2-in-1 Large Format and Oblique Aerial Camera Systems for 3D Urban Mapping

Geospatial World Forum 2018
- Mission Planning & Flight Guidance
- Sensor Management
- GNSS/IMU Navigation
- Aerial Sensor Systems
- Mobile Mapping Solutions
- Turn-key Solutions
IGI Modular Aerial Camera Systems

Applications:

- Aerial camera for special applications and light aircraft
- Complementary sensor for multi-sensor systems
- Multiple camera systems for a large nadir views
- Penta configurations for nadir & oblique
- 2-IN-1 system for large format & oblique
**DigiCAM-100**

100 Mpixel CMOS

Based on Phase One IXU-RS 1000

0.6s Image repetition

84db Dynamic range

1/2500 s min. exposure time

High endurance shutter with
> 0.5 mio. cycles

Lens options:
32mm / 40mm / 50mm / 70mm / 90mm (1/2000sec) / 110mm / 150mm
DigiCAM-100

100 Mpixel CMOS

Based on Phase One IXU-RS 1000

Image repetition: 0.6 sec

Dynamic Range: 84 db

Exposure Time: 1/2500 sec

High endurance shutter with

> 0.5 mio. cycles

IGI SMU-2 with 2 x 2TB hotplug SSD

Space for 10,000 or 20,000 images (redundant / not redundant)
**DigiCAM-200**

2 x 100 Mpixel CMOS, Central Projection

Channels: RGB, NIR (optional)

Across Track: 22.800 * 8.700 pixel

Along Track: 16.500 * 11.600 pixel

Focal Length: 90 mm

Image Repetition: 0.6 sec

Dynamic Range: 84 db

Exposure Time: Up to 1/2000 sec

High endurance shutter with > 0.5 mio. cycles
Penta-DigiCAM-200

2 x 100 Mpixel CMOS, Central Projection
4 x 100 Mpixel CMOS, Oblique

Channels: RGB, NIR (optional)

Across Track: 22.800 x 8.700 pixel
Along Track: 16.500 x 11.600 pixel
Oblique: 11.608 x 8.708 pixel

Focal Length: 90mm

Image Repetition: 0.6 sec
Dynamic Range: 84 db

High endurance shutter with > 0.5 mio. cycles
**DigiCAM-300**

3 x 100 Mpixel CMOS

- **Channels:** RGB, NIR (optional)
- **Across Track:** 36.600 x 8.700 pixel
- **Along Track:** 28.200 x 11.500 pixel
- **Focal Length:** 90 mm
- **Image Repetition:** 0.6 sec
- **Dynamic Range:** 84 db
- **Exposure Time:** Up to 1/2500 sec
- **High endurance shutter with > 0.5 mio. cycles**
Open Skies – Flying Altitudes

HIGH
DigiCAM-OS-h

MEDIUM
DigiCAM-OS-m

LOW
DigiCAM-OS-l
DigiTHERM-OS-l

1900 m
3500 m
6100 m
10000 m

5870 m 81°
3400 m 85°
1550 m 96°

63°
IGI Modular Sensor Management System

Two camera modules per SMU

SMU-rack on top of the sensor unit or arbitrary position

IMU integrated 2 .. 8 camera modules
IGI UrbanMapper

2-IN-1 Aerial Camera System

- Large format camera with NIR module
- Oblique camera (4 x 100Mpixel)

Modular Design:

- Upgradeable NIR & Oblique Camera Modules

RGB 28,200 x 11,600 pixels

RGBI 24,900 x 11,600 pixels (option)

84db Dynamic range, CMOS Technology

2cm GSD @ 400m AGL, 120kn, >80% Fwd Overlap

5cm GSD @ 1000m AGL, 150kn, >90% Fwd Overlap
IGI UrbanMapper

2-IN-1 Aerial Camera System
- Large format camera with NIR module
- Oblique camera (4 x 100Mpixel)

Modular Design:
- Upgradeable NIR & Oblique Camera Modules

RGB 28,200 x 11,600 pixels

RGBl 24,900 x 11,600 pixels (option)

84db Dynamic range, CMOS Technology

2cm GSD @ 400m AGL, 120kn, >80% Fwd Overlap

5cm GSD @ 1000m AGL, 150kn, >90% Fwd Overlap
IGI UrbanMapper

2-IN-1 Aerial Camera System
   • Large format camera with NIR module
   • Oblique camera (4 x 100Mpixel)

Modular Design:
   • Upgradeable NIR & Oblique Camera Modules

RGB 28,200 x 11,600 pixels

RGBI 24,900 x 11,600 pixels (option)

84db Dynamic range, CMOS Technology

2cm GSD @ 400m AGL, 120kn, >80% Fwd Overlap

5cm GSD @ 1000m AGL, 150kn, >90% Fwd Overlap
IGI Modular Sensor Management System

IGIplan

AEROoffice, IPS, 3rd Party

CCNS-5

AEROncontrol

SMU / IGIvisu
IGI UrbanMapper – IGIvisu, the operator’s view

- 20” / 4K touch screen
- Control of camera groups & single modules
- Tools and indicators for optimal illumination
**IGI UrbanMapper**

- Nadir-view: 28.200 x 11.500 Pixel
- Oblique-view: 11.600 x 8.700 Pixel
- Oblique angle: 42°
- Image repetition: 0.6 sec
- Focal length: 90mm
- \( \text{GSD}_{\text{oblique}} \approx 1.4 \times \text{GSD}_{\text{nadir}} \)
## 90mm lens

- Shutter with 1/2000 sec

### Forward image blur:

<table>
<thead>
<tr>
<th>Speed/GSD</th>
<th>2 cm</th>
<th>5cm</th>
<th>10 cm</th>
<th>20cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 kn</td>
<td>0.90</td>
<td>0.36</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>100 kn</td>
<td>1.29</td>
<td>0.51</td>
<td>0.26</td>
<td>0.13</td>
</tr>
<tr>
<td>120 kn</td>
<td>1.54</td>
<td>0.62</td>
<td>0.31</td>
<td>0.15</td>
</tr>
<tr>
<td>160 kn</td>
<td>2.06</td>
<td>0.82</td>
<td>0.41</td>
<td>0.21</td>
</tr>
</tbody>
</table>
IGI UrbanMapper

- Image repetition 0.6 sec

<table>
<thead>
<tr>
<th>Speed/GSD</th>
<th>2 cm</th>
<th>5 cm</th>
<th>10 cm</th>
<th>20 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 kn</td>
<td>91%</td>
<td>96%</td>
<td>98%</td>
<td>99%</td>
</tr>
<tr>
<td>100 kn</td>
<td>87%</td>
<td>95%</td>
<td>97%</td>
<td>99%</td>
</tr>
<tr>
<td>120 kn</td>
<td>84%</td>
<td>94%</td>
<td>97%</td>
<td>98%</td>
</tr>
<tr>
<td>160 kn</td>
<td>78%</td>
<td>92%</td>
<td>96%</td>
<td>98%</td>
</tr>
</tbody>
</table>

Forward overlap:
IGI UM Example: “Mission-Planning Brüssel”

- GSD nadir: 5cm
- GSD oblique: ~7cm
- Overlap: 85%
- Velocity: 160kn (82m/sec)
- Flying height: 3210 ft (980m)
- Repetition rate: 1 / 1.05 sec
- Blur: ~ one Pixel (nadir and oblique)

Region “Brüssel- Hauptstadt” 161km²
**IGI UM Example: “Mission-Planning Brüssel”**

GSD nadir 5cm
GSD oblique ~ 7cm
Overlap 85%

The graphics were created with an overlap of only 60% to improve the clarity of the view.
IGI UM Example: “Dortmund City”

Camera System: IGI UrbanMapper
Flight operations: AEROWEST, Dortmund, Germany
Weather conditions: Scattered clouds
Flying height above ground: 620m (block) 370m / 960m (some additional photos)
Flying speed: 130kn (67m/s)
GSD:
- 370m: 1.9cm / 2.7cm (nadir / average oblique)
- 620m: 3.2cm / 4.5cm
- 960m: 4.9cm / 6.9cm
Overlap (nadir block):
- forward overlap: 80%
- side overlap: 84%

Demo data-set available!
-> sales@igi-systems.com
IGI UM Example: “Dortmund City”

h = 370m   GSD=1.9cm
IGI UM Example: “Dortmund City”

h = 370m  GSD=1.9cm
IGI UM Example: “Dortmund City”

h = 370m
mean GSD = 2.7cm
IGI UM Example: “Dortmund City”

$h=370m$

$\text{mean GSD}=2.7\text{cm}$
IGI UM Example: “Dortmund City”

h = 370m  GSD = 1.9cm
IGI UM Example: “Dortmund City”
IGI UM Example – Nadir Image Block

DSM - “2.5D”
Dense Pointcloud
with equally spaced points
IGI UM Example – Dense Point Cloud
IGI UrbanMapper Example - Acute3D Viewer

City of Dortmund, Germany
City of Soest, Germany
IGI UrbanMapper Example - SURE - Shaded

City of Soest, Germany
IGI UrbanMapper Example – IGImatch/Sure
IGI UrbanMapper Example - Voxel Web App
IGI UrbanMapper Example: virtualcityMAP/Oblique
IGI UrbanMapper Example: virtualcityMAP/3D
IGI UrbanMapper Example: virtualcityMAP/3D
The **IGI UrbanMapper** combines a large format aerial camera & oblique camera within one system – 2-IN-1!

- Optimal workflow for the production of
  - Standard Orthophoto
  - True-Orthophoto
  - 3D stereo digitization
  - High accurate 3D CityGML models
  - Automatic 3D city models
2-in-1 Large Format and Oblique Aerial Camera Systems for 3D Urban Mapping

Thank You!

Geospatial World Forum 2018