

Phase One iXU-RS1000 Accuracy Analysis

The forefront of aerial photography



Phase One Industrial – Aerial Survey Products



iXU-RS1000, iXU1000 series





Phase One 190MP Aerial System



Phase One 50MP-100MP with DJI M600

Phase One Industrial – Cameras iXU-RS1000 series



iXU-RS1000 series

Camera Type	iXU-RS1000					
Camera Specifications						
Lens type	Rodenstock / Schneider-Kreuznach					
Focal longth F (mm)	RS lenses: 32, 40, 50, 70, 90, 110, 150					
	SK lenses: 28, 55, 80, 110, 150, 240					
FOV (across line, deg)	86.5 (28mm) - 12.9 (240mm)					
FOV (along flight line, deg)	70.3 (28mm) – 9.7 (240mm)					
Aperture	f/5.6					
Exposure principle	Leaf shutter					
Exposure (sec)	1/2000 to 1/125					
Image capture rate	1 frame every 0.6 sec					
Light Sensitivity (ISO)	50-6400					
Dynamic Range (db)	>84					
Spectral characteristics	R,G,B					
Sensor Spo	ecifications					
CMOS pixel size (µm)	4.6					
CMOS array (pix)	11,608 x 8,708					
Analog-to-digital-conversion (bit)	14					
Frame / Image	Specifications					
Frame geometry	Central projection					
Image size (pixel)	11,608 x 8,708					
Image volume (MP)	100					
Color	RGB or NIR					
Typical image size (MB)	300					
Image format	Phase One RAW, TIFF, JPEG					
Operational Specifications						
Power Consumption	< 10W					
Dimensions (depends on lens)	97.4 x 93 x <218 mm					
Weight (depends on lens)	< 2 kg					



Phase One 190MP Aerial System Specifications



Phase One 190MP Aerial System



Camera Type	iXU-RS1900	iXU-RS1900 4-band					
Camera Specifications							
Lenses type	Rode	enstock					
Number of lenses	2	3					
Focal length (mm)	90	90 & 50					
FOV (across / along flight line, deg)	45.7	/ / 33.0					
Aperture	f	/5.6					
Exposure principle	Leaf	shutter					
Exposure (sec)	1/2000) to 1/125					
Image capture rate	1 frame e	every 0.6 sec					
Light Sensitivity (ISO)	50-	-6400					
Dynamic Range (db)		>84					
Spectral characteristics	R,G,B	R,G,B, NIR					
Sensor Spe	cifications						
CMOS pixel size (µm)		4.6					
CMOS array (pix)	11,608 x 8,708						
Analog-to-digital-conversion (bit)	14						
Frame / Image	Specifications						
Frame geometry	Central	projection					
Image size (pixel)	16,470	x 11,570					
Image volume (MP)	190						
Color	RGB	RGB, NIR, CIR, 4-band					
Pansharpen ratio	N/A	1:1.8					
Typical image size (MB)	570	760					
Image format	Phase One R	AW, TIFF, JPEG					
Comple	ete Set						
iX Controller	up to 6 separ	rate USB3 ports					
Pilot monitor for navigation		Yes					
Operator monitor for camera management Yes							
Gyro-stabilizer SOMAG DSM400							
INS/GNSS	Applanix, NovAtel,						
Operational S	pecifications						
Power Consumption	18	30 W					
Dimensions (L x W x H) 46x43x37 cm							
Weight	3	0 kg					

Phase One iXU-RS1900 – Image Formation Principles





Phase One iXU-RS1900 vs iXU-RS1000 – productivity comparison



iXU-RS1900 increases the distance between flight lines on 63%.

Total flight time (including turns) required for capturing an area of 5km by 5km (25 km²) with 5cm ground resolution





Phase One Industrial – Test Field



Well-defined manmade features selected as GCPs







Test field characteristics				
Area	WE – 2.0 km SN – 1.2 km			
Number of GCPs	53			

± 0.8 cm

± 1.3 cm

GCPs measurements procedure:

GCPs RMSxy

GCPs RMSz

- geodetic observations were 1. The made according to static GPS survey procedure with one reference station.
- 2. The reference station was measured against CSAR permanent GPS station by two independent 1-hour long observation sessions.
- 3. Every GCP was measured by two independent half-hour long observation sessions.



Aerial Survey flight with iXU-RS1000/90



Cessna 172





Flight characteristics

Flight altitude	2,500 feet
GSD	4 cm
Distance between strips	230 m
Side overlap	49%
Forward overlap	80%
Frame size	450m x 340m
Orthophoto angle	17°
Building lean	15%
Ground speed	100 knot
Strips SN	9
Strips WE	2
Number of images	202

Accuracy analysis: 5 GCP and 48 Check Points



Block accuracy on Check Points

 $RMSxy = \pm 2.9 \text{ cm} (0.7 \text{ pix})$ $RMSz = \pm 6.0 \text{ cm} (1.5 \text{ pix})$

	5 GCP			48 Check Points			
	dX	dY	dZ	dX	dY	dXY	dZ
	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
MIN	-0.4	-0.5	-0.3	-5.9	-7.2	9.3	-11.5
MAX	0.4	1.1	0.2	3.9	4.6	6.0	7.4
Mean	0.0	0.0	0.0	0.1	-1.1	1.2	-2.6
STDEV	0.3	0.6	0.2	1.7	2.0	2.6	5.4
RMS	0.3	0.6	0.2	1.7	2.3	2.9	6.0



Accuracy analysis: 9 GCP and 44 Check Points



Block accuracy on Check Points

 $RMSxy = \pm 2.7 \text{ cm} (0.7 \text{ pix})$ $RMSz = \pm 5.1 \text{ cm} (1.3 \text{ pix})$

	9 GCP			44 Check Points			
	dX	dY	dZ	dX	dY	dXY	dZ
	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
MIN	-0.7	-0.5	-0.2	-5.8	-6.9	9.0	-10.6
MAX	0.6	1.4	0.2	3.5	4.8	5.9	10.7
Mean	0.0	0.0	0.0	0.3	-0.8	0.9	-0.7
STDEV	0.4	0.6	0.1	1.6	2.0	2.5	5.0
RMS	0.4	0.6	0.1	1.6	2.1	2.7	5.1



Accuracy analysis: 15 GCP and 38 Check Points



Block accuracy on Check Points

 $RMSxy = \pm 2.7 \text{ cm} (0.7 \text{ pix})$ $RMSz = \pm 4.4 \text{ cm} (1.1 \text{ pix})$

	15 GCP			38 Check Points			
	dX	dY	dZ	dX	dY	dXY	dZ
	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
MIN	-0.8	-1.2	-0.2	-6.3	-6.2	8.8	-8.1
MAX	0.6	1.8	0.2	3.3	5.9	6.8	5.3
Mean	0.0	0.0	0.0	-0.3	0.1	0.3	-1.8
STDEV	0.4	0.6	0.1	1.6	2.1	2.7	4.0
RMS	0.4	0.6	0.1	1.7	2.1	2.7	4.4



Accuracy analysis: summary

Residual	s on Check points		GCP =	5; Check Po	oints = 48
7.0	nes	e :	RMSxy	2.9 cm	0.7 pix
6.0			RMSz	6.0 cm	1.5 pix
5.0 6.0			GCP = 9; Check Points = 44		
Ê 4.0	5.1	ĭ Z	RMSxy	2.7 cm	0.7 pix
S 3.0			RMSz	5.1 cm	1.3 pix
2.0	2.7 2.7	¥XY	GCP =	15; Check P	oints = 38
1.0			RMSxy	2.7 cm	0.7 pix
		-	RMSz	4.4 cm	1.1 pix
5	9 15			•	
ે	Check Points				

- 1. The planimetric accuracy of the block on Check Points is always at the level of 0.7 pixel independently on the number and configuration of GCPs.
- 2. The altimetric accuracy of the block on Check Points starts from 6 cm (1.5 pix) with 5 GCPs and reaches 4.4 cm (1.1 pix) with 15 GCPs.
- 3. The altimetric accuracy is considered as high accuracy and even may be improved by use of high accuracy GPS data.



Phase One iXU-RS1000 – camera distortion model



- 1. The distortion model of the camera iXU-R\$1000 with 90 mm focal length fully corresponds to a standard Brown-Conrady symmetric radial distortion model.
- 2. Images captured with the camera may be easily transformed to undistorted model with a maximal residual less than 1 µm.





Thank You

