Transportation Infrastructure
WGF 2017

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Growing Population

THE WORLD’S POPULATION IS GROWING TODAY 7.4BN - 10BN IN 40 YEARS
Mapping the Unknown

- From 1861, Victorian engineers built miles of purpose-built subways large enough to walk through, for running gas, electricity, water, and hydraulic pipes.
- Removing the inconvenience of continually excavating highways to allow access to underground utilities.
- Most are still in use today – some have infrastructures surveys have not been updated since they were created.

Fresh water & Sewers
London, like most other major cities, has extensive underground infrastructure for fresh water supply and sewers.

Gas & Electricity
in 1861, Victorian engineers built several miles of purpose-built subways large enough to walk through, for running gas, electricity

Railway
The Mumbai Suburban Railway is an offshoot of the first railway to be built by the British in India, and is also the oldest railway system in Asia. The first train ran a distance of 34 km, on 16 April 1853
Mapping the Inaccessible

- Italy during August and October 2016, multiple earthquakes impacted central Italy
- Historically only airborne data could be used for disaster
- Key to rebuilding and insurance is having a ground based capture
New Technology Enabling Mapping in New Ways

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>NEW</th>
<th>OLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey or nothing (once-in-lifetime)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Complete as-built capture</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Progressive Capture (during construction)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Monitoring</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Surveying Faster (higher ROI)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Dam waterway normally filled with water
Productivity Driving Reality Capture Products for Infrastructure

- Vehicle Speeds up to 120km/h
- Outdoors only
- Speed determines max pt per Sq mtr

- Above and Below Ground
- Mass Digitisation
- 15km/h Acquisition Speed

- Walking pace
  - Underground or outdoor

- Walking pace – indoors or outdoors
Infrastructures Need Flexiblity - Leica Pegasus:Two

- Fast to deploy – no preparation
- Vehicle independent
- Boat, train, trolley, car
- Significantly flexibility in applications
- Battery operated
Breadth of Digital Infrastructure Surveying
Pegasus: Two

- Expressways, Highways, Roads corridor mapping.
- Railways, Fast Trains, Tram ways corridor mapping.
- Canals and distributaries system, having service roads.
- 3D City modeling, City surveys & Topographic Surveys.
- Surveys for Airport runways and adjacent areas.
- Surveys for Telecommunication – along road network.
- Water and Gas pipe lines survey along the existing roads.
How Do Our Customers Generate Value From P2

- Civil Survey
- GIS Asset Management
- 3D Point Cloud
- GIS Application
- Road Survey
- Ortho TIFF
- DTM
- Civil Engineering
- Airport Survey
- City Modelling
- Road GIS Asset Management
- 3D Point Cloud
- Rail Survey
- Content
Government investment
Important government investment: 400 Million $USD

200 KM
200 Km of simple road in northern Colombia

Acuracy
Accuracy measurement of heights very important for design the new road surface

www.grupoacre.com
Why the Pegasus solution?

We obtain complete point cloud and pictures

Geometry and attributes at the same time

www.grupoacre.com
Mobile LiDAR and Multi-beam Sonar - Tittabawasse River, USA

1. High Level of Detail
2. Superior Deliverable
3. Collection Time vs. Traditional Methods
4. Impact to property owner
Customer Example: Infrastructure Mapping of Hydroelectric Dam in Italy
Pegasus:Backpack
Customer Example: Infrastructure Mapping of Sewers
Pegasus:Backpack
Customer Example: Infrastructure Mapping of Sewers

Pegasus:Backpack
Urban Planning and Monitoring – Infrastructure?

Credit: Genesys International
Urban Planning and Monitoring

• Dimly lit corridors even during Mid-Day (Problem solved by using Flash mounted on the backpack)
• Extremely narrow lanes and by lanes
• Haphazard lane and by lane layouts
• Hutments present below ground level
• Closely spaced hutments with overlapping roofs causes problems in acquiring GPS fixes
• Varying Terrain Undulations
• Turbulence from slum dwellers and political unions

Credit: Genesys International
Urban Planning and Monitoring - Deliverables

Hut Wall Extraction Top View

Hut Wall Extraction Side View

Credit: Genesys International
Rail Infrastructure – Maintenance of Rail Bridge
SiTrack: Two

Weserbridge, northern Germany, built 1873
Detection of the beams because of bridge sleeper renewal
### Rail Infrastructure – Maintenance of Rail Bridge

**SiTrack:Two**

<table>
<thead>
<tr>
<th>dimension</th>
<th>classical measurement (levelling, tachymetric)</th>
<th>measurement with mobile laser scanning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field work</td>
<td>100 beams/sleepers a day (8h)</td>
<td>4000 beams/sleepers a day (8h)</td>
</tr>
<tr>
<td>Manpower</td>
<td>2 engineers</td>
<td>2 engineers</td>
</tr>
<tr>
<td></td>
<td>3 safety persons</td>
<td>3 safety persons</td>
</tr>
<tr>
<td>Field work: time</td>
<td>20 days*</td>
<td>0.5 days</td>
</tr>
<tr>
<td>Field work hours</td>
<td><strong>800</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td>Office work</td>
<td>500 beams/sleepers a day (8h)</td>
<td>250 beams/sleepers a day (8h)</td>
</tr>
<tr>
<td>Manpower</td>
<td>1 engineer</td>
<td>2 engineers</td>
</tr>
<tr>
<td>Office work: time</td>
<td>4 days</td>
<td>8 days</td>
</tr>
<tr>
<td>Office work: hours</td>
<td>32</td>
<td>128</td>
</tr>
<tr>
<td>Total work hours</td>
<td><strong>832 h</strong></td>
<td><strong>148 h</strong></td>
</tr>
</tbody>
</table>

*probably necessary overnight costs not included
Rail Infrastructure – Maintenance of Rail Bridge

SiTrack:Two
Below and Above Ground Asset Management
Customer's Choice – Pegasus Platform - 61 Units Globally – Fastest Growing Community in 3 yrs

- Updated for Q3 2016.
- Demos available in all regions.
- 8 Pegasus:Backpack system – France, Holland, Norway, India

- 1 unit in Belgium
- 2 units in Holland
- 3 units in UK
- 8 units in France
- 1 unit in Hungary
- 4 units in Italy
- 3 units in Ukraine
- 1 unit in Russia
- 5 units in Japan
- 1 unit in S.
- 1 unit in China
- 1 unit in China
- 1 unit in Brazil
- 2 units in Mexico
- 1 unit in Brazil
- 1 unit in S.
- 1 unit in S.

Pegasus Systems units sold

- 18
- 2
- 1
- 1
- 1
- 1
- 4
- 1
- 8
- 2
- 1
- 1
- 1
- 2
- 1
- 1
- 1
- 1
- 1
- 1
- 3
- 4
- 2

U.S.A  Mexico  Belgium  Portugal  Greece  Italy  Russia  Holland  S. Korea  Switzerland  Hungary  France  UAE  China  Japan  India  Brazil  Uruguay  UK  Dubai
Thank You

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