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CADASTRAL MAPPING BASED ON UAV IMAGERY

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CADASTRAL MAPS

LANDS

DWELLINGS

BUILDINGS

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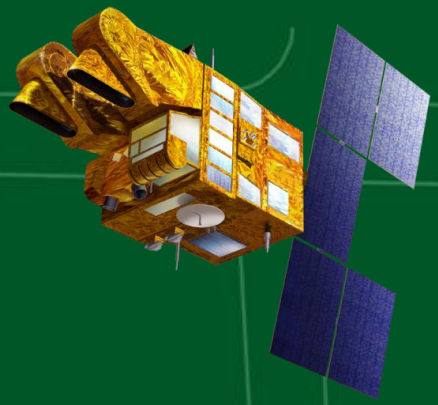
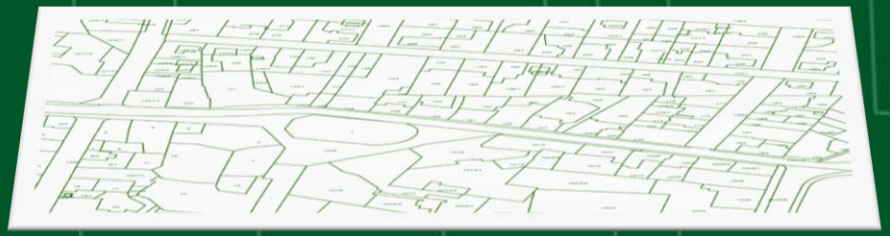
CADASTRAL MAPS





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AIM OF RESEARCH

IF AN ACCURACY OF ORTHOIMAGES

CREATED BASED ON UAV DATA

IS SUFFICIENT TO CADASTRAL MAP UPDATE?

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TEST AREA

CHRZĘSNE (POLAND) 52°26'45.0"N 21°28'52.0"E

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TRIMBLE UX5 UAV SYSTEM

SONY NEX 5R

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TRIMBLE UX5 UAV – SOLUTION COMPONENTS

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TRIMBLE UX5 UAV

Type	Body with the wings
Weight	2.5 kg
Wing span	1 m
Wing surface	34 dm^2
Dimensions	100 x 65 x 10 cm
Motor	Electric motor with propellers
Battery	14.8 V, 6000 mAh
Altitude	75 – 750 m
GSD	2.4 - 24 cm
Image overlap	60-90%

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SONY NEX 5R

Sony NEX 5R	
przetwornik	CMOS APS-C 23.4 mm × 15.6 mm
resolution	16.1 Mpix
size	111/59/39 mm
weight	210 g (without battery)

Lens SEL-16F28
Focal length 16 mm, equivalent 24 mm

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WORKFLOW

Data Capture

- Mission planning
- Control point measurement
- UAV Flight

Data Processing

- Bundle adjustment
- Digital Elevation Model creating
- Ortho creating
- Mosaicking of orthoimages

Cadastral map vs. orthoimage

- Analysis of orthoimage accuracy
- Assessment of possibility of orthoimage interpretation

MISSION PLANNING

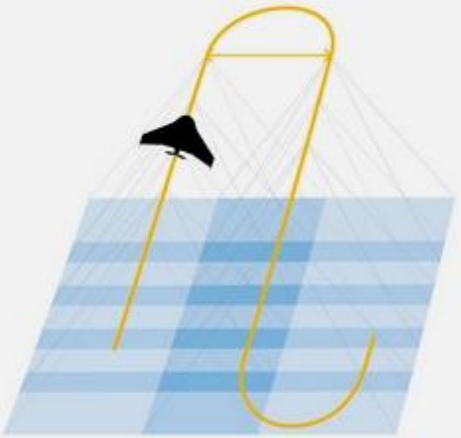
http://uas.trimble.com/calculator

Flight calculator

Calculate the ground sample distance, area coverage, flight time and number of pictures for both the UX5 and UX5 HP.

Flight height min 75, max 750	75	m
Overlap of pictures min 60, max 90	60	%
Area length min 0.1	0.1	km
Area width min 0.1	0.85	km

Calculate



MISSION PLANNING

http://uas.trimble.com/calculator

	Type	Lens	GSD *	Area Coverage	# Flight Lines	Flight Time	# Pictures
	UX5	15mm	2 cm	0.085 km²	19	15 minutes	76
	UX5 HP	15mm	2.4 cm	0.085 km²	12	11 minutes	48
	UX5 HP	25mm	1.5 cm	0.085 km²	20	15 minutes	80
	UX5 HP	35mm	1 cm	0.085 km²	28	19 minutes	112

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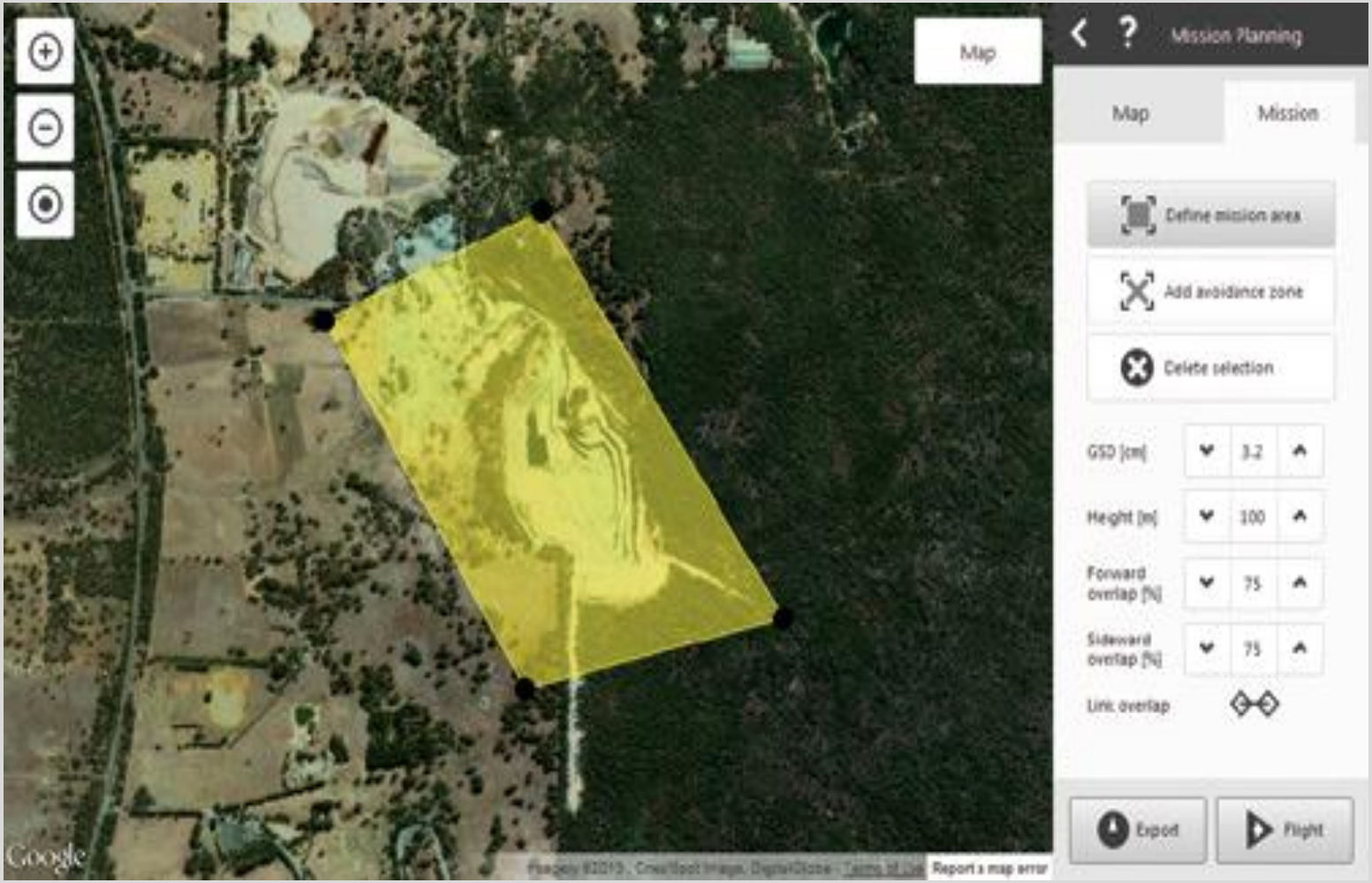
MISSION PLANNING



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MISSION PLANNING

Parameter	Test package
Number of rows	37
Number of images	3 625
Camera / focal length [mm]	NEX 5/ 15.51
overlap (along / across-track direction) [%]	80/ 70
Flight altitude [m]	200
Exposure time	1/2.500 s
Camera matrix pixel size [µm]	4.75

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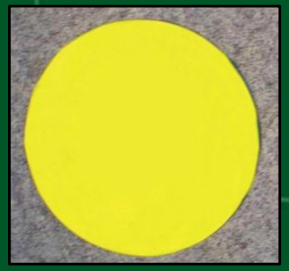
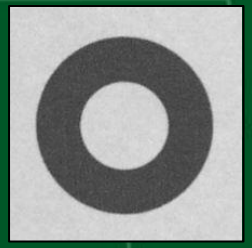
GROUND CONTROL POINTS

ACCURACY OF GPS RTK MEASUREMENT		
mx [m]	m_y [m]	m_z [m]
0.03	0.03	0.03

EXAMPLES OF SIGNS





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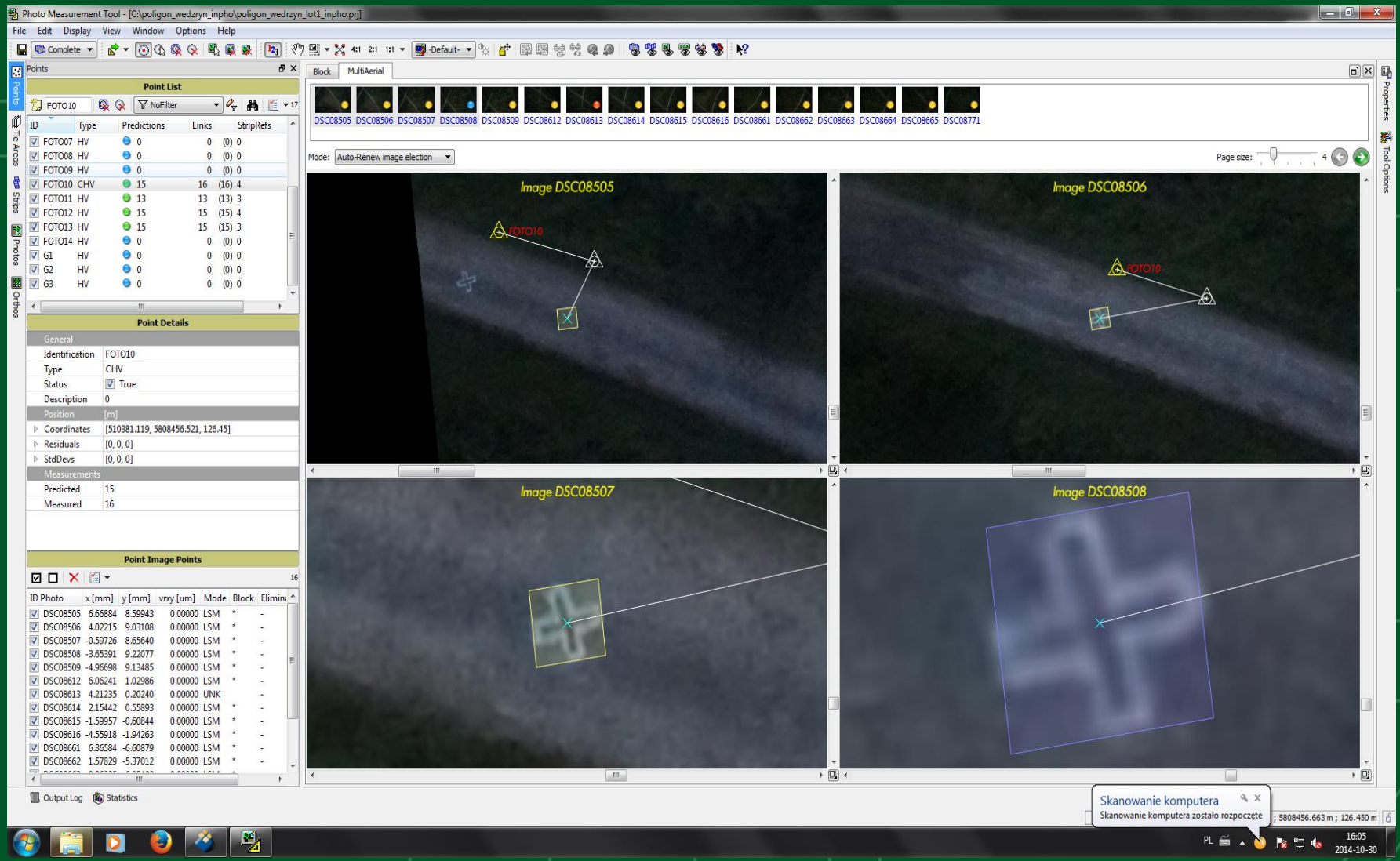
GROUND CONTROL POINTS



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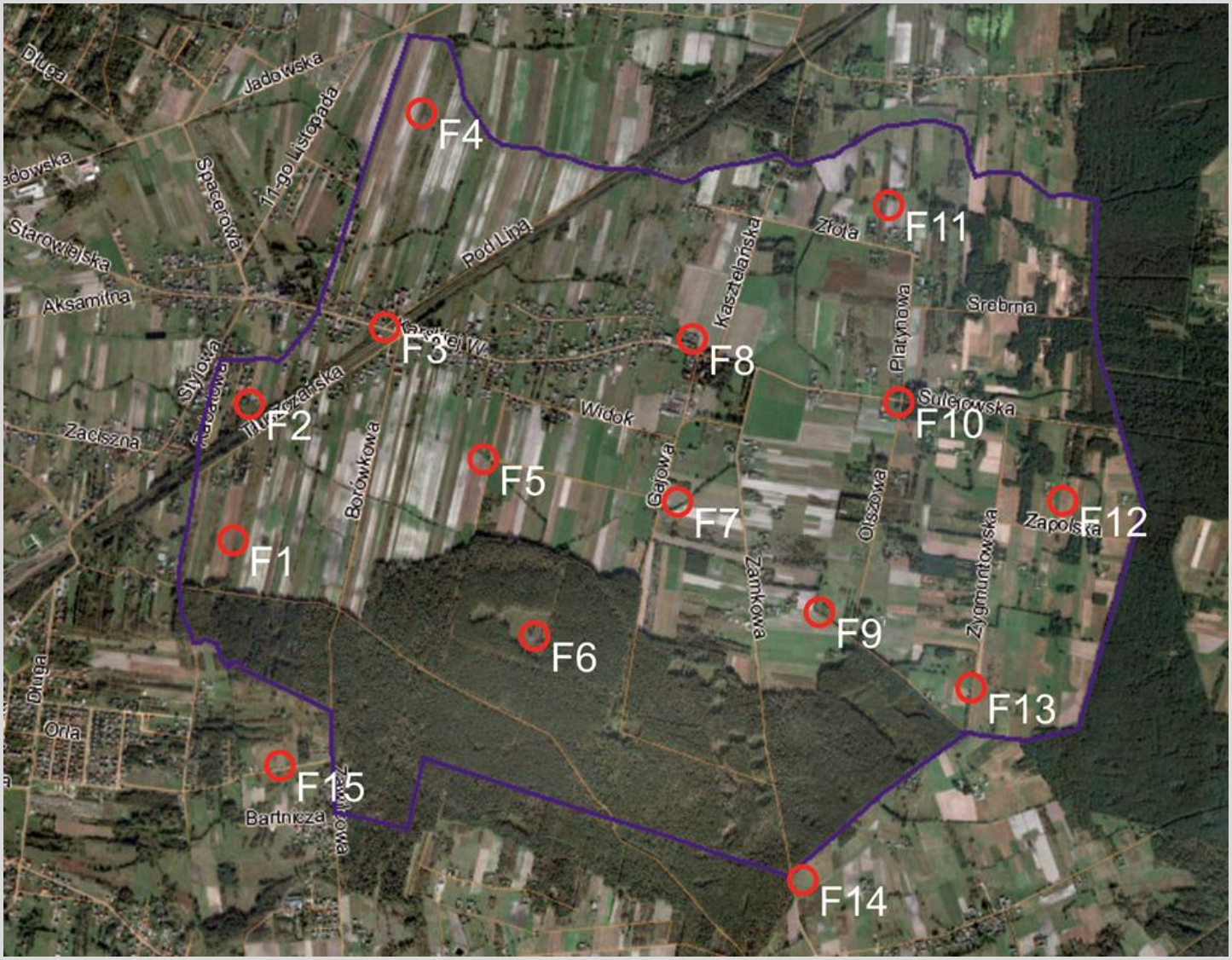
GROUND CONTROL POINTS



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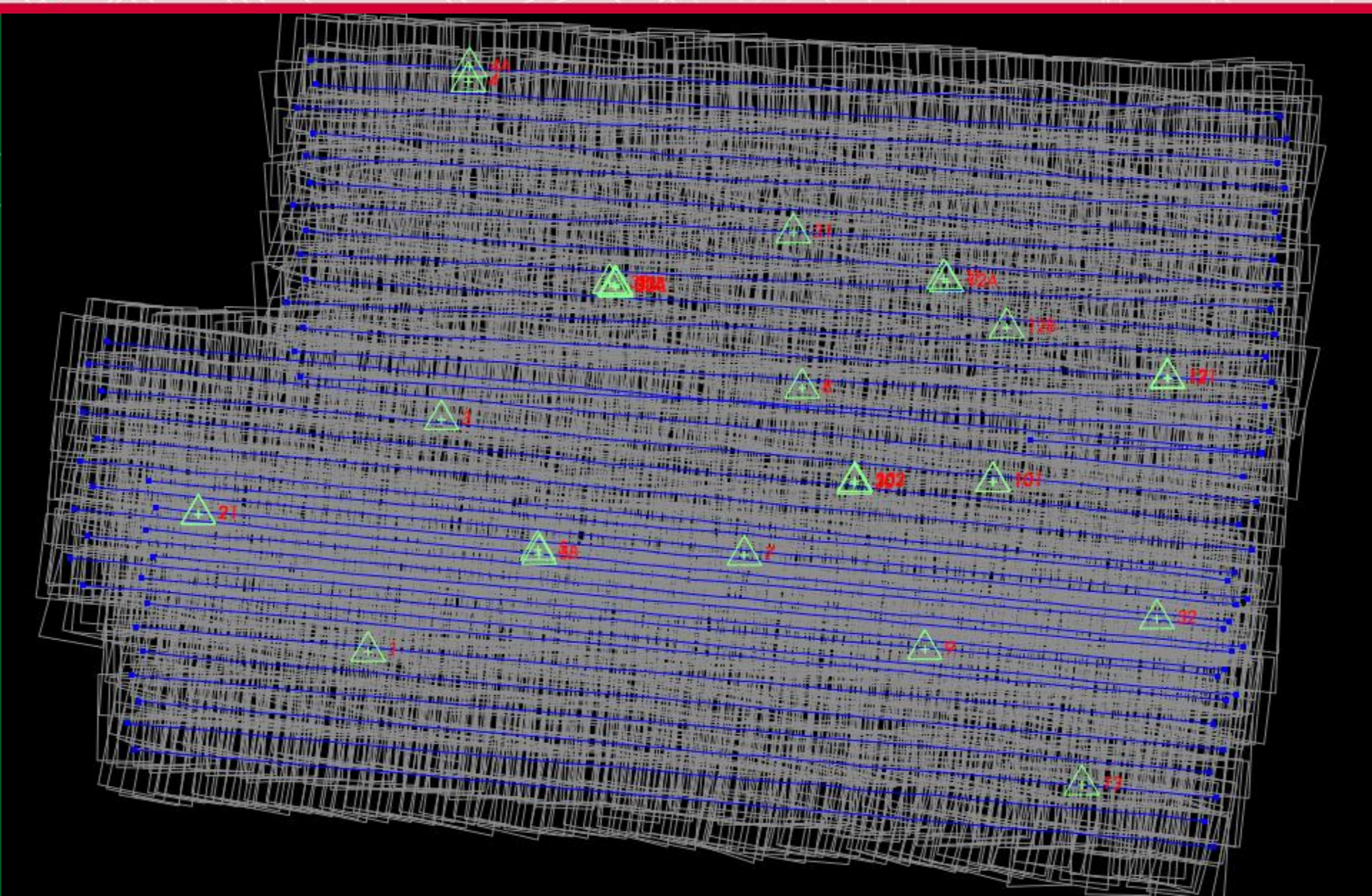
RESULTS OF BLOCK ADJUSTMENT



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RESULTS OF BLOCK ADJUSTMENT

σ_0 [µm]/[pix]	6.9/1.4
Number of control points	16
Number of check points	5
RMS error for control points (X, Y, Z) [m]	0.03; 0.03; 0.09
RMS error for check points (X, Y, Z) [m]	0.11; 0.04; 0.13
mX0 [m] / mY0 [m] / mZ0 [m]	0.10 / 0.08 / 0.09
mω [°] / mϕ [°] / mκ [°]	0.020 / 0.026 / 0.007

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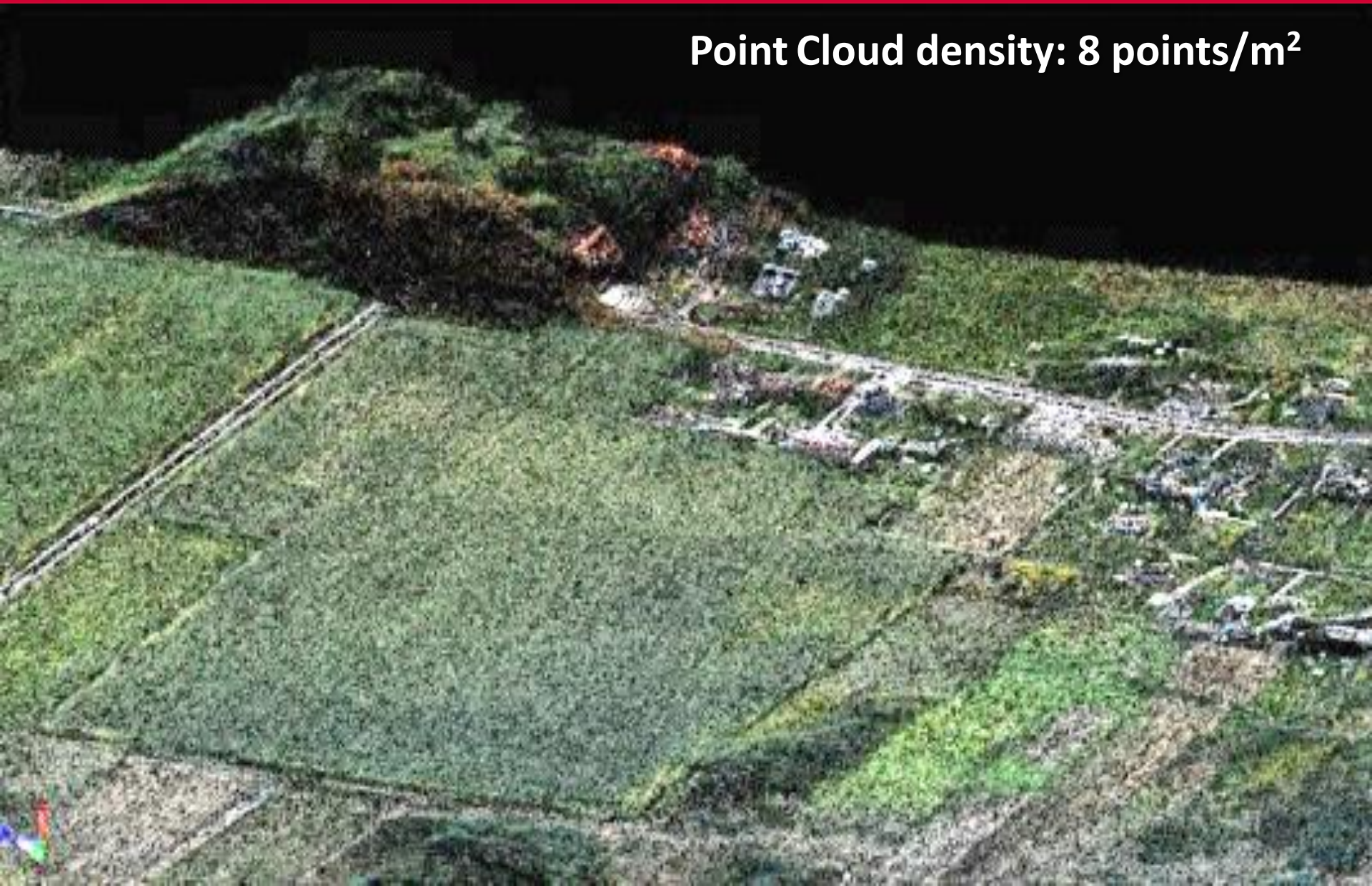
DIGITAL ELEVATION MODEL



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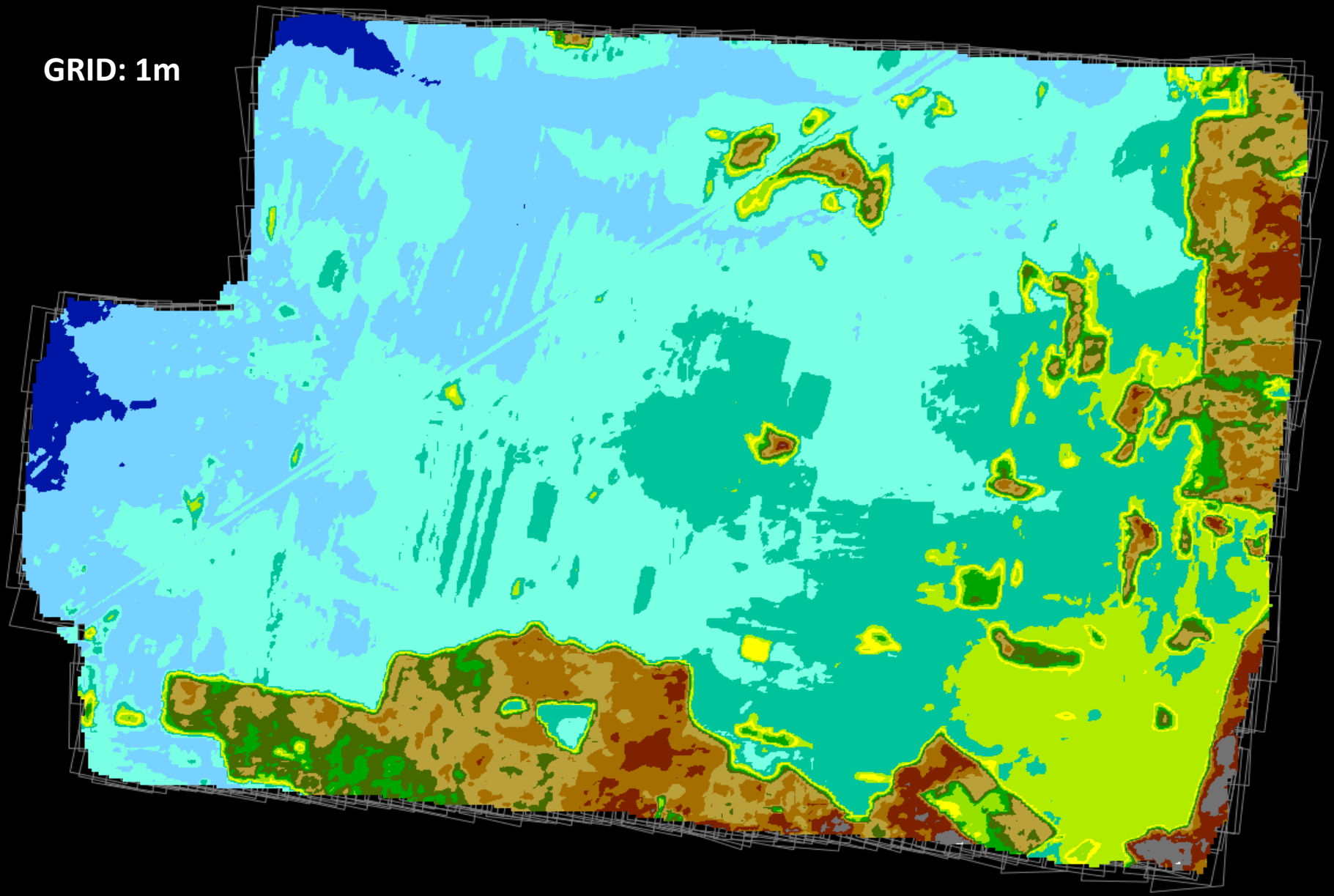
DIGITAL ELEVATION MODEL

GRID: 1m



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ORTHOIMAGE OF CHRZĘSNE BASED ON UAV IMAGERY

Pixel size: 6 cm

Accuracy: 12 cm

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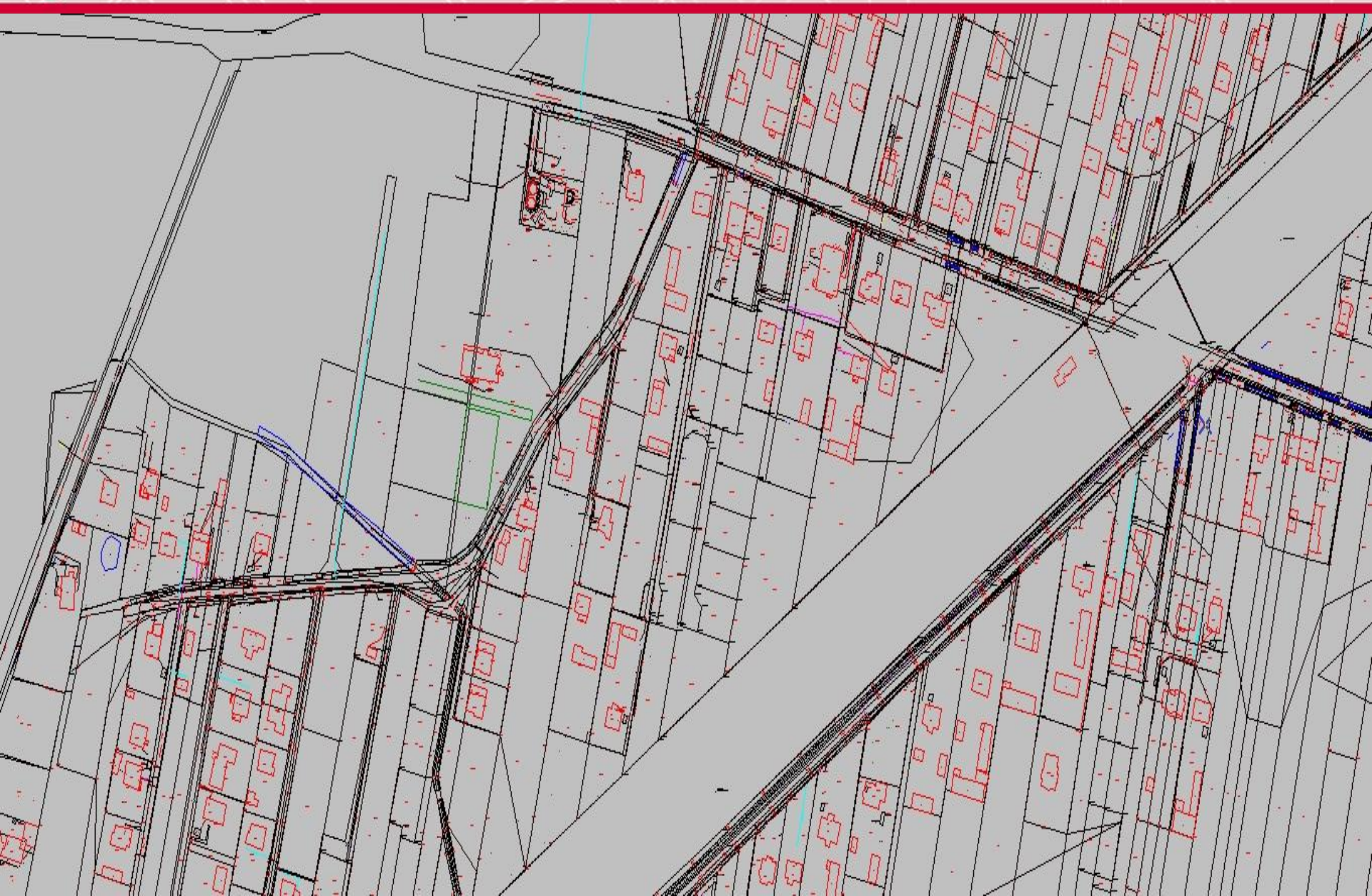
CADASTRAL MAP OF CHRZĘSNE



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ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

LOW URBAN AREA

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ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

LOW URBAN AREA - BUILDINGS

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ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

LOW URBAN AREA - PLOTS

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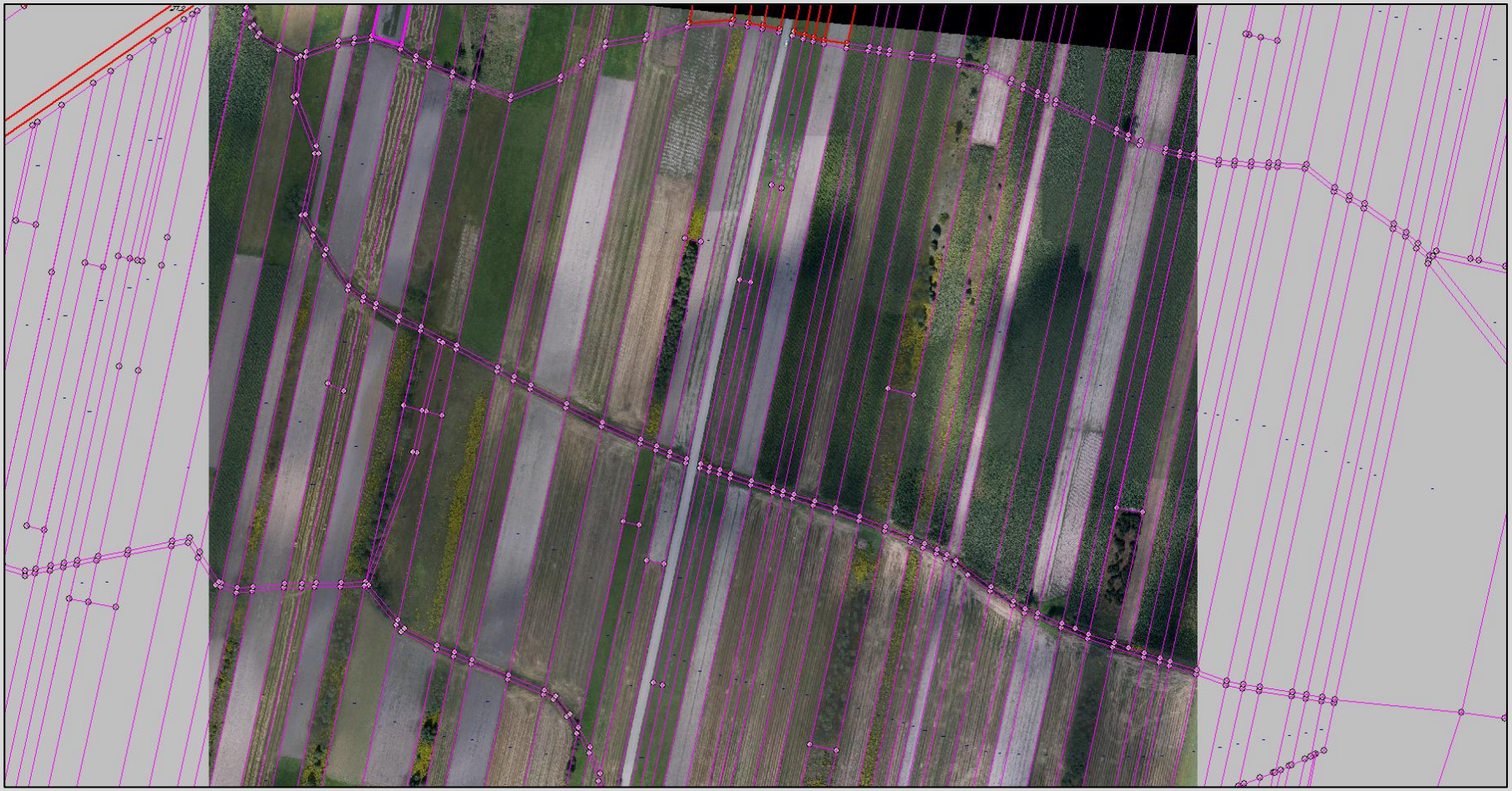
ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

ARABLE LANDS



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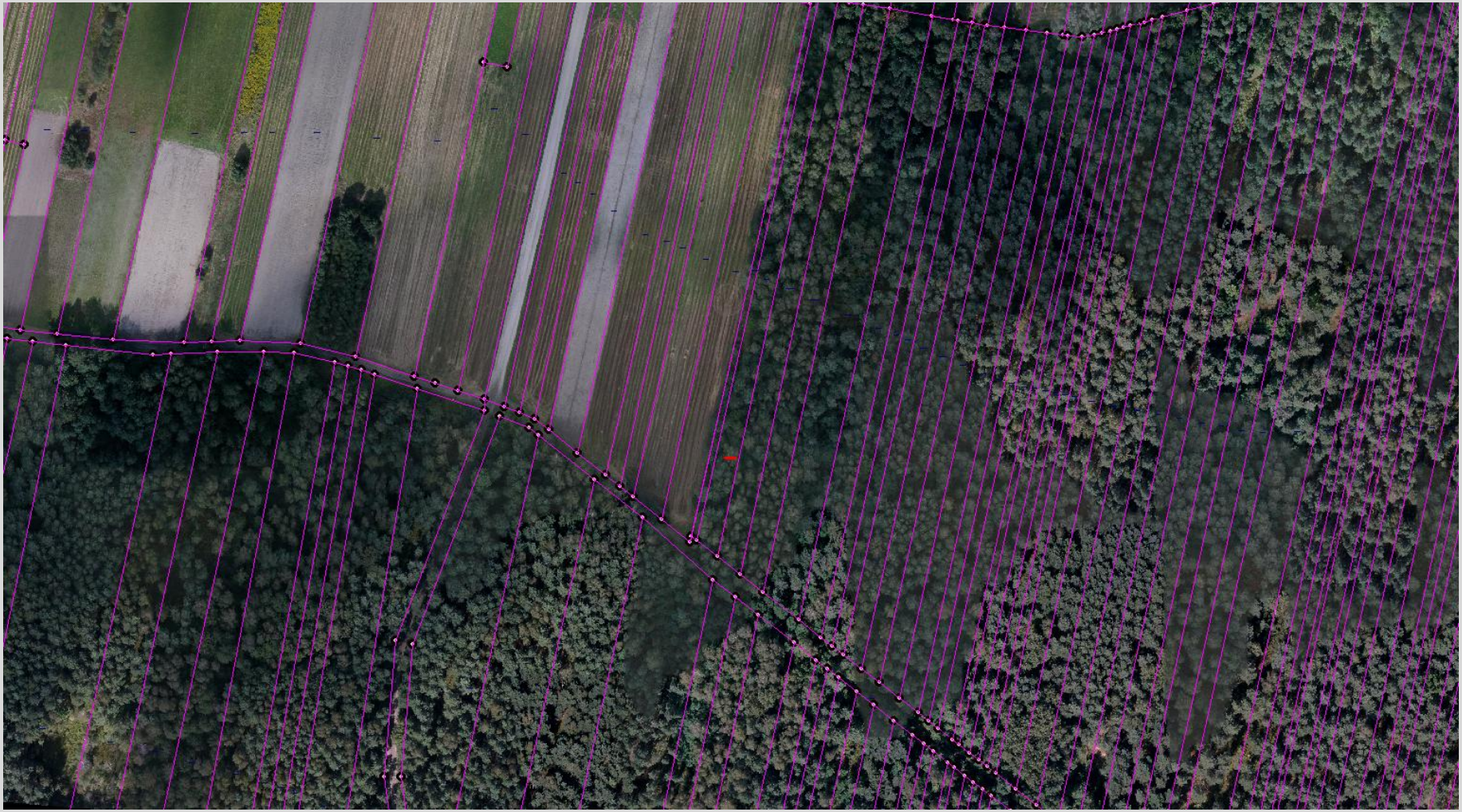
ORTHOPHOTO BASED ON UAV IMAGERY WITH VECTOR LAYER OF CADASTRAL MAP

FOREST



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CADASTRAL MAP VS. ORTHOIMAGE

	number of objects	Identification of objects [%]	m_0 [m]
Buildings	75	91	0.80
Plots	40	80	0.51
Roads	15	95	1.02
Arable Land	20	80	0.40

SUMMARY AND CONCLUSIONS

1. The accuracy of orthoimage generated based on uav imagery and the accuracy cadastral map were compared.
2. The analysis included: buildings, plots, roads, arable lands and forest.
3. The ability of identifying objects was over 90% (buildings, roads), more than 80% (plots and arable lands).
4. The geometric accuracy and interpretative advantages of the resulting orthoimages allow to updating the cadastral map in rural areas.
5. The interpretive possibilities of orthoimages is influenced by the flight altitude pixel size, spectral and radiometric resolution of a sensor.
6. It is estimated that such an update of cadastral maps based on UAV imagery can be less costly than on-ground measurements.

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THANK YOU FOR YOUR ATTENTION

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