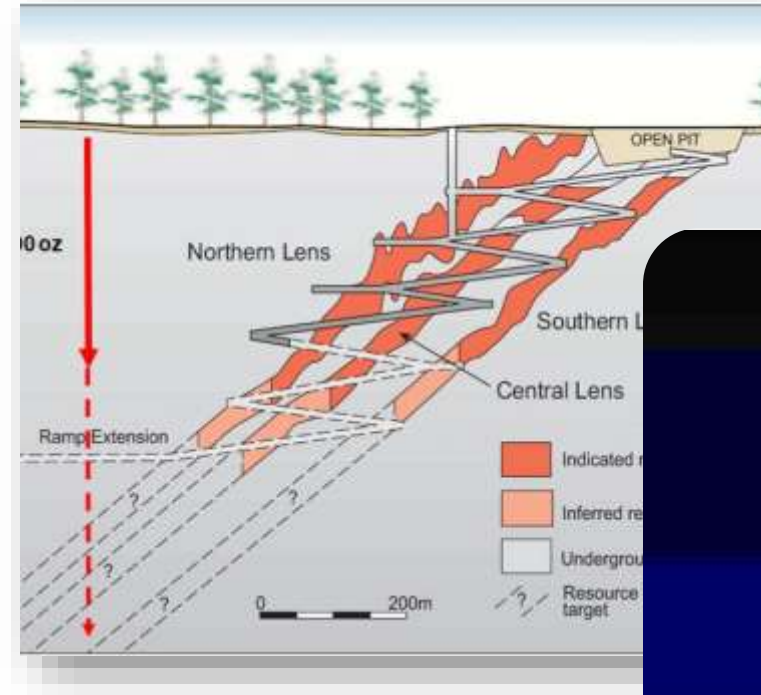

1. LASER SCANNER SETUP >> 2. SCHEDULED AUTOMATIC SCANS >> 3. GEOMETRICAL CHANGES 3D MONITORING >> 4. AUTOMATIC ALERT
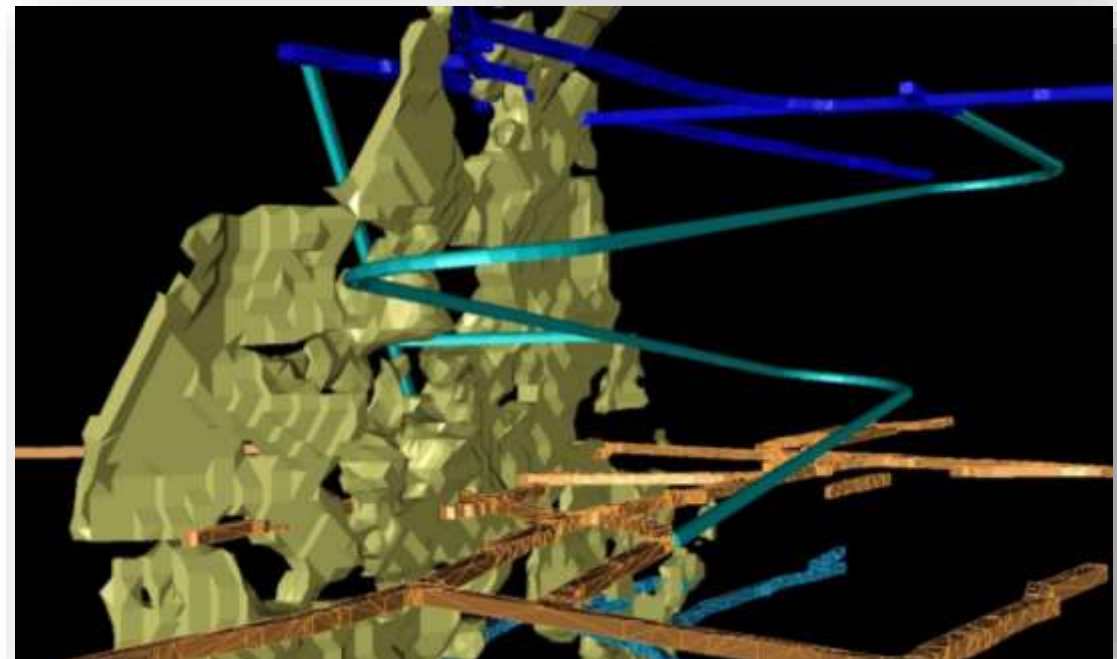
Cavity Monitoring System

- Create accurate 3D models of cavities

- Data can be exported to mine planning and visualization software for analysis

- Developed and patented by Noranda and Optech in early 1990's

CMS

Trusted and Efficient Cavity Mapping System

- Safe mapping solution for caves, mine shafts and manholes

- Real-time data visualization to check quality during scanning

- 2cm range accuracy, 0.1° angular accuracy

- Easy to install and operate, flexible ad complete set of accessories

- Efficient: Full dome scan in 5 minutes
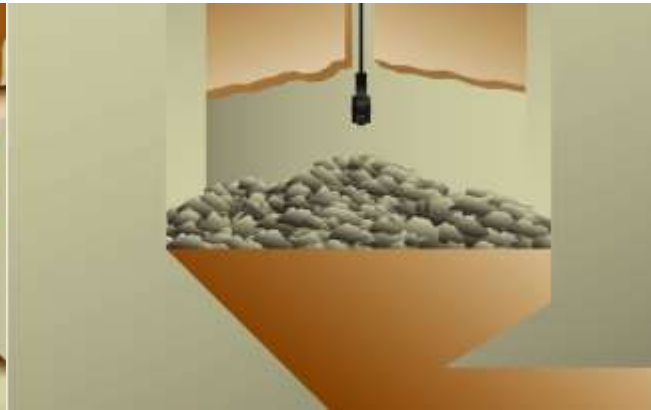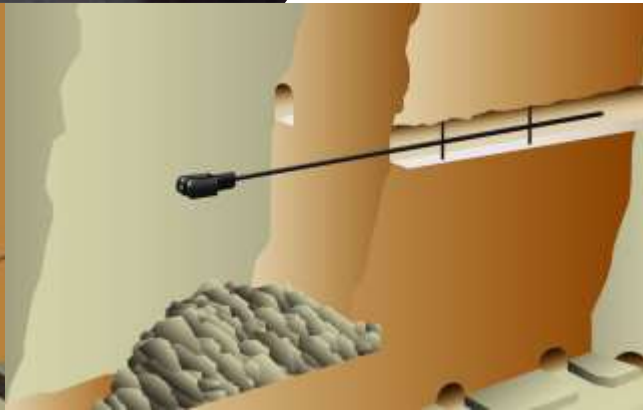
Underground Mining

3D mapping for underground mining

Trusted solution for cavity monitoring

Narrow diameter fits through small openings

Built for rough and hostile environments

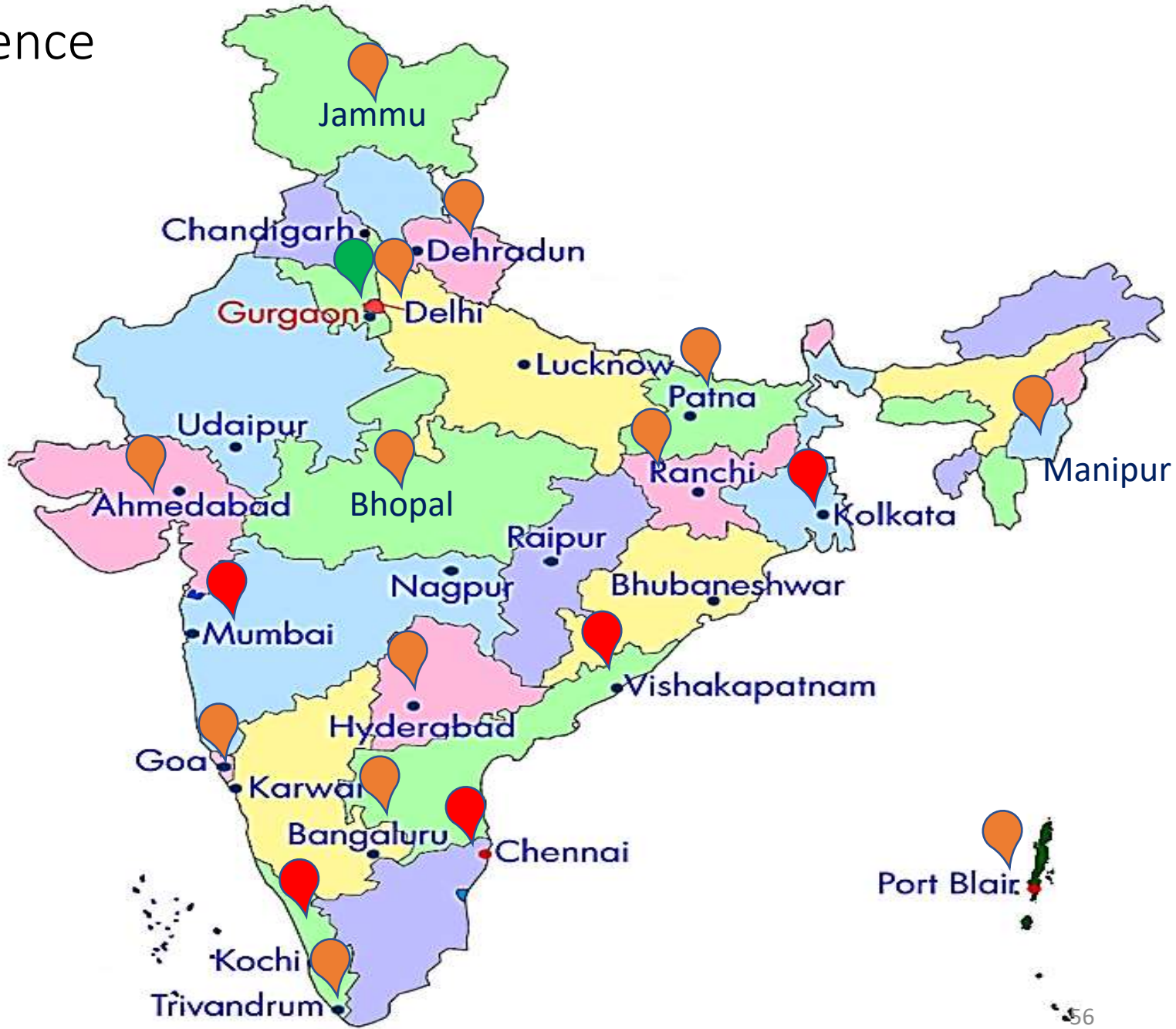Conceptualize, design, and deliver exceptional execution

Pan India

www.panindiagroup.com

paie@panindiagroup.com

Pan India : Country Wide Presence

Legends

- 🟢 Corporate Office
- 🔴 Regional Office
- 🟠 Site Office

Jammu, Chandigarh, Dehradun, Gurgaon, Delhi, Lucknow, Patna, Manipur, Udaipur, Ahmedabad, Bhopal, Ranchi, Kolkata, Raipur, Bhubaneshwar, Mumbai, Nagpur, Vishakapatnam, Hyderabad, Goa, Karwar, Bangaluru, Chennai, Kochi, Trivandrum, Port Blair

PAN INDIA CONSULTANTS PVT. LTD.

Thank You!