Leica Geosystems:

"Grow Your Business“

Leveraging Digital Twins for Energy-Efficient and Liveable Cities

Craig Hill
VP Marketing & Services


DIGITAL TWIN CITIES
The focus is its people !

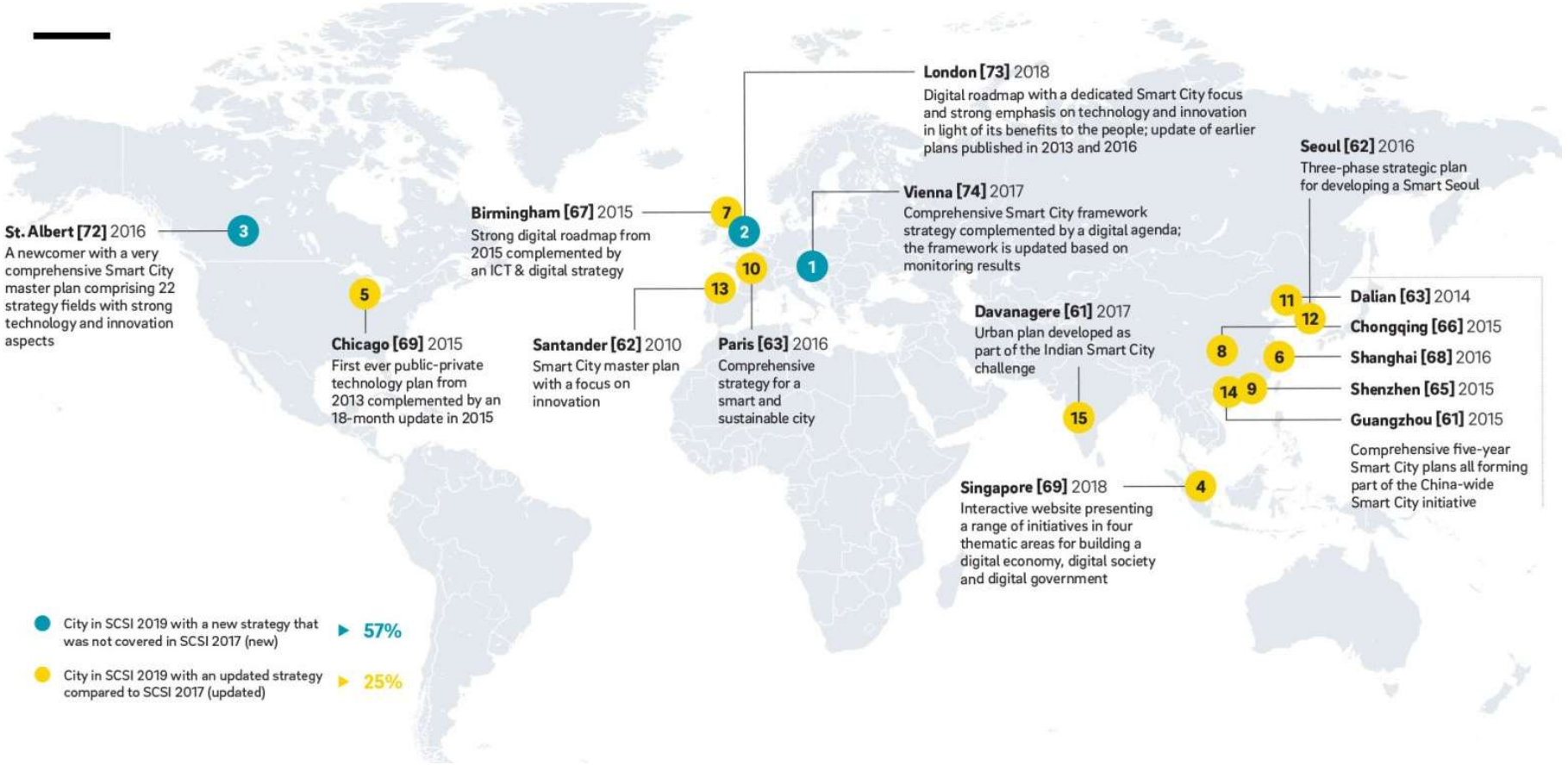

BETTER QUALITY OF LIFE
For residents and visitors


ECONOMIC COMPETITIVENESS
To attract industry and talent


SECURITY
Simulations in digital world

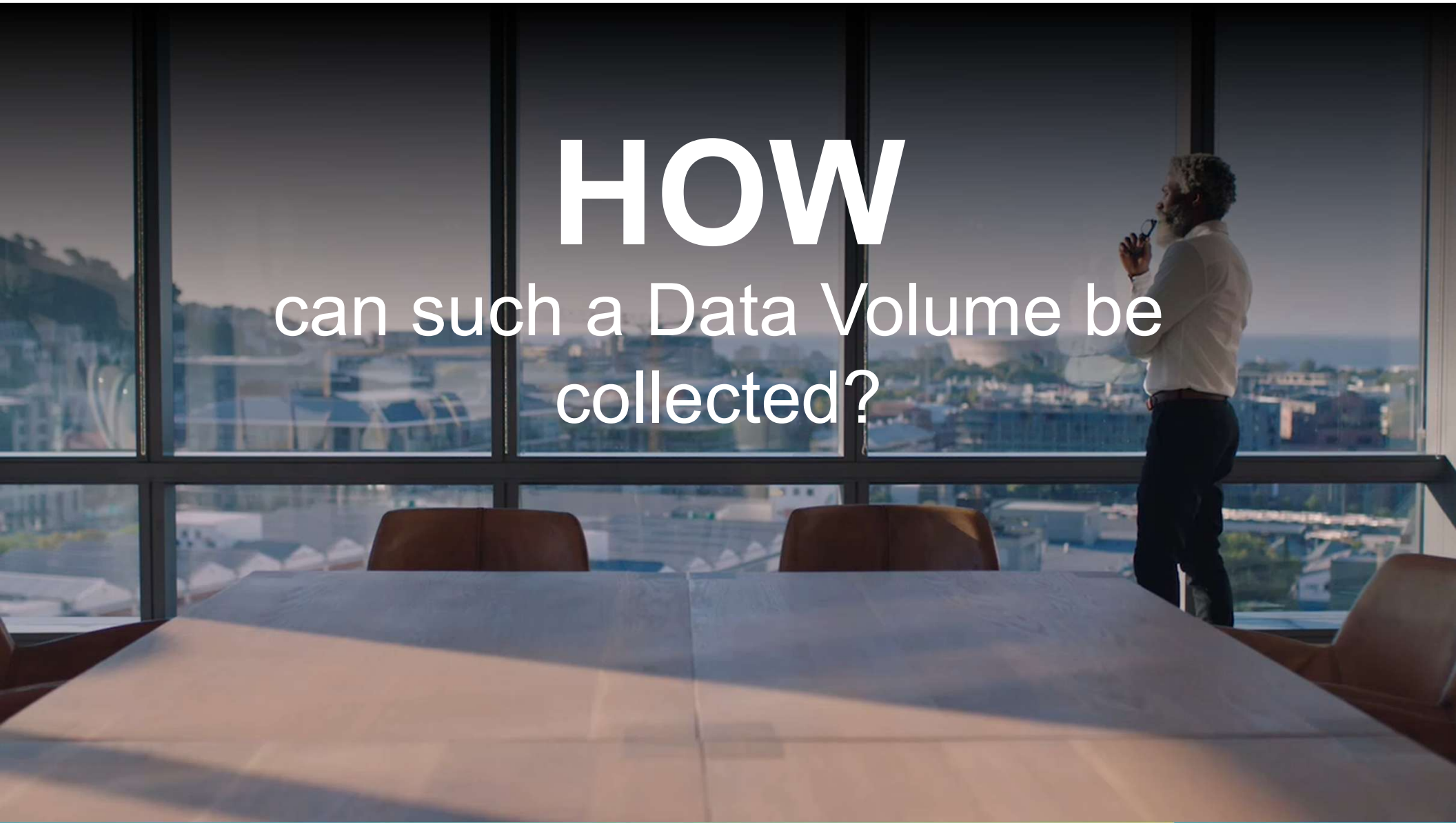

ENVIRONMENTALLY
Focus on sustainability

15 Smartest Cities Worldwide (2019)



HEXAGON

Smart City Strategy Index: Wien und London weltweit fortschrittlichste Städte | Roland Berger


HOW
can such a Data Volume be collected?

Product Portfolio

Airborne Hybrid

Terrestrial-Mobile

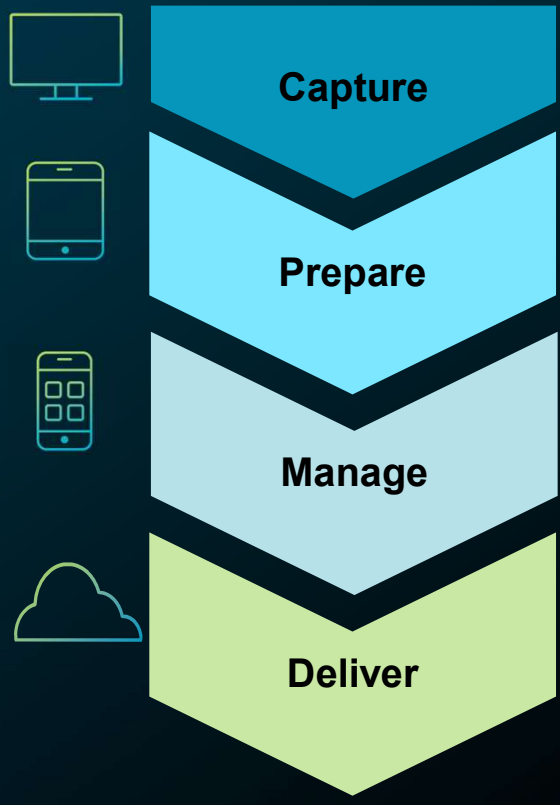
Terrestrial-Static

SCALE

The scale axis represents the range or volume of capture, from low to high.

ACCURACY

from highest to lowest range of accuracy



CHOOSE THE BEST PLATFORM FOR THE APPLICATION

Generic purpose: Mapping Systems are designed for **large scale documentation**.

AIR / CITY / COUNTRY

- Aerial mapping and surveying (urban and rural areas)
- Large-scale terrain analysis
- Environmental monitoring (city and countryside)
- Remote sensing for agriculture and forestry
- Disaster assessment and management
- Urban planning and development
- Infrastructure monitoring over large areas

As Base for…

- Constructions (road, infrastructure, …)
- Maintenance (road, infrastructure, …)
- Autonomous driving / simulations
- Digital City models
- Infrastructure
- Simulations (Traffic, City climate, …)
- Disaster response planning
- Environmental conservation efforts
- National and regional planning

ROAD / CITY

- Road surface inspection (damage)
- Pavement flatness control
- Change detection / deformation management
- Monitoring of retention walls
- Creating HD Base Maps
- Road-Asset Management
- City infrastructure
- Combination with Ground Penetrating Radar

As Base for…

- Constructions (road, infrastructure,…)
- Maintenance (road, infrastructure,…)
- Autonomous driving / simulations
- Digital City models
- Infrastructure
- Simulations (Traffic, City climate, …)

RAIL

- Calculation of track geometry
- Inspection of vegetation
- Inspection of rail infrastructure (bridges, tunnels)
- Clearance analysis/ simulations
- Monitoring of retention walls
- Rail-Asset Management

As Base for…

- Rail constructions
- Rail maintenance

BOAT

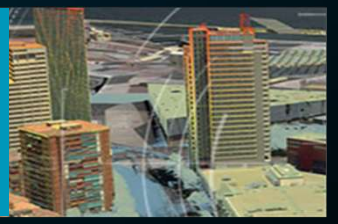
- Documentation of riverbanks, coastal line (maps, erosion)
- Inspection of infratstructure (quay walls, bridges)
- Change detection
- Harbour/shipping -Asset Management
- Visualisation (fly through)
- Combination with echosounders

HEXAGON

Airborne sensor portfolio

Airborne Hybrid Oblique Imaging & LiDAR Sensor	 CityMapper-2	 CountryMapper
Airborne Imagery Sensors	 DMC-4	
Airborne Topographic LiDAR Sensors	 TerrainMapper-3	 SPL100
Airborne Bathymetric LiDAR Sensors	 CoastalMapper	 Chiroptera-5
	 HawkEye-5	

Unified Processing

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

HEXAGON

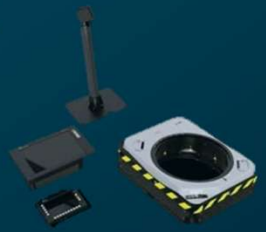
Modular components - Fit for purpose sensors

Integrated Hybrid
Components

Topo LiDAR:
Hyperion

Imaging:
MFC

Bathy LiDAR:
Theia



Peripherals

Leica CityMapper-2

Processing

Hybrid Systems integrating Camera and LiDAR Sensor Modules

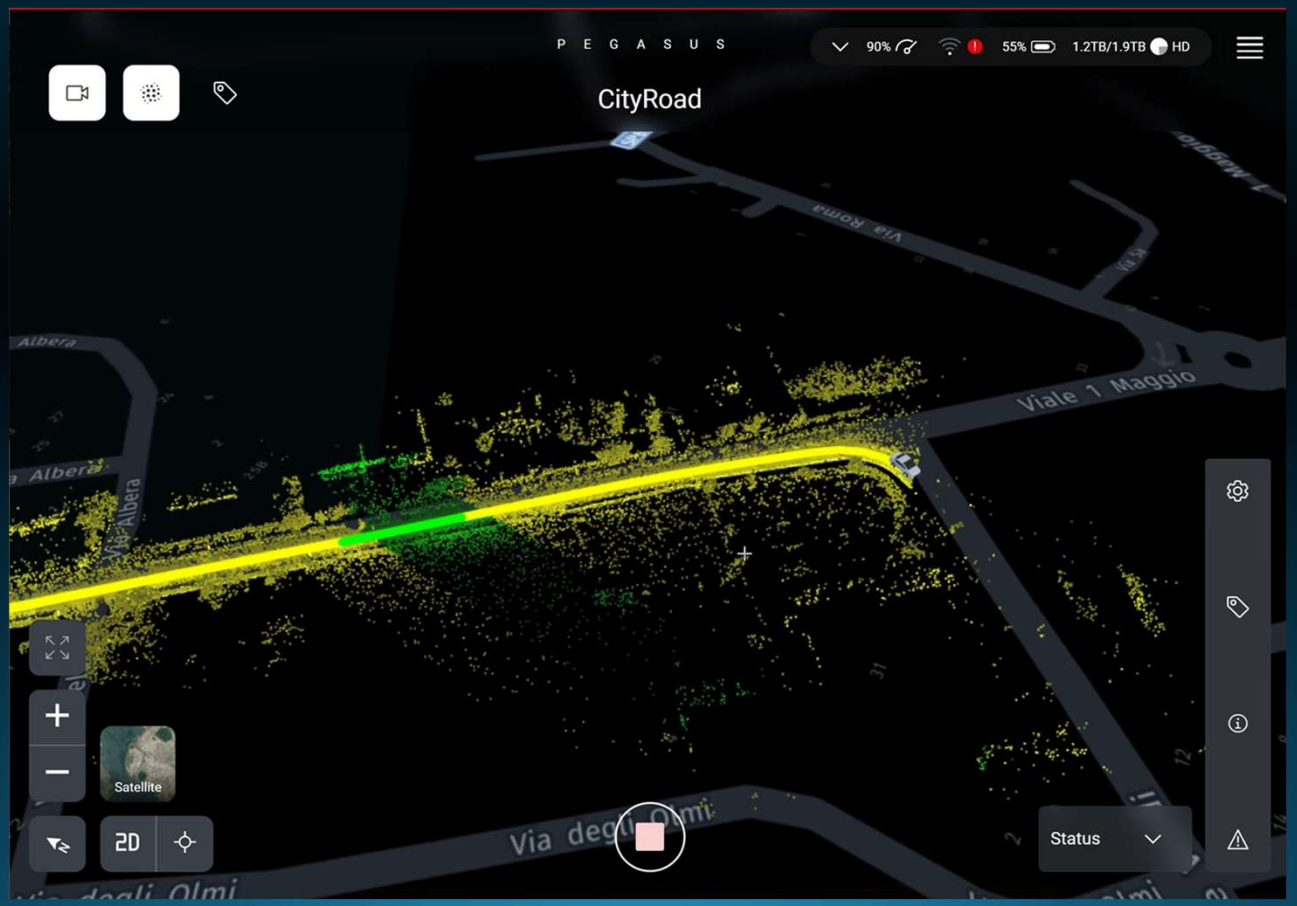
One Workflow

Leica Pegasus TRK

Mobile Mapping System (MMS)

Feld-Software

Intuitive, automated, simple



HEXAGON

Pegasus TRK - System Overview

Sensor Units

TRK100

- Dual Head Scanner
- Multi beam Scanner
- Time-of-flight technology
- MatchPoint technology
- Lightest system

TRK500/700 Neo

- TRK500 Neo: Single Head Scanner
- TRK700 Neo: Dual Head Scanner
- Time-of-flight technology
- Longest range
- Lightest High-End system
- Hybrid module

TRK500/700 Evo

- TRK500 Evo: Single Head Scanner
- TRK700 Evo: Dual Head Scanner
- Phase Shift technology
- Highest pointcloud accuracy
- Highest pointcloud density
- Hybrid module

HEXAGON

Leica Pegasus TRK

Pegasus TRK100

Pegasus TRK Neo

Pegasus TRK Evo

MAIN APPLICATIONS

		Pegasus TRK100	Pegasus TRK Neo	Pegasus TRK Evo
ASSETS	Road signs, telco/power lines	●	●	●
MODELLING	City modelling, simulations	●	●	●
SURVEYING	Cadaster, road-construction	●	●	●
MARINE	Costal erosion, canals	○	●	●
MINING	Volumetric analysis	○	●	●
AUTONOMOUS	HD Base Maps	○	●	●
ENGINEERING	As built, structure analysis, deformation	○	●	●
RAIL	Track geometry, as built, inspection	○	●	●

HEXAGON

The Digital Reality Feedback Loop

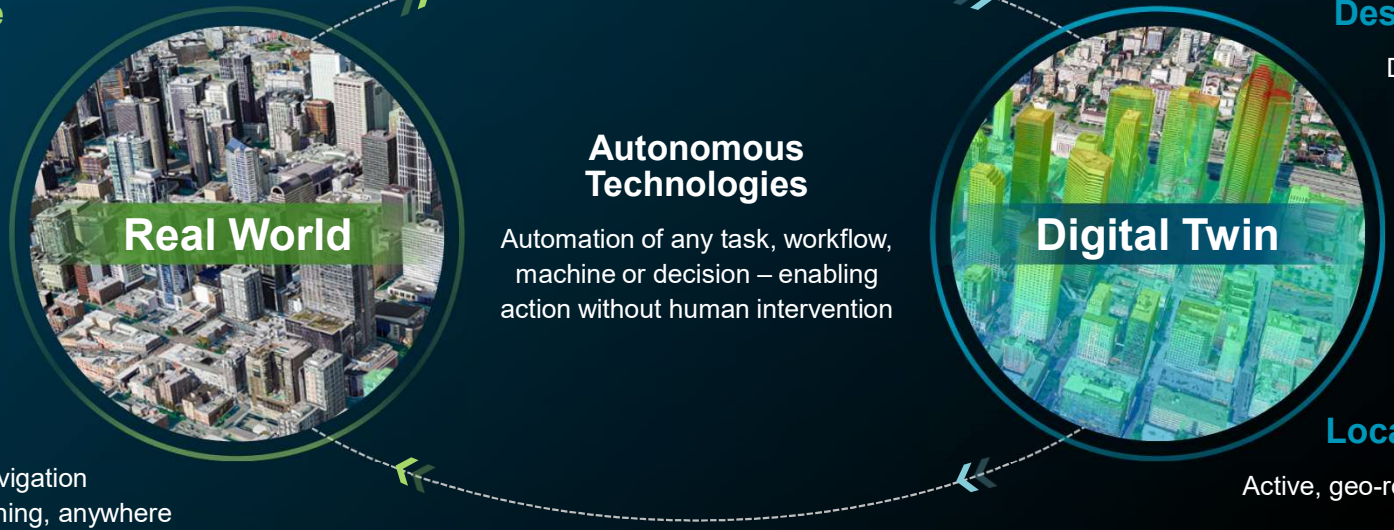
Hexagon's core technology competencies enable a digital reality feedback loop – creating freedom of insight so you can be proactive, preventative and event-predictive

Reality Capture

Digital capture of the physical world

Positioning

Location, tracking, navigation and/or control of anything, anywhere



Autonomous Technologies

Automation of any task, workflow, machine or decision – enabling action without human intervention

Design & Simulation

Design and replication of real-world scenarios

Location Intelligence

Active, geo-referenced intelligence of real-world situations

HEXAGON

Airborne / MMS – Positioning and Trajectory

- To accurately compute the **position and trajectory** of the aircraft/vehicle, multi-frequency, multi-constellation GNSS is needed on the aircraft/vehicle
- GNSS correction data is needed during data collection from reference stations (**CORS**) to compute centimetre-level coordinates of the aircraft/vehicle
- To improve the georeferencing accuracy of the model, **GCP's** are evenly placed across the area and coordinated with centimetre-level accuracy with GNSS

Ground Control Point (GCP)

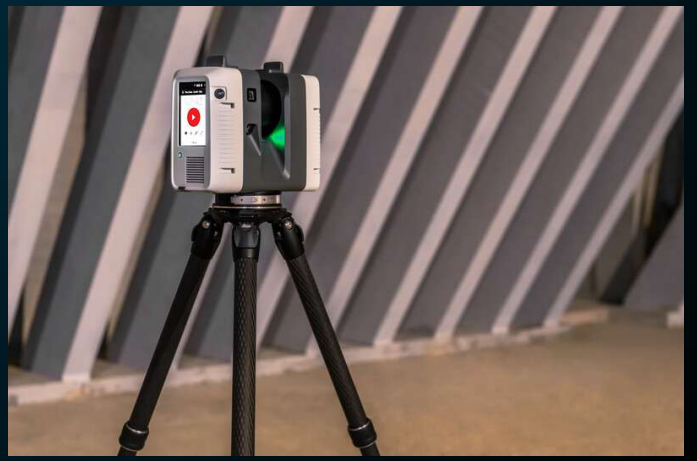
CORS station

HEXAGON

Terrestrial & Mobile Laser Scanning

- **Highest Accuracy:** Terrestrial laser scanning offers exceptional precision, making it ideal for creating digital twins that require the most accurate representation of real-world conditions.
- **Efficiency:** Mobile laser scanning excels in quickly capturing data in both indoor and outdoor settings, significantly speeding up the digital twin creation process.
- **Versatility:** Both static and mobile laser scanning can access hard-to-reach areas, ensuring comprehensive data capture for creating detailed digital twins across diverse environments.

BLK2GO Mobile laser scanner

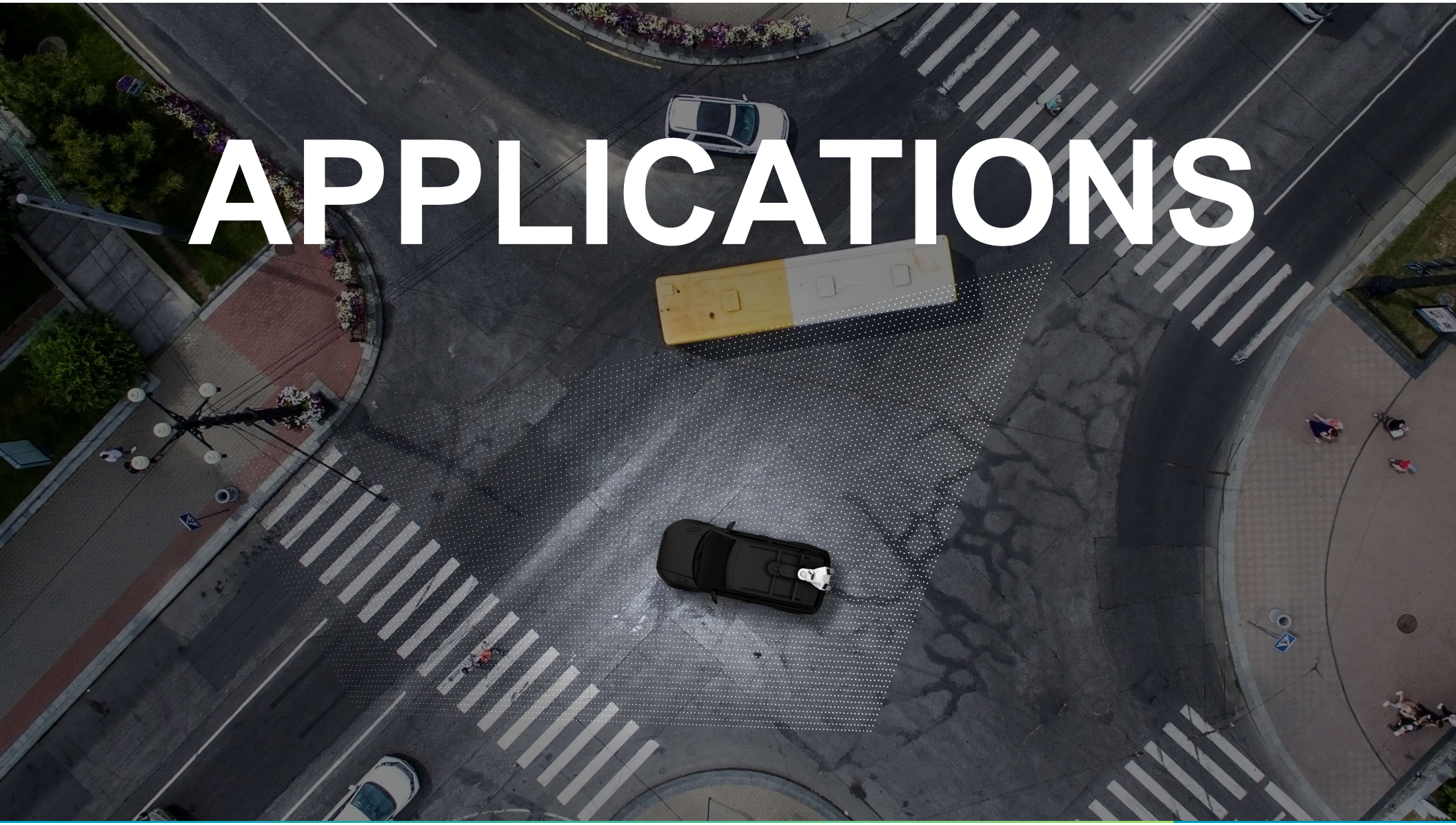


RTC360 Terrestrial laser scanner

BLK ARC Mobile laser scanner for robots

BLK2FLY Flying laser scanner

HEXAGON


APPLICATIONS

Derived analytics

Managing urban areas

City

Digital Twin - City of Munich

- Improved constuction site coordination
- Simulation as base for better climate
- Cycle path planning with 3D visualization

City

Digital Twin - City of Hamburg

- Efficient management of loading zones for inner-city delivery logistics
- Project – digital recording of construction site areas

Hamburg

City

Digital Twin - City of Basel

- Hexagon & University of Applied Sciences and Arts Northwestern Switzerland (FHNW) combine their expertise
- DigitalCities4Us project uses high-resolution 3D geodata and digital twins to enhance urban accessibility for individuals with mobility restrictions.

City

Digital Twin - City of St Gallen

- The city of St. Gallen serves as a model, utilizing digital twins and simulations to visualize potential transformations, which aids urban planners in making informed decisions and gaining public support for sustainable initiatives.

Infrastructure

Heavy Transport Italy

Heavy Transport

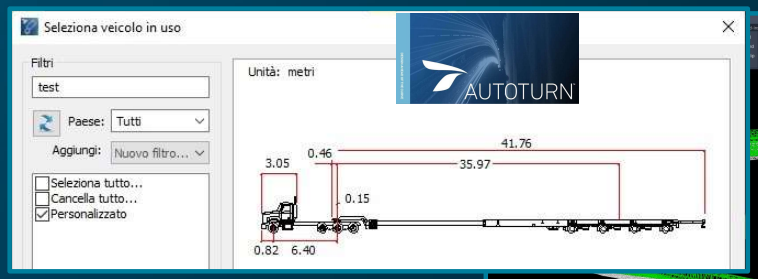
Challenge:
Documentation of existing road infrastructure

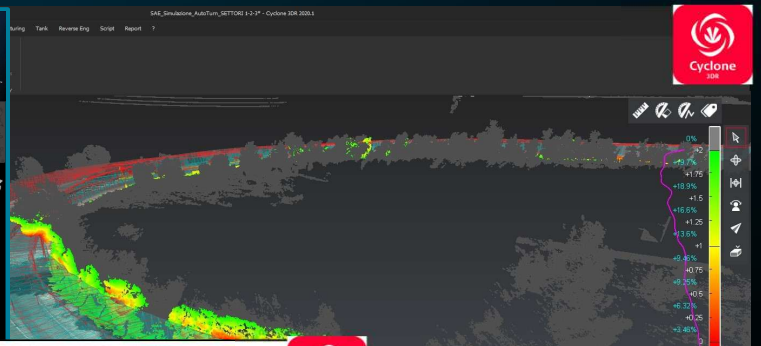
Purpose:
Create base map for simulations of heavy / oversize transports

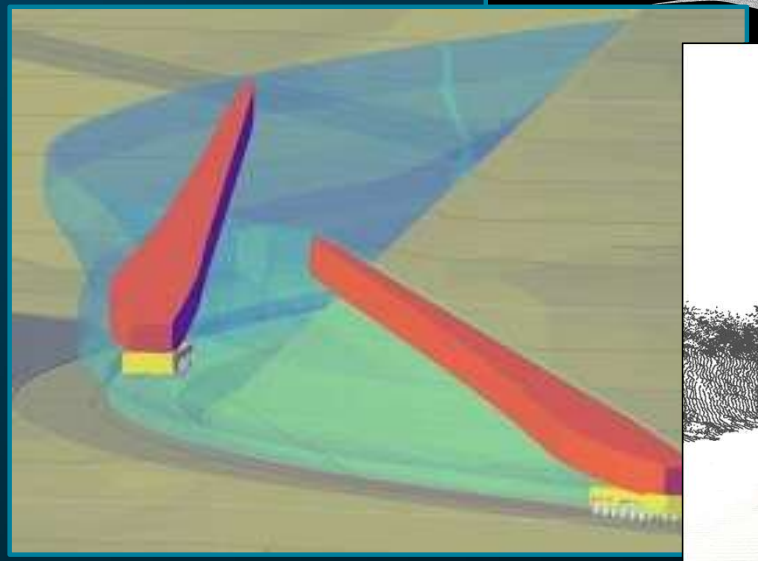
Solution:
- Pegasus Two:Ultimate / Pegasus TRK
- AutoTurn, Cyclone 3DR

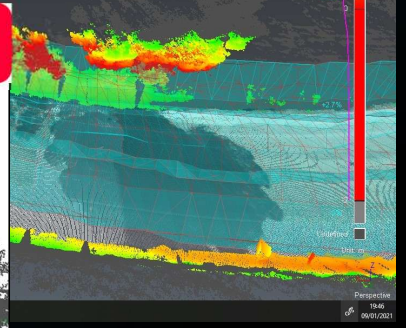
HEXAGON

Heavy Transport









HEXAGON

Heavy Transport

Conclusion:

- Pegasus is a truly flexible MMS

- Highly efficient
  - 1 operator
  - Data processing on site
  - Highest possible safety for Operator

HEXAGON

GIS - Asset Management

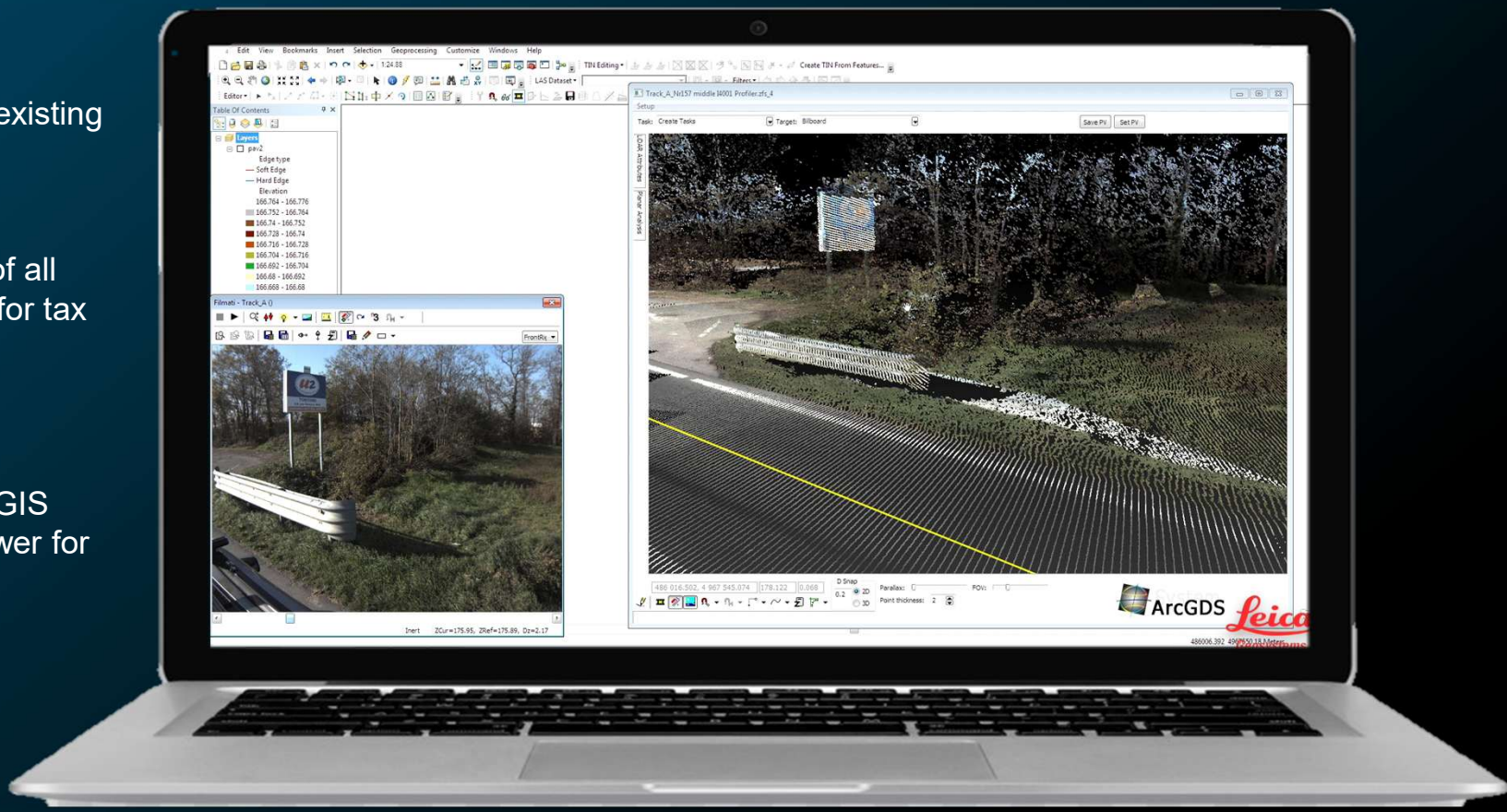
Tax collection – Billboard campaign

Tax collection via Billboard campaign

Challenge:
Documentation of existing billboards

Purpose:
Create data base of all existing billboards for tax collection

Solution:
- Pegasus TRK
- ArcGIS Pro / QGIS
- CloudWorx Viewer for ArcGIS Pro



HEXAGON

Mapping

Riverbank Survey Hungary

One-Pager
Leica Pegasus TRK700 Neo: Capturing data by boat along riverbanks

Customer use case: National Water Management department in Hungary adopt the latest mobile mapping technology

"The latest mobile mapping technology is so **versatile** that it can capture data from a **car** along ground routes and bridges, and from a **boat** along riverbanks for more complete field measurement tasks."

- CHALLENGE: Efficiently measure and map both above and below-bridge structures and the waterline in a short timeframe while ensuring accurate and synchronised data acquisition for further analysis
- SOLUTION: Combining bathymetry and LiDAR technologies to capture, process and deliver a highly accurate terrain model of the structural elements above and below the waterline
- RESULTS: A comprehensive topographic survey of the entire riverbank, above and below the waterline for future flood risk assessment, infrastructure planning and design, erosion control and water resource management

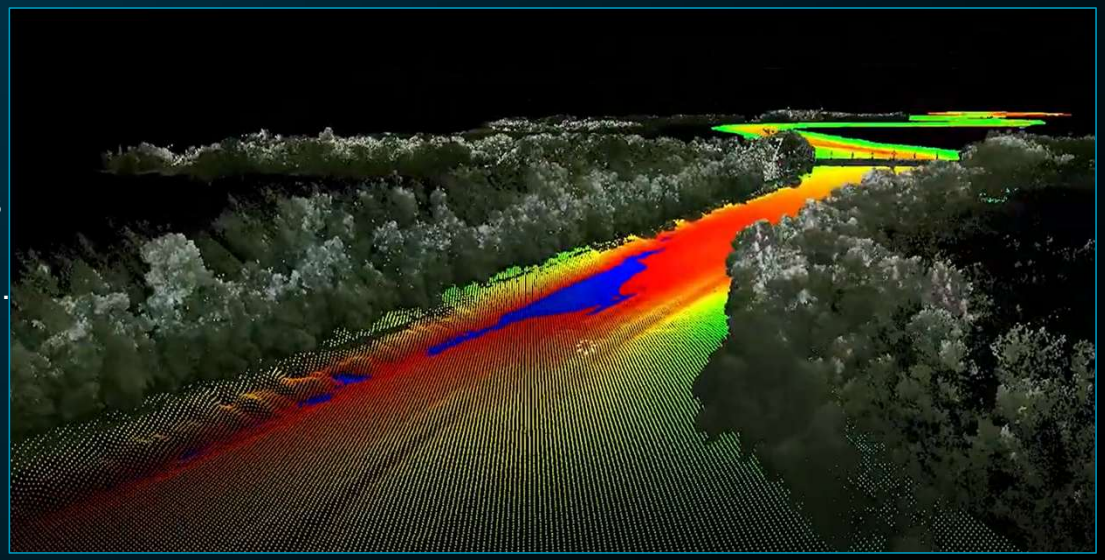
WATCH THE DATA VIDEO

HEXAGON

Riverbank Survey

Conclusion:

- Pegasus TRK proved to be an ideal tool for large-scale boat applications
- The long-range LiDAR is ideal boat applications
- Data transfer to Cyclone 3DR worked seamless.
- Efficient end to end solution



HEXAGON

Communication

“Italia 1 Giga”

Digital twin for broadband expansion

Capgemini

Broadband Expansion

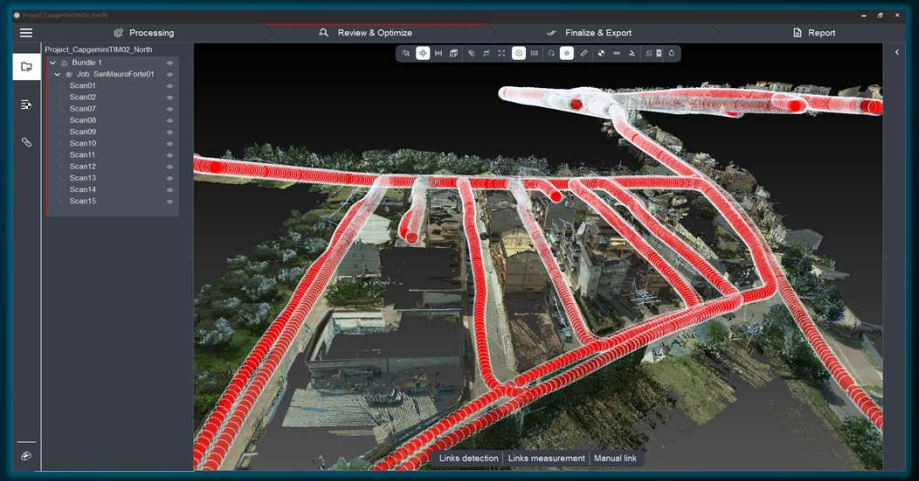
Equipment:
- 3 x Pegasus TRK500 Neo
- BLK2GO

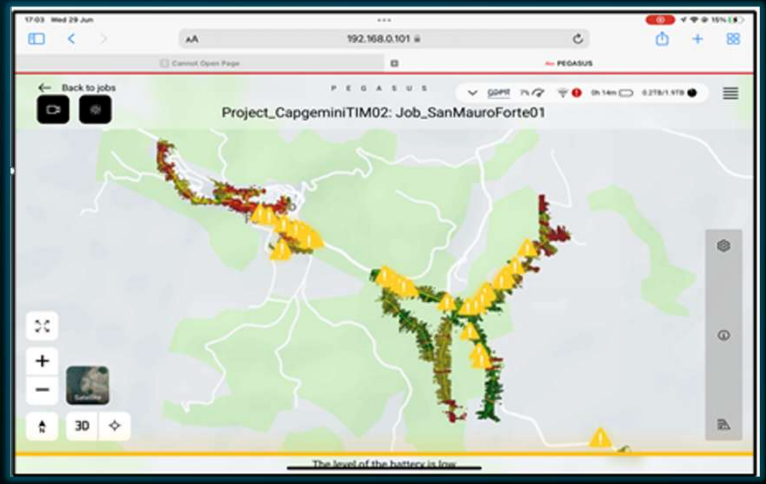
Task:
Mapping urban infrastructure
- House numbers
- Counting intercoms
- Documentation of existing telecommunications infrastructure

Purpose:
Creating the basis for broadband expansion
- Inventory documentation
- Construction planning

HEXAGON

Broadband Expansion



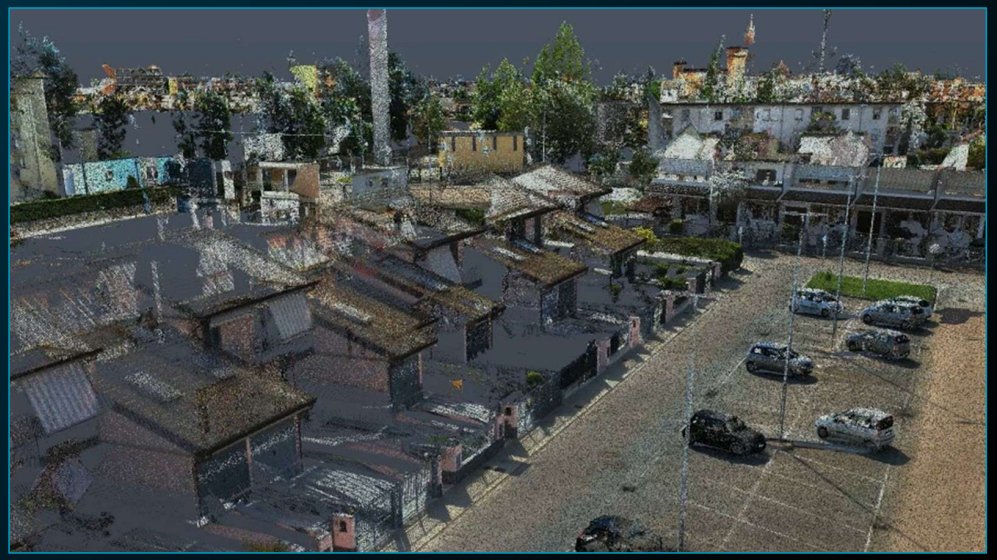


HEXAGON

Broadband Expansion

Conclusion:

- Increased efficiency
  “60% faster than conventional”
- Higher data quality
  “20% less rework”
- Reuse data for other business opportunities
- Increased safety of Operator



HEXAGON

Cities

Tackling City Pollution

City Pollution

Equipment:
- Pegasus TRK500 Neo

Task: Mapping of city environment

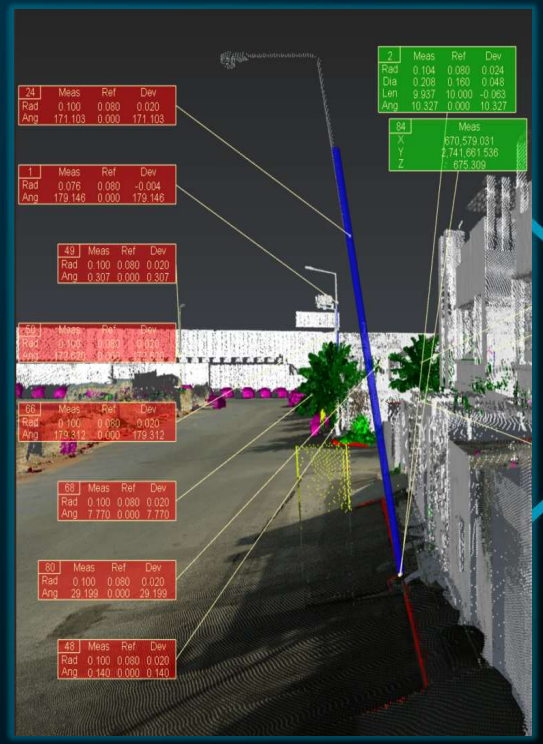
Purpose: Detection of
- Waste
- Abandoned/disused cars
- Broken lamp-posts
- Graffiti
- Street damages, potholes
- Outdated street furniture
- As Built documentation

HEXAGON

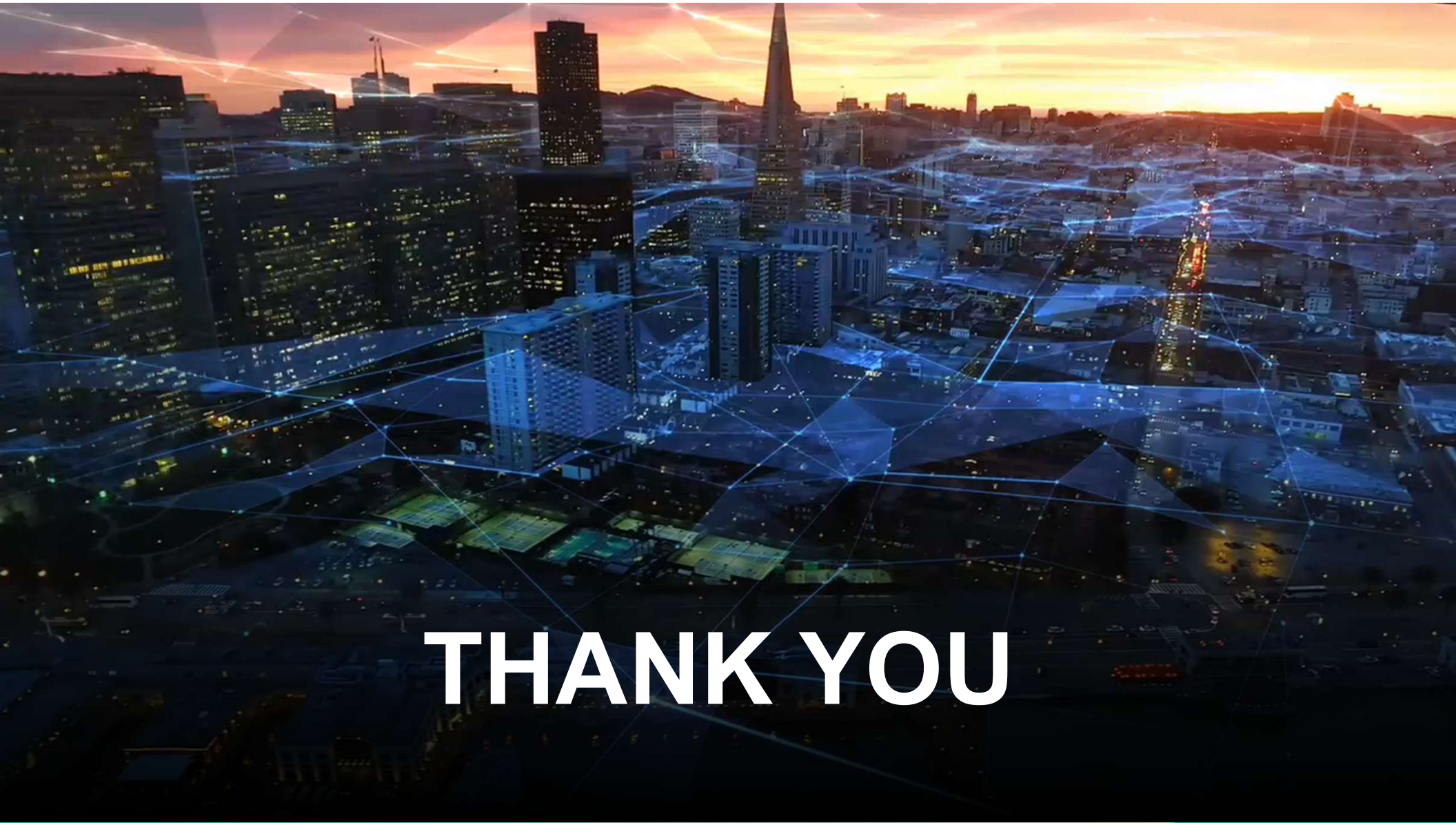
City Pollution

HEXAGON

City Pollution



HEXAGON


THANK YOU