BÜLENT ECEVİT UNIVERSITY

Roof Modelling Potential of UAV Point Clouds by Laser Scanning

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ENHANCING THE GEOSPATIAL
MATURITY OF SOCIETIES

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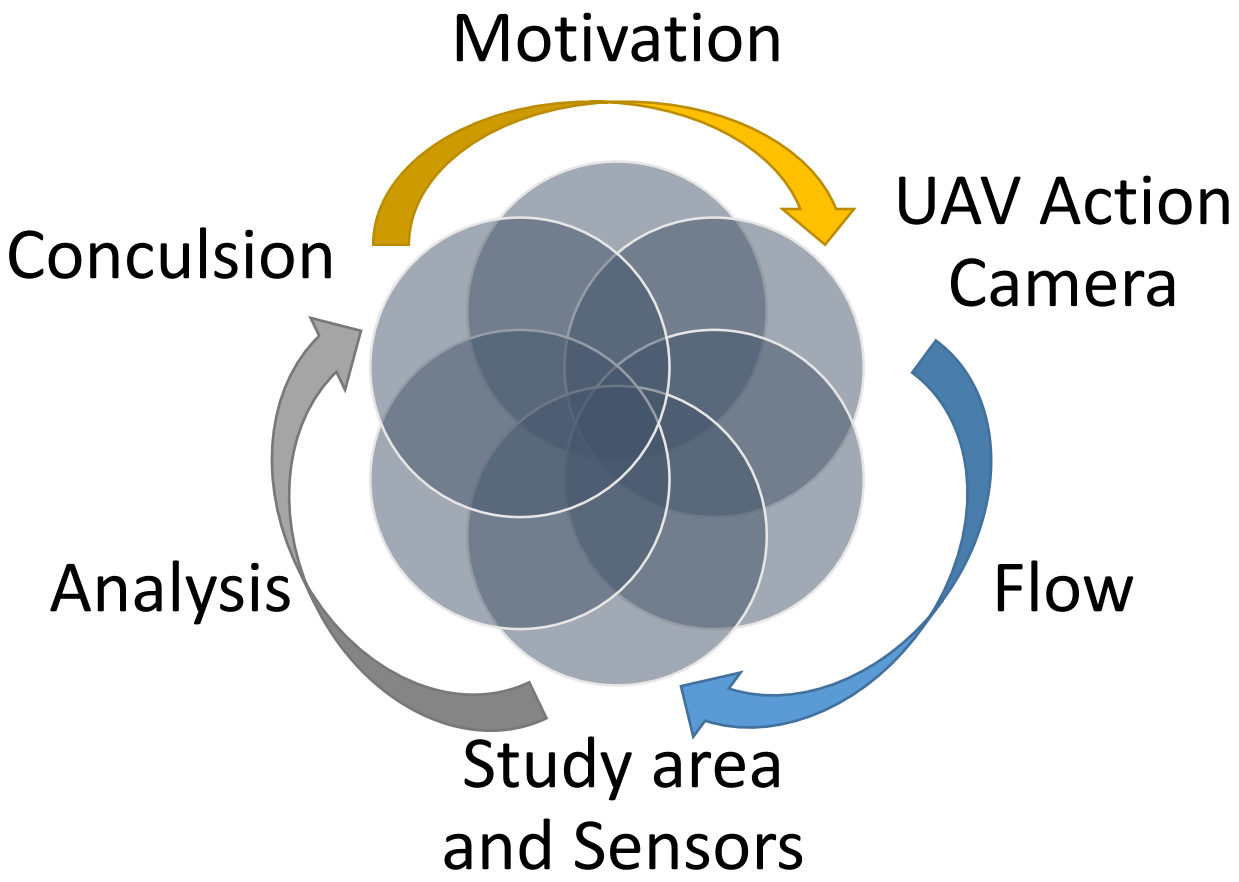

Motivation
UAV Action
Camera
Flow
Study area
and Sensors
Analysis
Conculsion

Motivation

DIY UAV (Do It Yourself)

Low-cost and periodic map generation

Performance of SJ4000 Action Camera ?

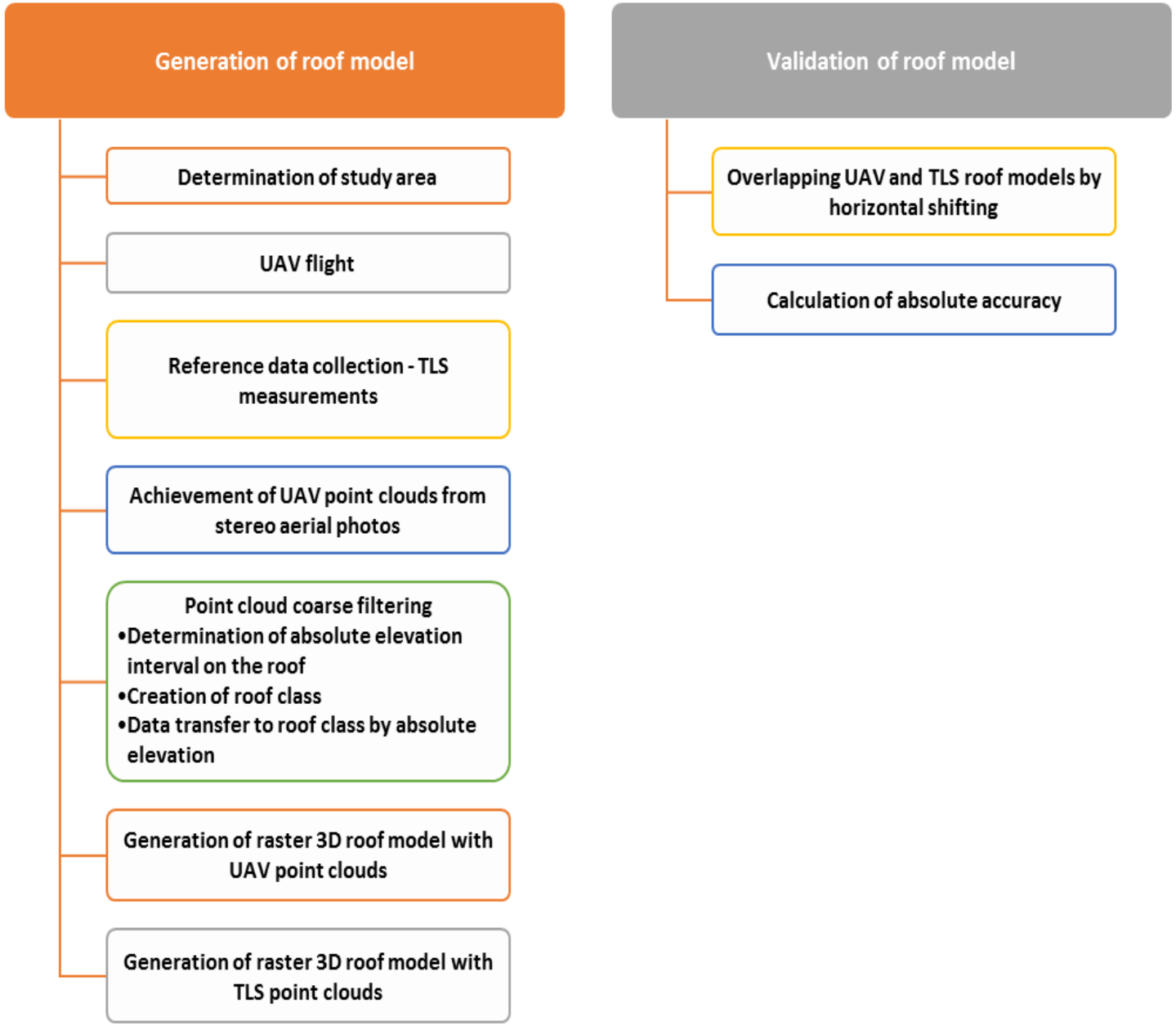
Do It Yourself UAV

Pratical Ready to Flight

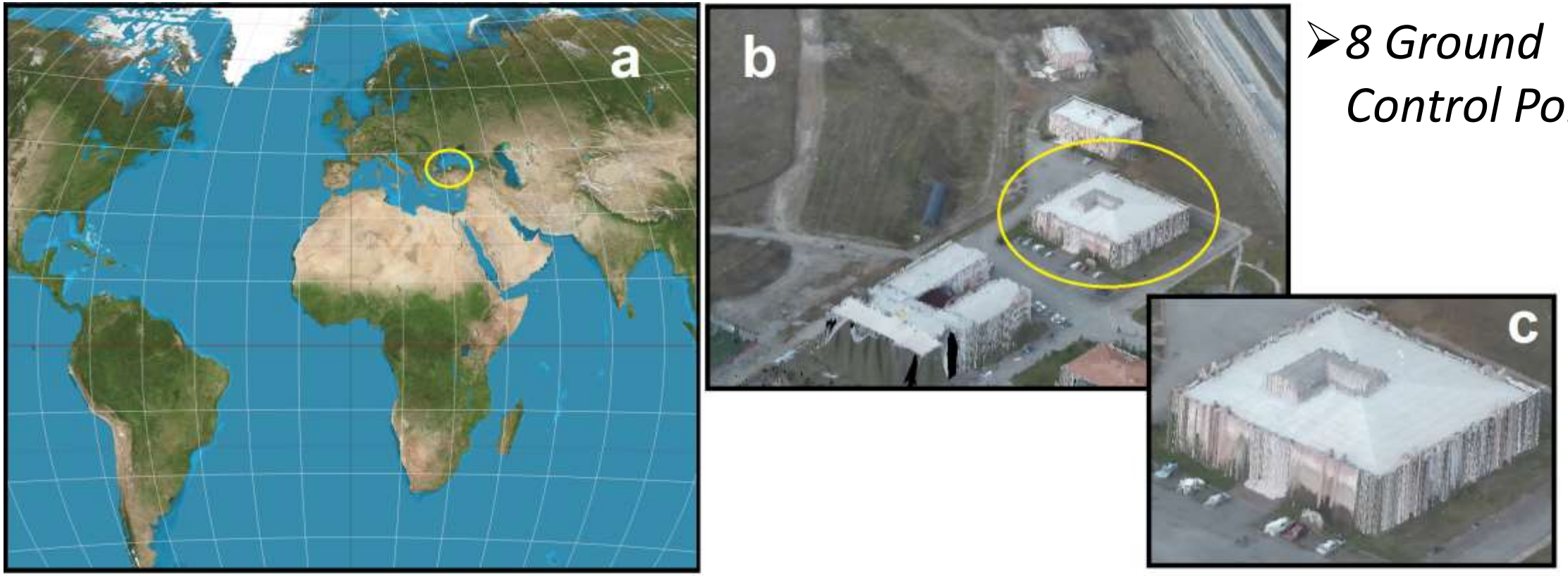
Individual Payload Integration

Make it smart be smart (Pixhawk OEM)

Flow


Generation of roof model
Determination of study area
UAV flight
Reference data collection - TLS measurements
Achievement of UAV point clouds from stereo aerial photos
Point cloud coarse filtering
•Determination of absolute elevation interval on the roof
•Creation of roof class
•Data transfer to roof class by absolute elevation
Generation of raster 3D roof model with UAV point clouds
Generation of raster 3D roof model with TLS point clouds
Validation of roof model
Overlapping UAV and TLS roof models by horizontal shifting
Calculation of absolute accuracy

Study Area and Sensors



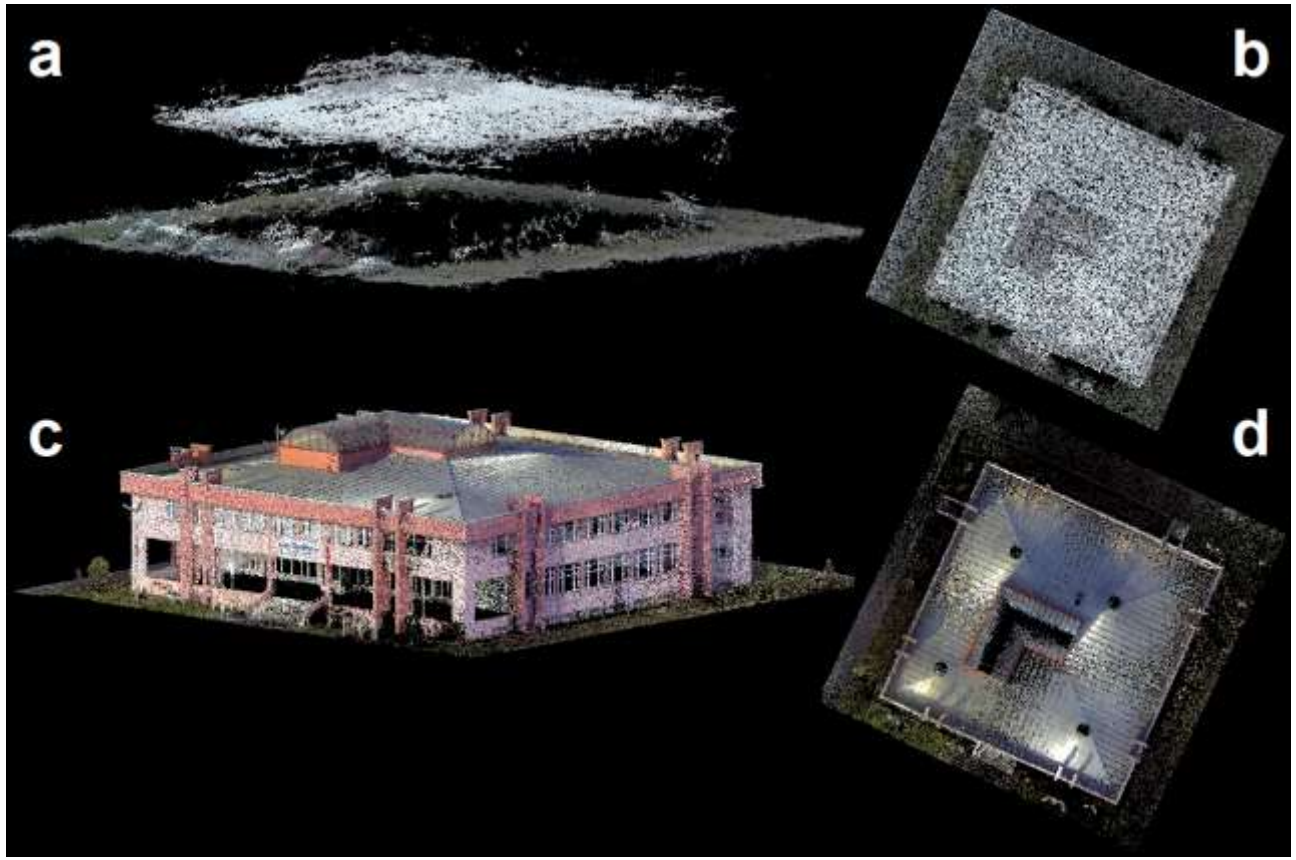
- *8 Ground Control Points*

Civil Aviation Academy Building

Sensors

SJ4000 Action Camera	
Focal length	2.764 mm
Resolution	4032x3024px
Sensor	Aptina AR0330 CMOS
Pixel size	1,1905µ

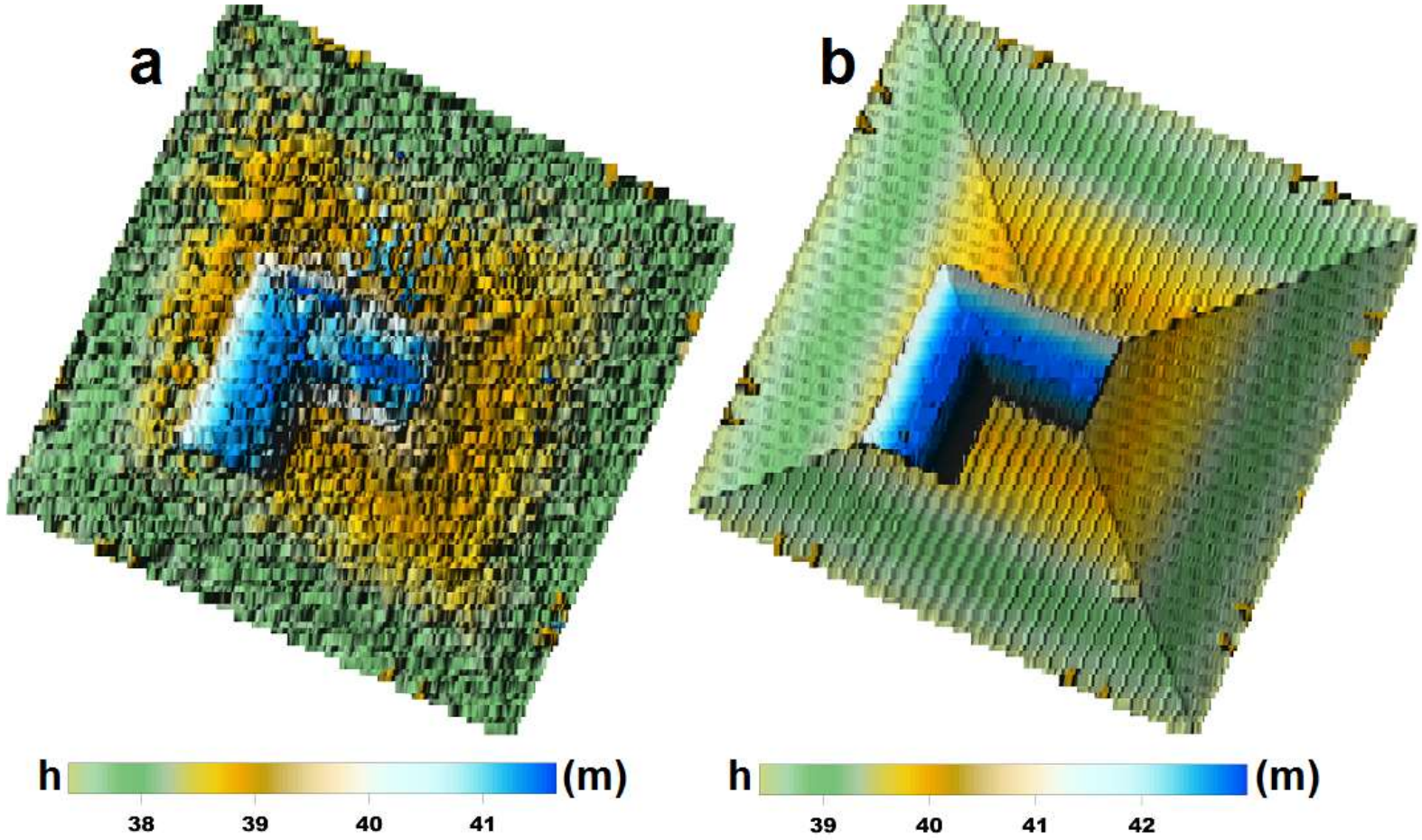
Faro Laser Scanner Focus3D X 330	
Range	0.6m - 330m
Measurement speed	up to 976,000 points/second
Ranging error	±2mm
Laser class	Laser class 1,
Wavelength	1550nm
Beam divergence	0.19mrad(0.011°)(1/e, half angle)
Beam diameter at exit	2.25mm (1/e)
Field of view	(vertical) 300° , (horizontal) 360°
Multi-sensor	GPS, compass, height sensor, dual axis compensator
Scanner control	via touchscreen display and Wi-Fi
Size	240 x 200 x 100mm



- 120m flight altitude
- approx. 20 minutes
- 39 photos

Analysis

SJ4000



FARO 330X

DEMSHIFT

Overlapping Horizontal Shift

Reference roof model	tested roof model	Shift in X (cm)	Shift in Y (cm)
TLS	**UAV**	5.1	- 5.0

DEMANAL

- Model to model comprasion

Reference roof model	Tested roof model	Spacing (m)	RMSE (m)	SZ (m)	SZ as function of slope (m)	Excluded points (%)
TLS	UAV	0.25	0.28	0.28	0.17+1.20×tan(α)	0.22

$$SZ\ as\ function\ of\ roof\ tilt = SZ + b \times \tan(\alpha)$$

Conculsion

- Unmanned air vehicle roof model was generated from point clouds derived by the aerial photos of very popular and low cost action camera SJ4000.
- The geolocation potential of generated roof model was validated by model-based comparison with a reference roof model acquired by terrestrial laser scanning data.
- Generated roof model has ***±5cm planimetric*** and ***17cm vertical*** absolute accuracy.
- The accuracy of 3D roof model achieved by ***SJ4000*** point clouds corresponds the required geolocation accuracy standards of 1/1000 scaled topographic maps.

Thanks for your patient…