UAS data processing retrospective

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- Investigations before 2000
- Mechanical and analytic instruments for processing
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Early investigations

1759

I.H.Lambert

"Perspectiva Liber"

1764

M.V.Lomonosov

The proposal to use "Camera obscūra"

1840

F.D. Arago

The proposal to use images to create topographic maps

1858

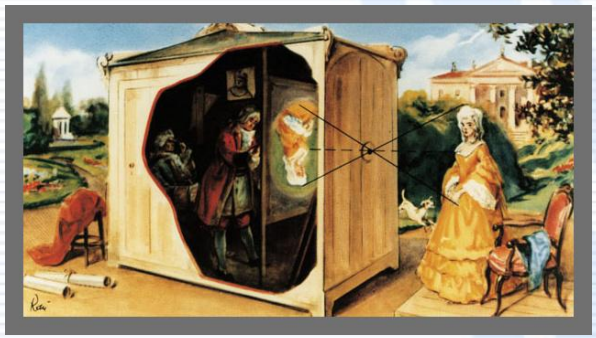
G. Tournachon

First aerial survey from a manned balloon

1860

A. Laussedat

He performed photo surveying from a roof of the high building



"Camera obscūra"

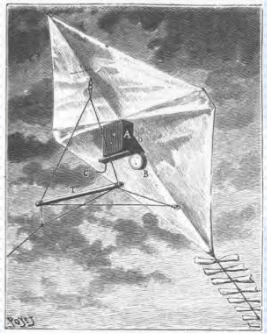
Photogrammetry – (in greece) photos – light, gramma – recording, metrio – measurement

Early investigations

1888

A. Batut

Using aerial kites



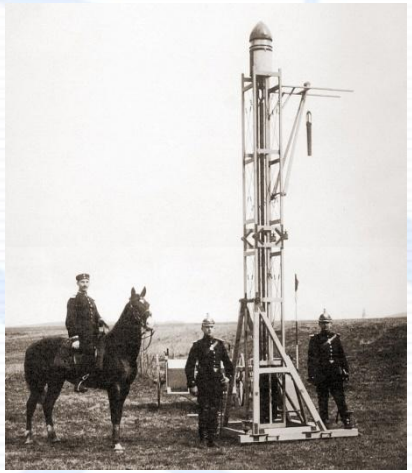
1903

J. G.Neubronner

Using Pigeons

1904

A. Maul



Using rockets

Early investigations in Russia

1886

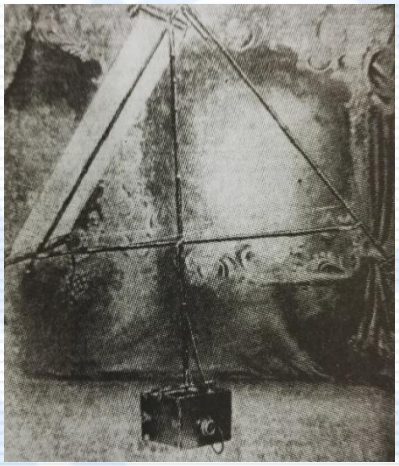
A.M. Kovanko

Saint-Petersburg 1886

Using box-kites

1908

S.A. Ulyanin



Camera with a sail to lift on a kite

First mechanical instruments for processing

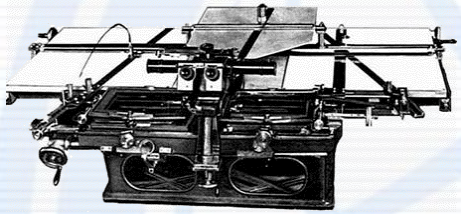
1901

K. Pulfrich

Stereocomparator

1909

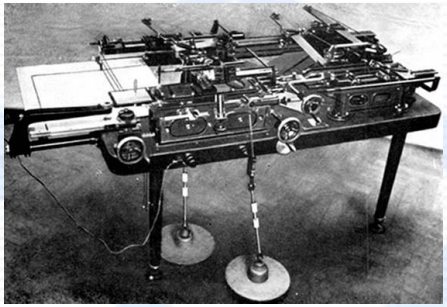
E.Orel



Stereoautograph

1914

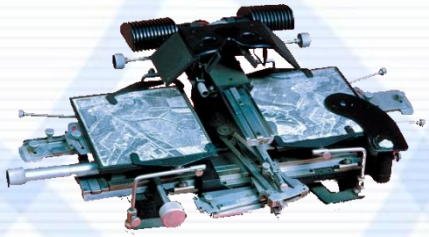
E.Orel



Stereoautograph improved

1932

F.V.Drobyshev

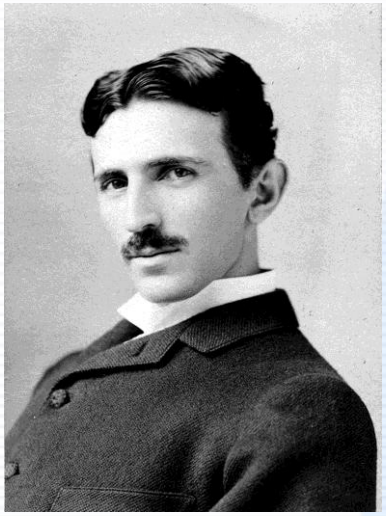


Stereometr

Investigations before 2000

1898

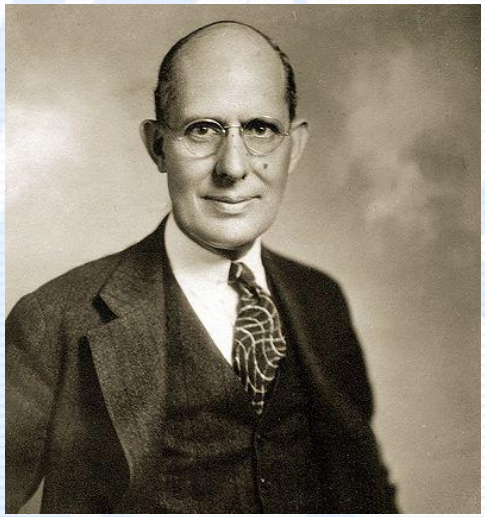
N. Tesla



Using first radio-controlled UAV

1910

C.F. Kettering



Using UAV controlled by clockwork

1933

United Kingdom

Using reusable radio-controlled UAV

Investigations before 2000

1950

LA-17

1987

TU-243

Mechanical and analytic instruments for processing

1946

Rectifier FTM (SEG-4)

1954

Stereoprojector SPR-2

1953

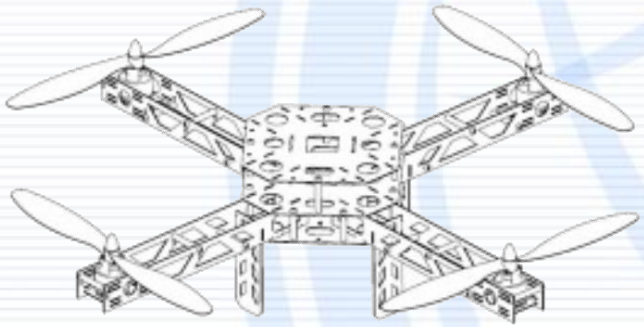
Stereocomparator (Steko 1818)

1998

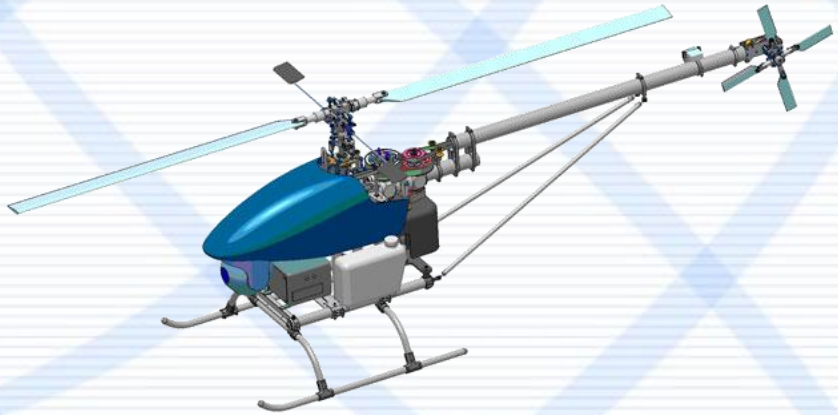
Leica SD-2000

Investigations after 2000, UAS types

Aircrafts



Multicopters



Helicopters

UAS weight, size and shape

Flying wing

< 10 kg

Fuselage

< 30 kg

UAS weight and shape

Light

4 rotors

6 rotors

8 rotors

Heavy

1 upper rotor

2 upper rotors

Ptero (Russia)

2004

Ptero E3

2009

Ptero E4

2015

Ptero G0

Finko (Russia)

2010

SUPERCAM 240

2011

SUPERCAM 250

2012

SUPERCAM 350

Sensfly (Switzerland)

2009

Swinglet CAM

2013

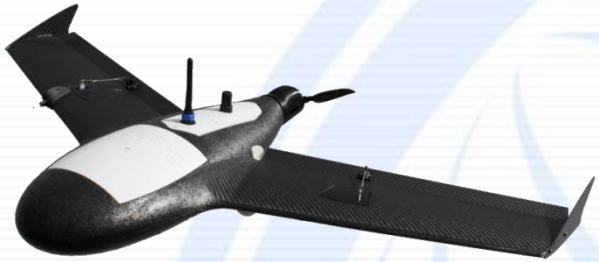
eBee

2016

eBee RTK

Trimble (USA)

2010



Gatewing X100

2014

Trimble UX5

2016

Trimble UX5 HP

UAS reviews

Aircraft UAS usage in Russia

Model	Ptero-E5	Ptero-SM	Gatewing X100
Picture			
Manufacturer	AFM-Servers Russia, Moscow www.ptero.ru	AFM-Servers Russia, Moscow www.ptero.ru	Gatewing NV/Trimble Belgium, Gent www.gatewing.com
Weight of the empty board, kg	9.5	10.5	N/A
Max. take-off weight, kg	20	21	2
Length, m	2.1	2.14	0.6
Wing span, m	3.03	3.13	1
Type of engine, the power consumption	Electric motor, 3,5 kW	Gasoline motor (single-cylindred, four-stroke, Saito SG-36)	Electric motor, 250 W
Max. range, km	130	600	50

Aircraft UAS usage in other world

Model	RQ-84Z AreoHawk	G212	G180
Picture			
Manufacturer	Hawkeye UAV Distributor Ltd New Zealand, Palmerston North www.hawkeyeuav.com	GerMAP GmbH Germany, Welzheim www.germap.com	GerMAP GmbH Germany, Welzheim www.germap.com
Max. take-off weight, kg	5.2	3.2	2.8
Length, m	1.4	N/A	N/A
Wing span, m	2.8	2.12	1.8
Type of engine, the power consumption	Electric motor	Electric motor, 200 W, 1 Li-Po-battery 4+ cells, 14.8V	Electric motor, 200 W, 1 LiPo-battery 3 cells, 11.1V
Max. range, km	30.окт	1.3	1
Flight altitude, m	200- 1500	80 - 300	80 - 300

Helicopter UAS

Model	Dragon 35	ZALA 421-02X	Scout B1-100 UAV Helicopter
Picture			
Manufacturer	Leica Geosystems Switzerland, Zurich uas.leica-geosystems.us	ZALA AERO Russia, Izhevsk bpla.ru	Aeroscout GmbH Switzerland, Luzern aeroscout.ch
Max. take-off weight, kg	70	90	75
Height, cm	65	118	100
Length, m	214	286	330
Width, cm	82	75	100

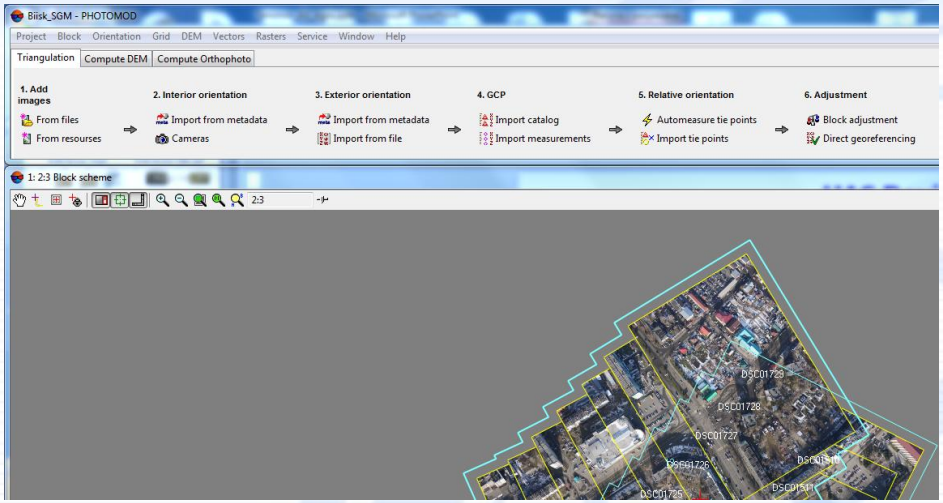
Multicopter UAS

Model	Aibot X6	md4-1000	Versa X6
Picture			
Manufacturer	Aibotix GmbH Germany, Kassel aibotix.com	Microdrones GmbH Germany, City ? microdrones.com	Versadrones Ireland, Shepperton versadrones.com
Max. take-off weight, kg	6.6	2.65	3
Height, cm	45	49.5	35
Diameter (including blade), cm	105	173	90

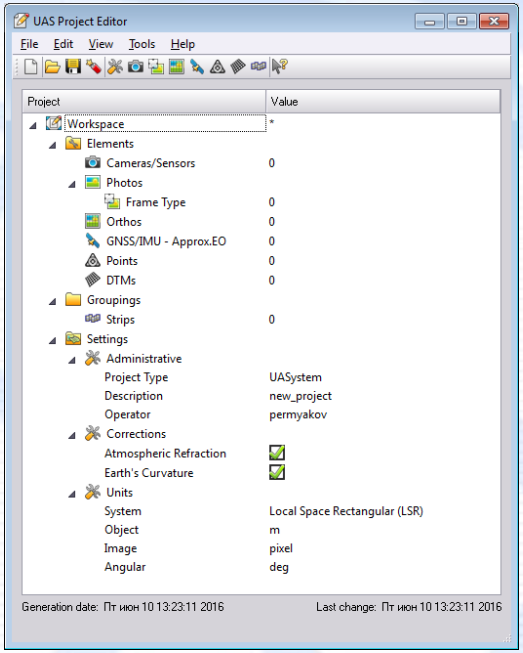
Software

1980	inpho	INPHO, Trimble, USA	2008	Agisoft	PhotoScan, Agisoft, Russia
1994	RACURS	PHOTOMOD, Racurs, Russia	2011		ContextCapture, Bentley, USA
1995	MosaicMill / EnsoMosaic	EnsoMOSAIC Fusion, MosaicMill, Finland	2011	PIX4D	Pix4Dmapper, Pix4D, Switzerland
2002	orbit	Orbit UAS Mapping, Orbit GeoSpatial Technologies, Belgium	2012	MENCISOFTWARE	APS, Menci Software, Italy
2003	simactive Cutting-Edge Photogrammetry Software	Correlator3D, SimActive, Canada	2013	DroneDeploy	DroneDeploy, DroneDeploy, USA

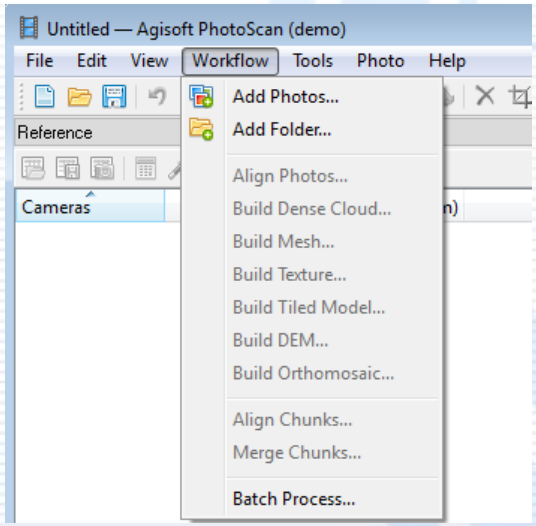
Software reviews



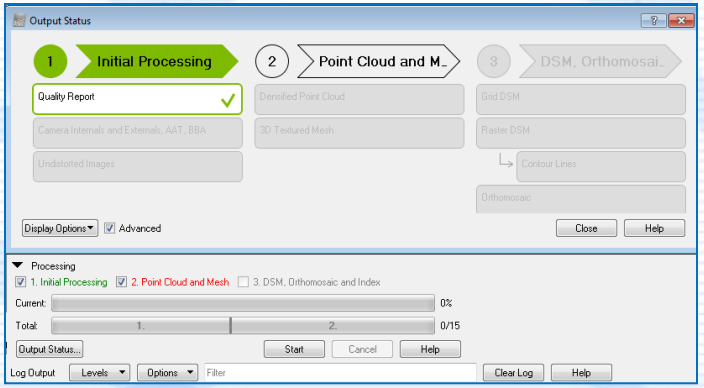
PHOTOMOD UAS



INPHO UAS master



PhotoScan

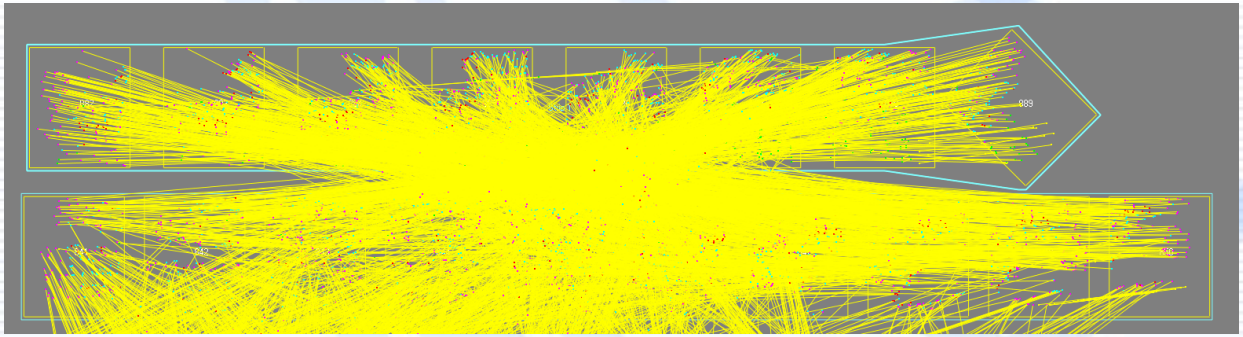


PIX4DMapper

Phototriangulation

Area correlators

Feature Based correlators



Block scheme

Cameras

Point and shoot camera

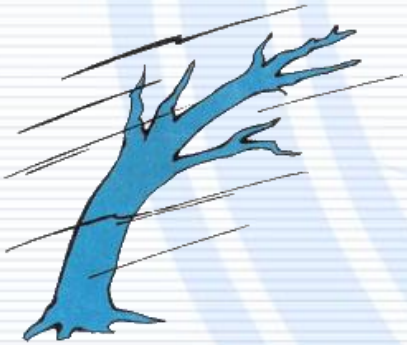
SLR

Industrial camera

External factors and conditions of aerial survey

Humidity

Temperature



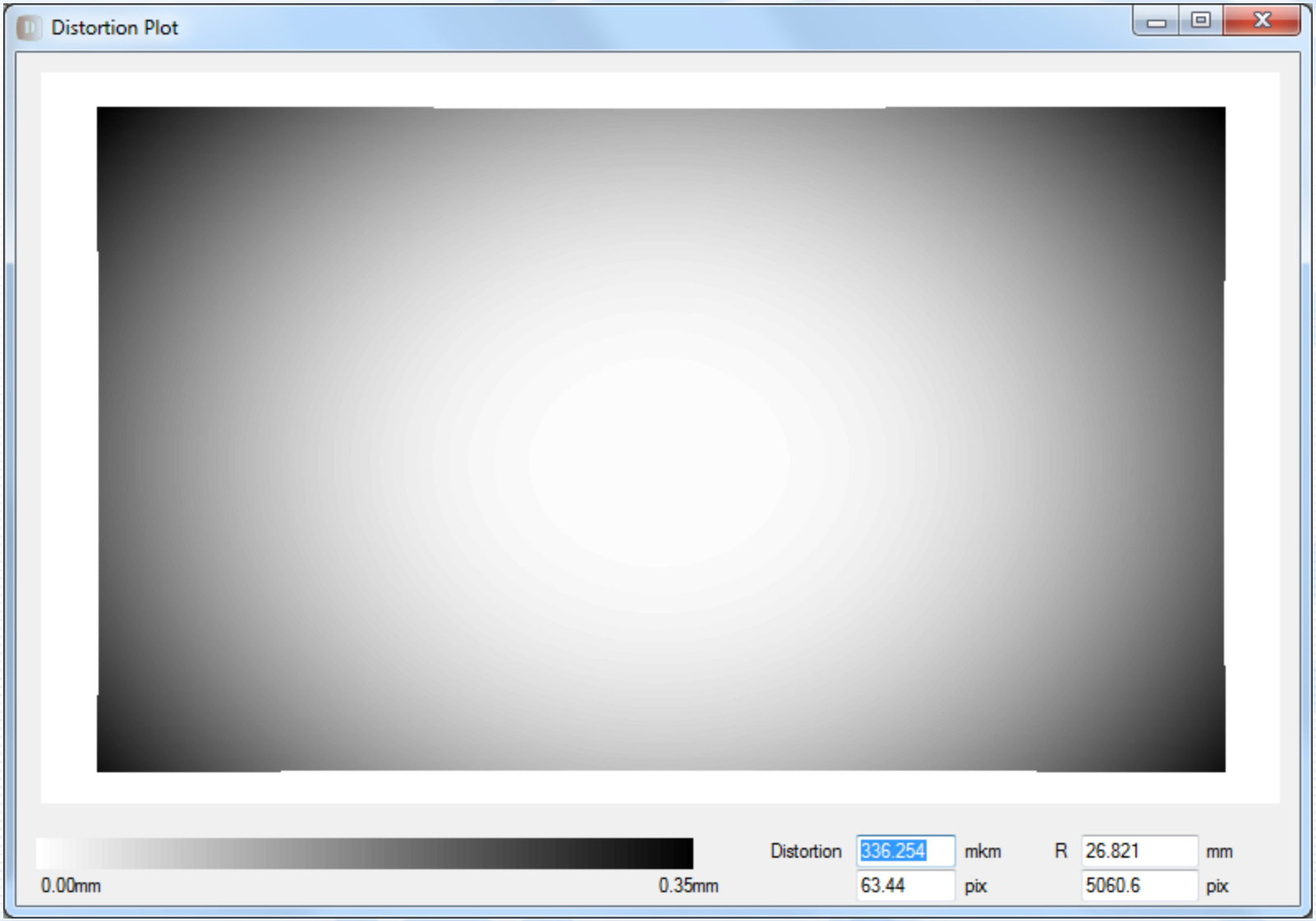
Wind speed during surveying

Technical problems with UAS data

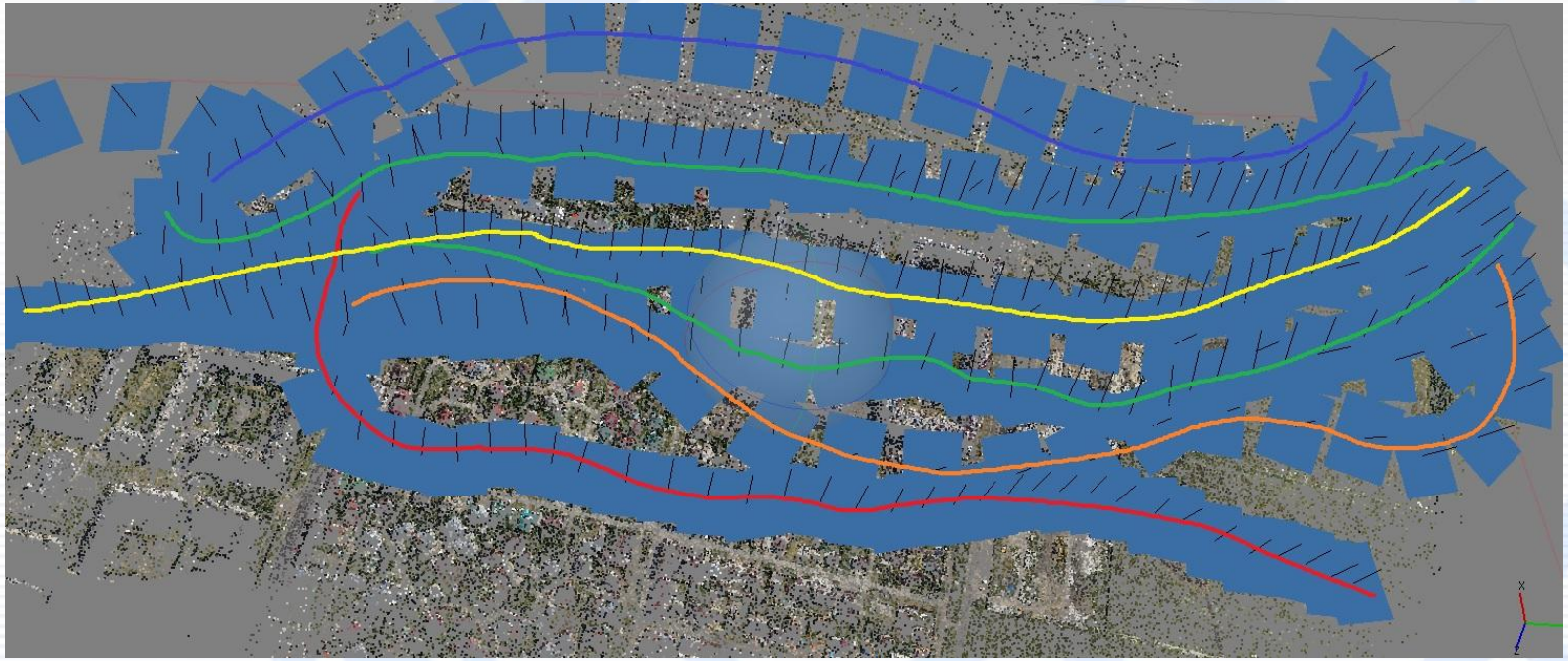
Image quality: blur, speckle, defocusing, incorrect auto exposure

Consumer camera: absence of a laboratory calibration, focal-plane shutter, an incomplete set of manual settings

Distortion plot (typical case)

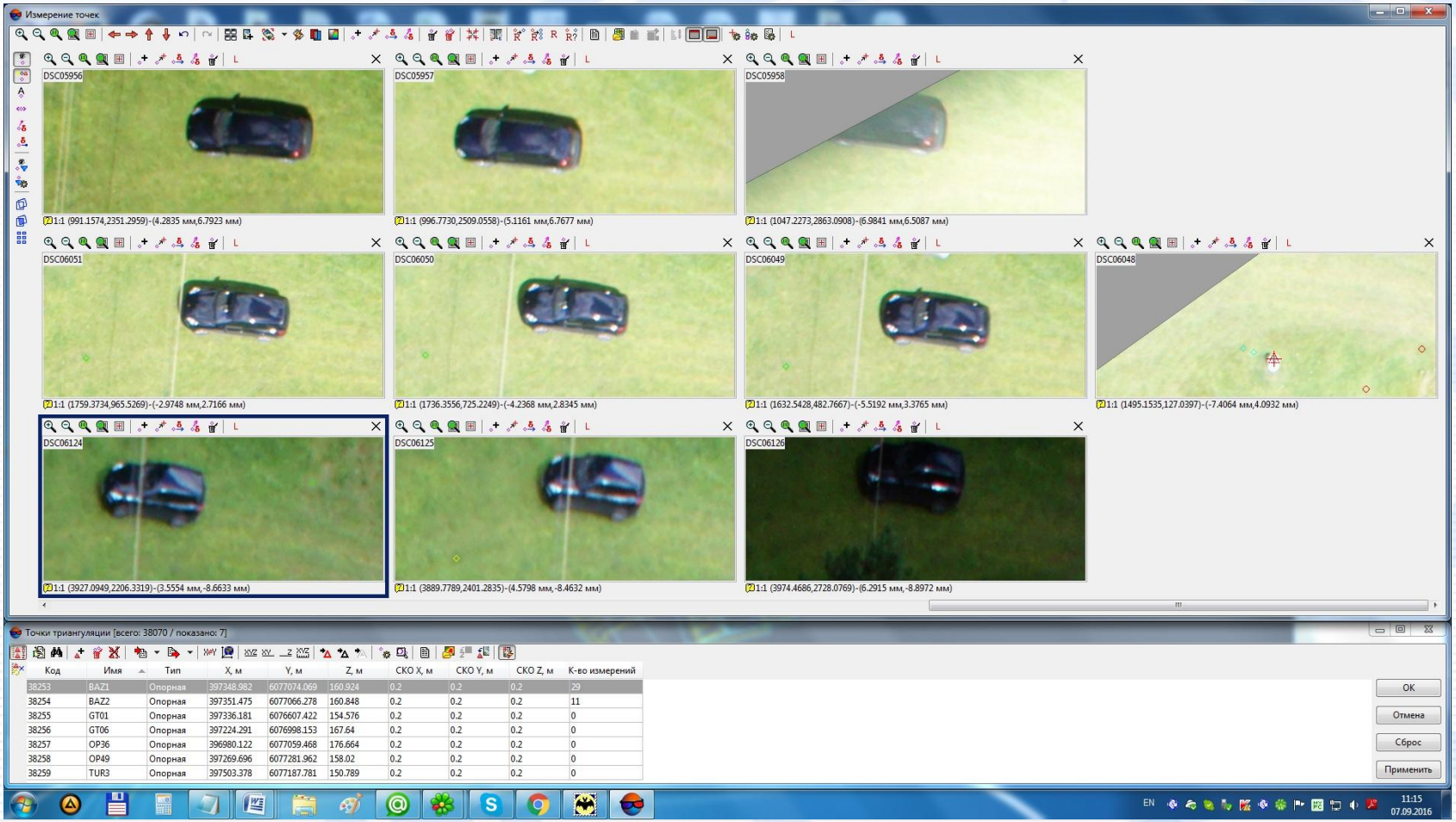


Problems of photogrammetric processing



Incorrect aerial surveying

Problems of photogrammetric processing



Incorrect camera operation

Output products

DSM

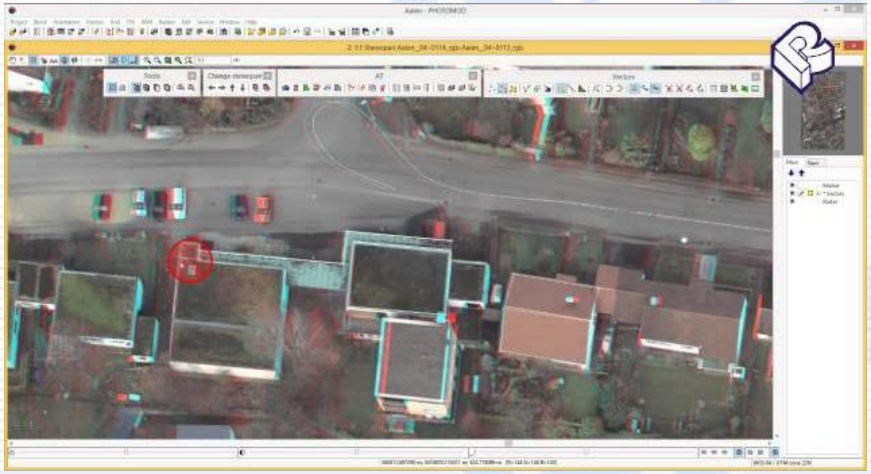
Orthophotoplan

Processing accuracy
can be up to 1-2 pix GSD

Output products

Point cloud

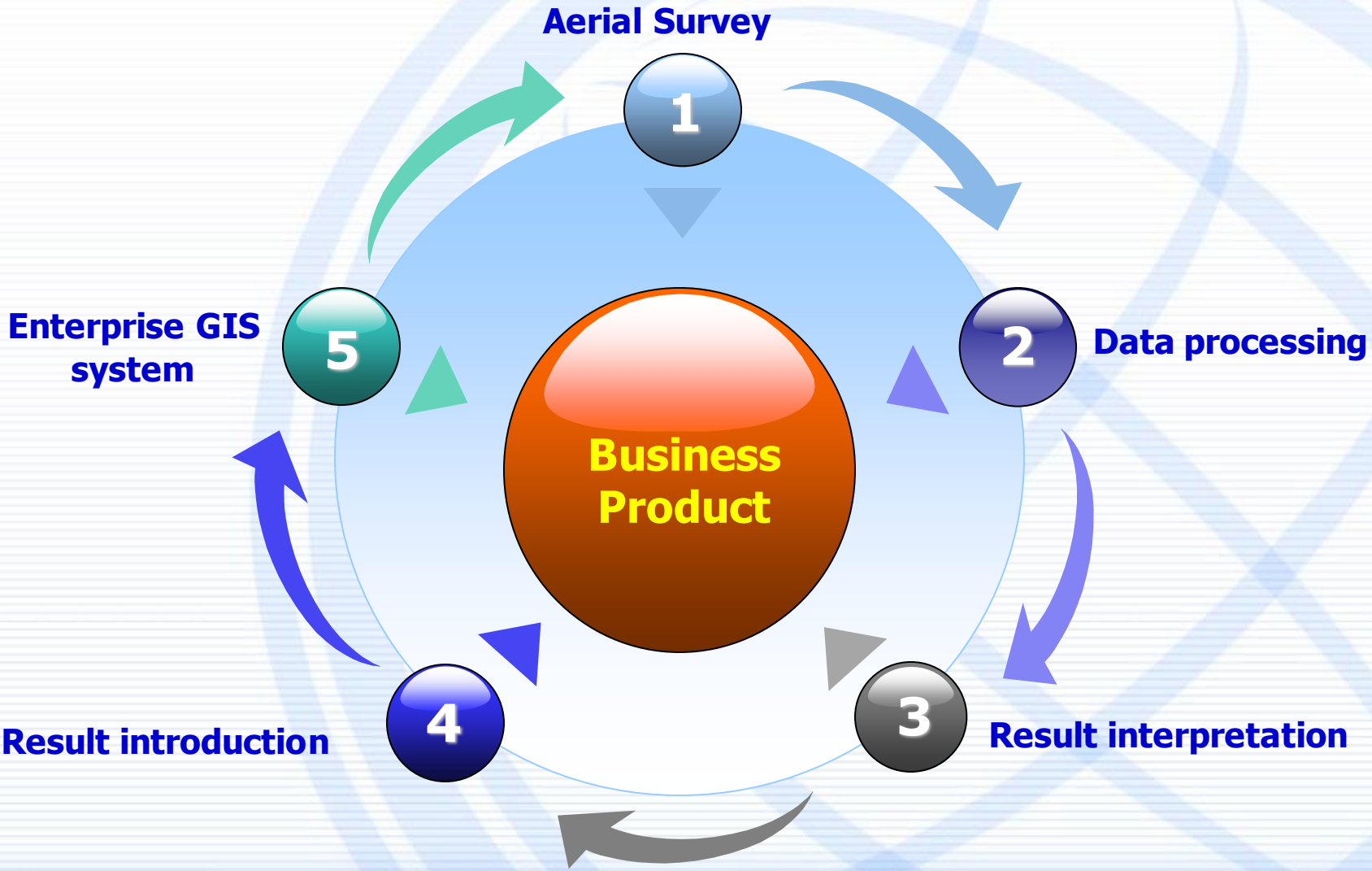
Vector 3D model



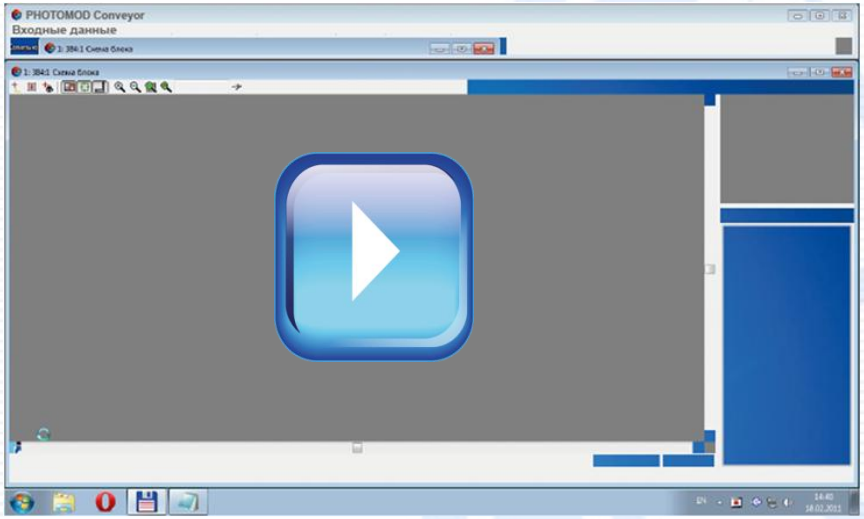
Stereovectorization

Raster 3D model

Trends


Aerial Survey
1
2
Data processing
3
Result interpretation
4
Result introduction
5
Enterprise GIS system
Business Product

FUTURE?



Full automatic batch process without human intervention

Control and management of processing results with a full virtual human presence

Special thanks

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Thank you for attention