

Airborne Laser Scanning and 3D Modeling

Laser scanning – technology of the XXI century

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Geokosmos South and South East Asia

IIT Kanpur, 2008

Geokosmos Today

Company Profile

- ❖ Leading surveying company in Russia and CIS
 - ❖ Integrated advanced approach: 3D airborne, terrestrial and bathymetric laser scanning technologies combined with digital aerial photography
 - ❖ High accuracy surveys and productivity: Broad scope of geodetic works at any scale in any region of the world with high precision, reliability and fast turnaround
 - ❖ Surveying and mapping services:
 - ❖ Of the peak quality
 - ❖ At any scale
 - ❖ Of large volume
 - ❖ **AT ONE TIME!**
- From a single service provider – one stop-shop!**

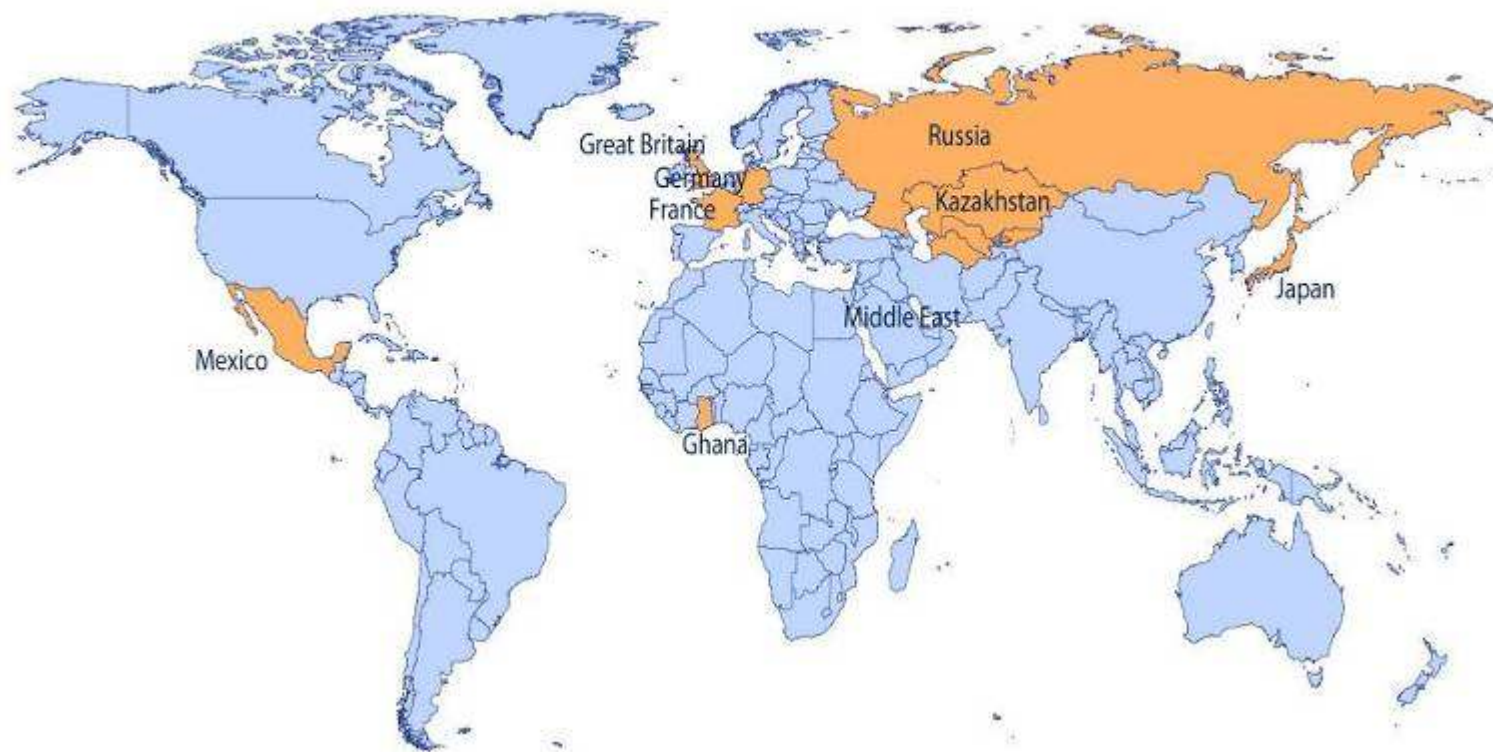
Company Profile

- ❏ Geokosmos was founded in 1993. It is the first private surveying company in Russia which has obtained worldwide recognition and operates in the global market through its overseas branch offices in Western Europe, Asia, Middle East and Africa
- ❏ Geokosmos International Representative Office in Frankfurt am Main:
 - ❏ Founded in 2003
 - ❏ Effectively operates worldwide and develops international business
 - ❏ Initiated successful partnerships with major airborne surveying companies

Company Profile

- ❖ The Company's staff is over 200 highly qualified and motivated employees
- ❖ State-of-the-art equipment and in-house developed software products for integrated processing of airborne and terrestrial laser survey data
- ❖ Geokosmos services are ISO 9001:2000 certified

International Representative Offices

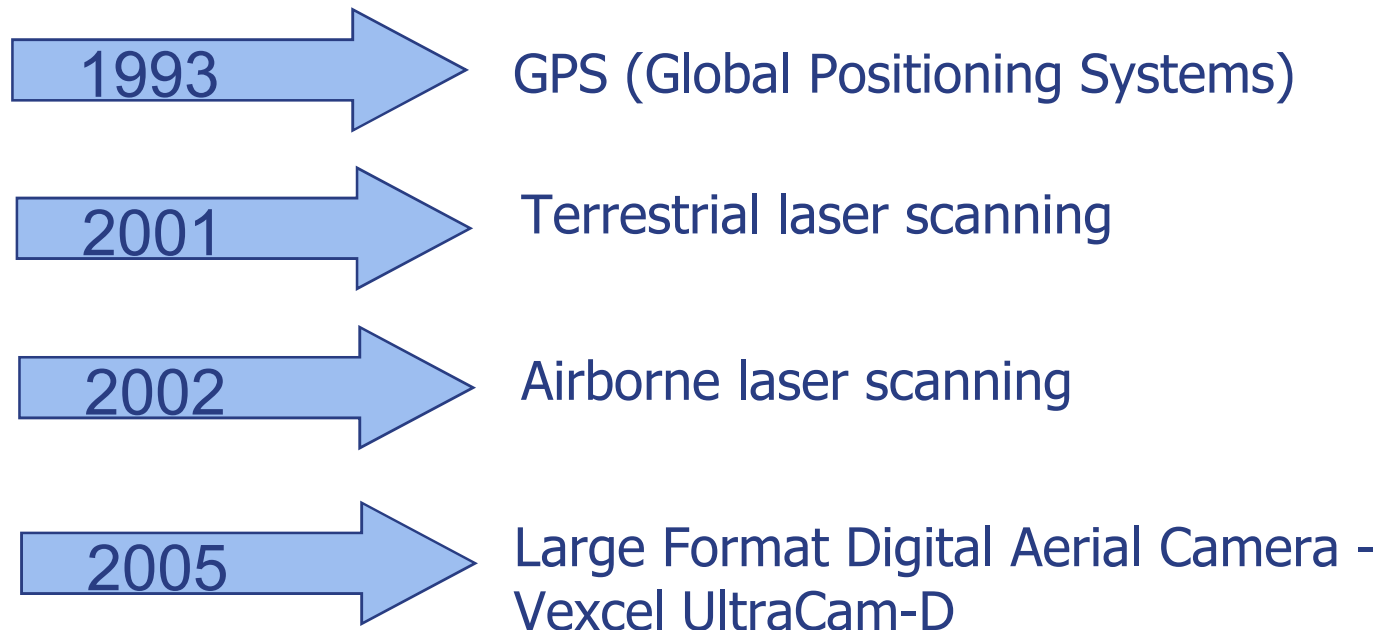


Geokosmos Projects Around the World



Geokosmos is the leading innovative company!

- ▣ First in Russia to introduce into the commercial use:



Applications

- ✚ Urban planning
- ✚ Environmental monitoring
- ✚ Water/flood management
- ✚ Planning, development and monitoring of oil and gas facilities
- ✚ Power lines and substations planning, design and renovation
- ✚ Highway and railroad construction
- ✚ Forestry management
- ✚ Land management
- ✚ Landscape architecture
- ✚ Bathymetry

Products

- ❏ 3D digital terrain (DTM), elevation (DEM) and surface (DSM) models
- ❏ 3D digital orthophoto plans of high resolution
- ❏ Digital maps and topographic plans of linear and aerial objects at any scale
- ❏ High precision 3D digital models of engineering facilities, buildings and constructions
- ❏ Digital maps and 3D bottom contour models of the shelf and inland shallow water basins
- ❏ Cadastral maps and plans as well as land-use documentation

Equipment

Equipment	Manufacturer	Quantity
ALTM 3100/ airborne laser scanner	Optech	3
ALTM 2050/ airborne laser scanner	Optech	2
UltraCam D/ Large format digital aerial camera	Vexcel	1
AIC modular LC/ digital aerial camera	Rollei	6
LMS-Z360i/ terrestrial laser scanner	Riegl	1
LMS-Z420i/ terrestrial laser scanner	Riegl	2

Equipment

Equipment	Manufacturer	Quantity
GPS 5700, 5800/ receiver set	Trimble	35
GPS-GLONASS/ receiver	Javad	10
Total Station 3300, 3600, 5600	Trimble	10
Field Controller	Trimble	45
RD 4000 locator	Radidetection	15
SonarLite/ echo sounder	Ohmex Instrumets	5

Long-term co-operation with major companies

- ✚ Gazprom
- ✚ Federal Grid Company of the Unified Energy System
- ✚ Russian Railroads Company
- ✚ TNK BP
- ✚ Norilsk Nickel
- ✚ Nadymgazprom
- ✚ Kubangazprom
- ✚ Urengoygazprom
- ✚ Yamalgazinvest
- ✚ Surgutneftegaz
- ✚ Lukoil-Nefteproduct
- ✚ VNIPIGAZDOBYCHA
- ✚ Dorservice Group
- ✚ Slavneft-Megionneftegaz
- ✚ Samotlorneftegaz
- ✚ NefteGazAerokosmos
- ✚ Mosavtodor
- ✚ Lengiprotrans
- ✚ Mosgiprotrans
- ✚ UralgiprodorNII
- ✚ Kubanwaterproject
- ✚ Schurovsky Cement

Projects

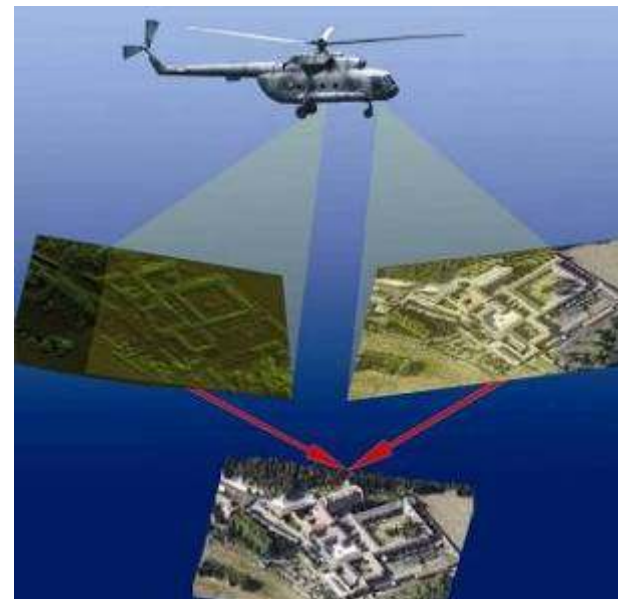
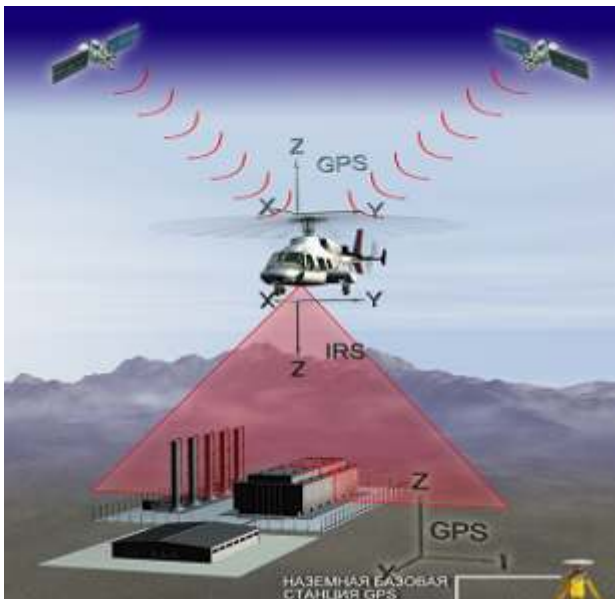
- ❖ Total volume of work in 2003-2006 is more than 100 000 sq. km
- ❖ In 2004-2006 Geokosmos won big tenders (thousands of km) for geodetic surveying and mapping in Kazakhstan (Kazakhstan Railroads Company), Lithuania, Latvia, Germany, France, Spain and Africa (Ghana)

Airborne Laser Scanning

What is Laser Scanning?

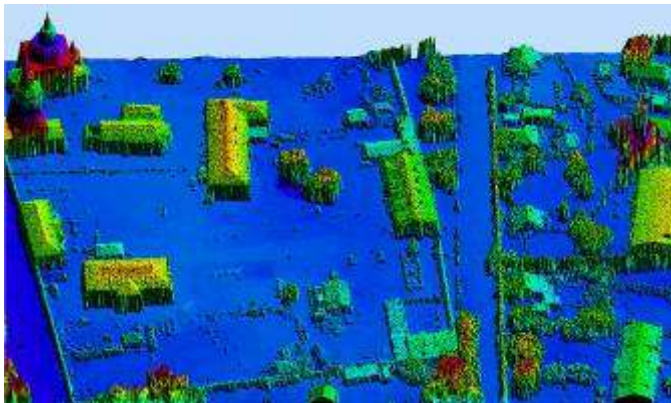
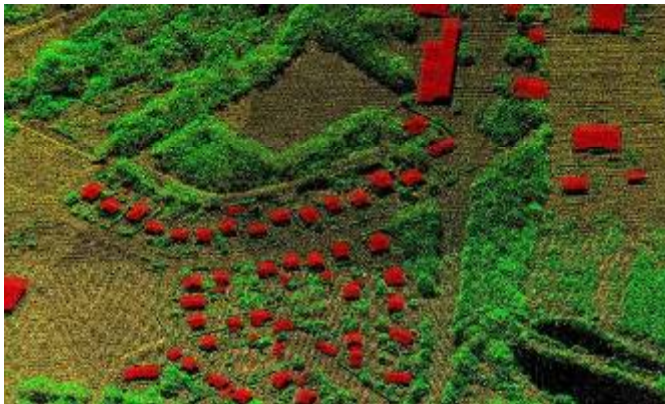
Immediate acquisition of 3 D Digital Terrain Model combined with aerial photos in real-time co-ordinates:

- ❑ On-board GPS receiver records the aircraft trajectory
- ❑ IMU records aircraft attitude
- ❑ Scanner records distance und scan angle of the laser beam
- ❑ Digital aerial camera executes aerial photography



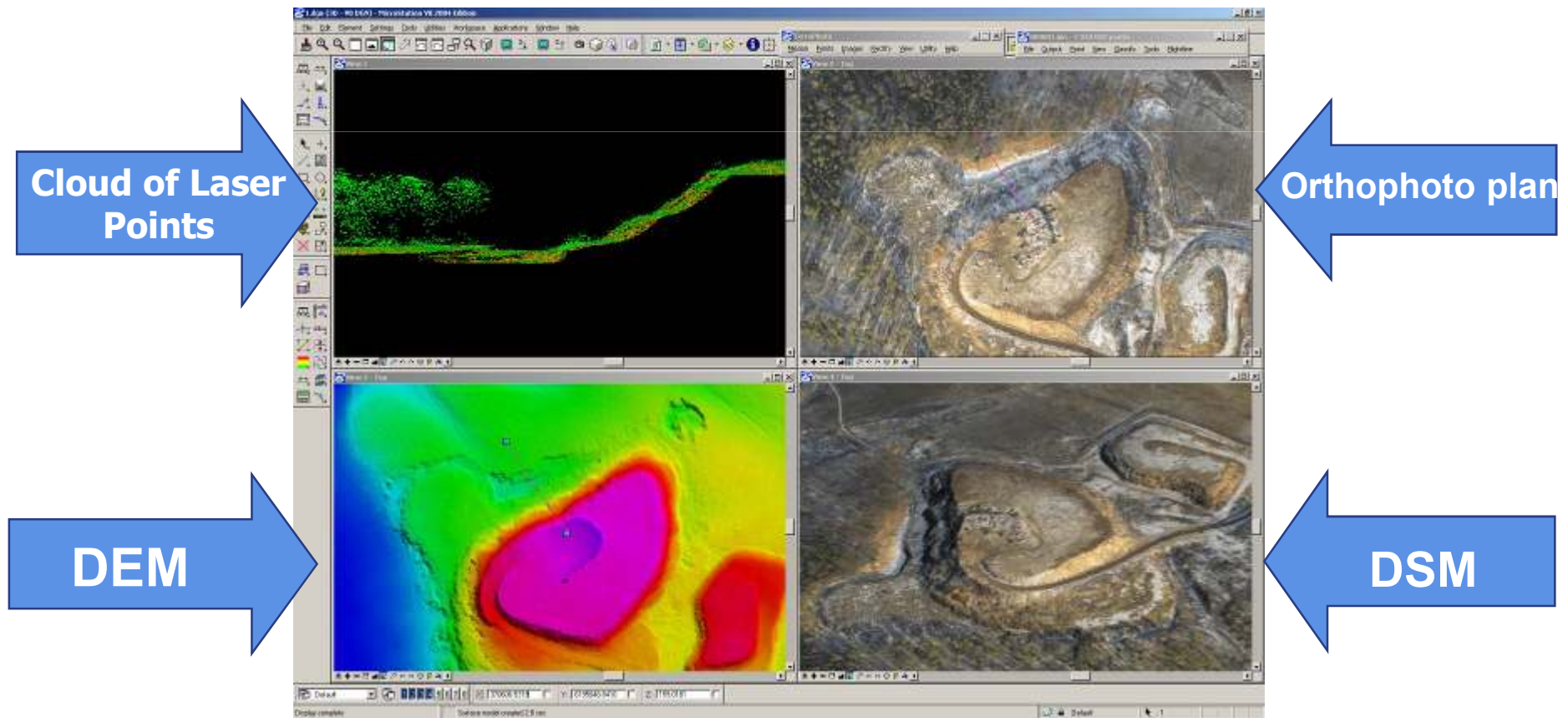
Aerial Survey Data

- ▣ 3D cloud of laser points and digital photo image

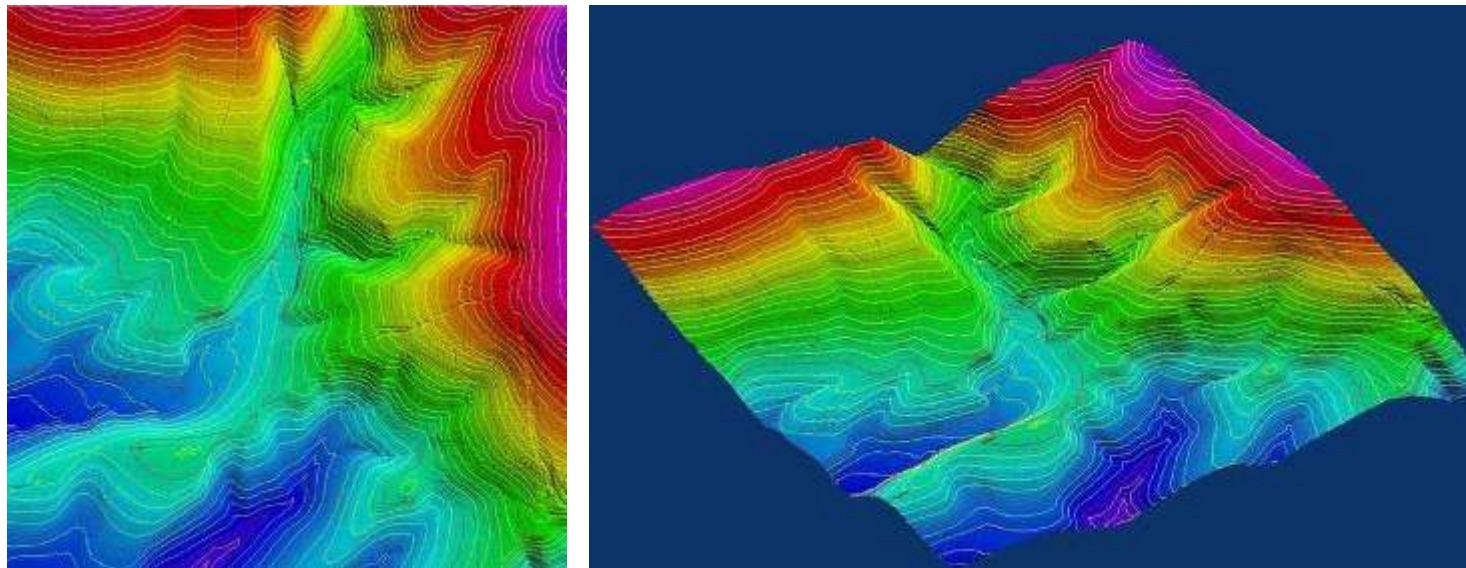


Aerial Survey Data

- 3D cloud of laser points and digital photo image



Digital Terrain Model



- ⊕ Creating high precision DTM of the territories without landmarks – tundra, completely-snow-covered areas, deserts, sand beaches, etc. which cannot be achieved by any other technology

Technology Advantages

- ❖ Direct acquisition of Digital Terrain Model (DTM) and Digital Surface Model (DSM); geometric measurements based on these models
- ❖ High precision of 3D digital models which depends on the flight and scanning conditions (first of all – flying height and speed and scanning corridor width)
- ❖ Substantial decrease of terrestrial geodetic works in the whole work flow
- ❖ Available transportation facilities without increasing the cost of works

Unique Features

- ❖ True relief (ground surface) under canopy in any season
- ❖ Location and shape of high-tech engineering facilities, pipelines, buildings, etc.
- ❖ Detailed topographic plans and maps of territories without landmarks (tundra, completely snow-covered areas, deserts, sand beaches, etc.)

Equipment Specifications

Geokosmos Aerial Survey Equipment

Aerial Survey Equipment:

- ⊕ Laser Scanner (sensor unit and control rack)
- ⊕ IMU
- ⊕ Digital Camera
- ⊕ GPS-receiver
- ⊕ Pilot display
- ⊕ Notebook
- ⊕ Raw data processing software (Applanix POSPac)
- ⊕ Software for 3D modeling and creation of orthophoto and topographic plans (AutoCAD, Altexis, Geokosmos 3D Processor)



ALTM 3100

Main productivity parameters	Main technical parameters
Laser repetition rate	100 kHz
Operating altitude	80 – 3500 m
Elevation accuracy	15 cm x 1200 m altitude 25 cm x 2000 m altitude 35 cm x 3000 m altitude
Horizontal accuracy: 1/2000 x altitude	1/2000 x altitude
Swath width	from 0 to 0,96 x altitude
Range capture	Up to 4 range measurements for each pulse including last

Airborne platforms



Cessna 206



Partenavia P68

Airborne platforms



Cessna 402



Beechcraft King Air
200

Other possibilities:

- Cessna 207, 402
(aircrafts already had downlook viewing ports)
- Pilatus Porter P6
- Piper (various types)
- Bell 206
- Robinson R-44
- Eurocopter Squirrel

Technical requirements to Airborne platforms

- Downlook viewing port on an aircraft for ALTM installing. Scanner Head is mounted just above this port. No shadowing elements or glass should be in the field of vision of the Scanner Head (40-50 degree for ALTM 2050-3100).
- The Control Rack could be mounted up to 2m from the scanner head.
- Ambient temperature for the Control Rack (cabin temperature) must be within the range 5-35°C.
- The GPS antenna must be installed somewhere on the top of the fuselage.
- ALTM System needs power supply from the aircraft - direct current 28V. System consume up to 35A.
- Dimensions for the downlook viewing port - 55-60 sm in diameter (centric form is preferable).

System Installation on board



Scanner head



Control rack

Projects

Selected Projects (Urban Planning)

**City of Wroslaw, 2006,
Poland**

End product: Orthophoto

- Total area –365 sq.km
- Pixel size – 0,10 m
- Technologies of Airborne Laser Scanning and Vexcel camera

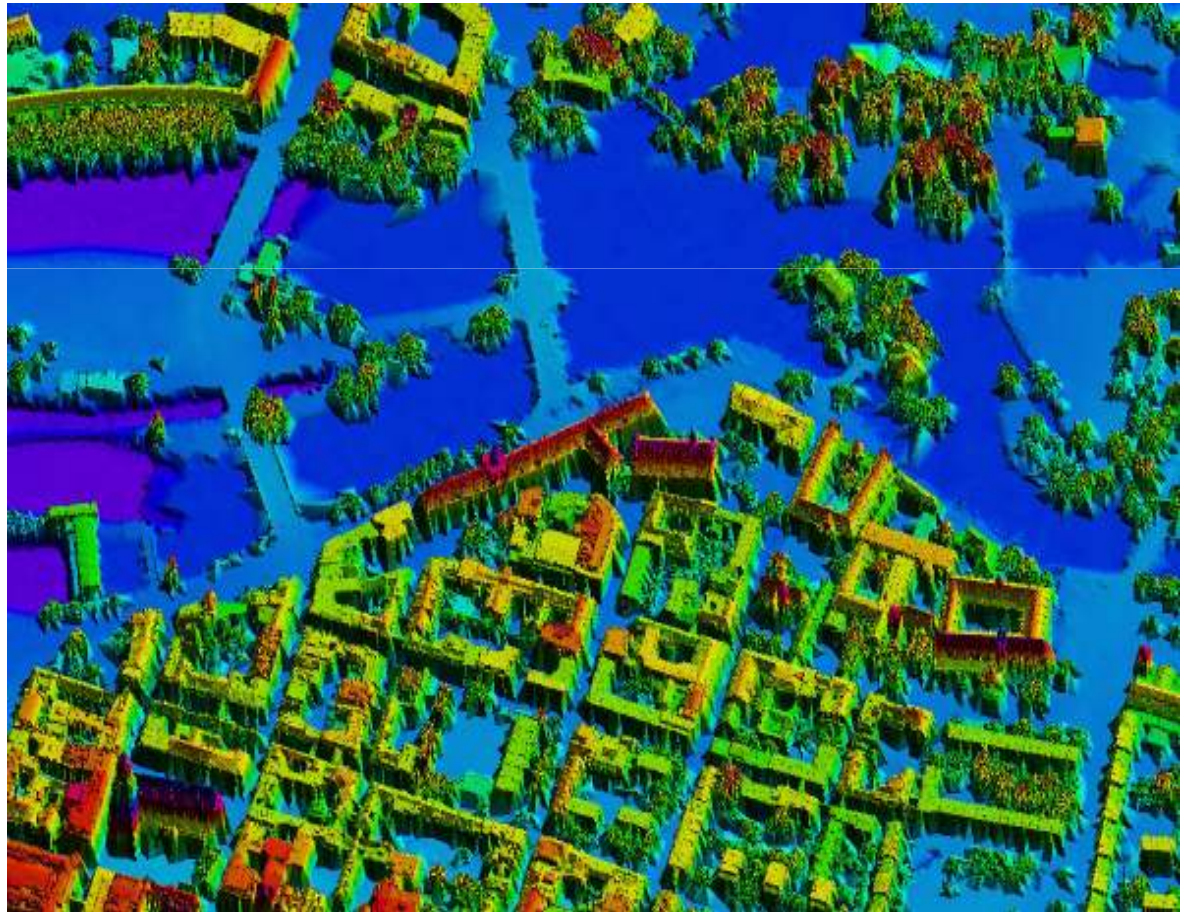


Selected Projects (Urban Planning)

**City of Wroslaw, 2006,
Poland**

End product: DSM

- Total area – more 365 sq.km
- Accuracy – 0,15 m
- Technologies of Airborne Laser Scanning and Vexcel camera



Selected Projects (Flood Management)

Spain, 2006

End product: Orthophoto,

- Total area – more 700 sq.km
- Pixel – 0,20 m
- Technologies of Airborne Laser Scanning and Rollei Digital aerial camera

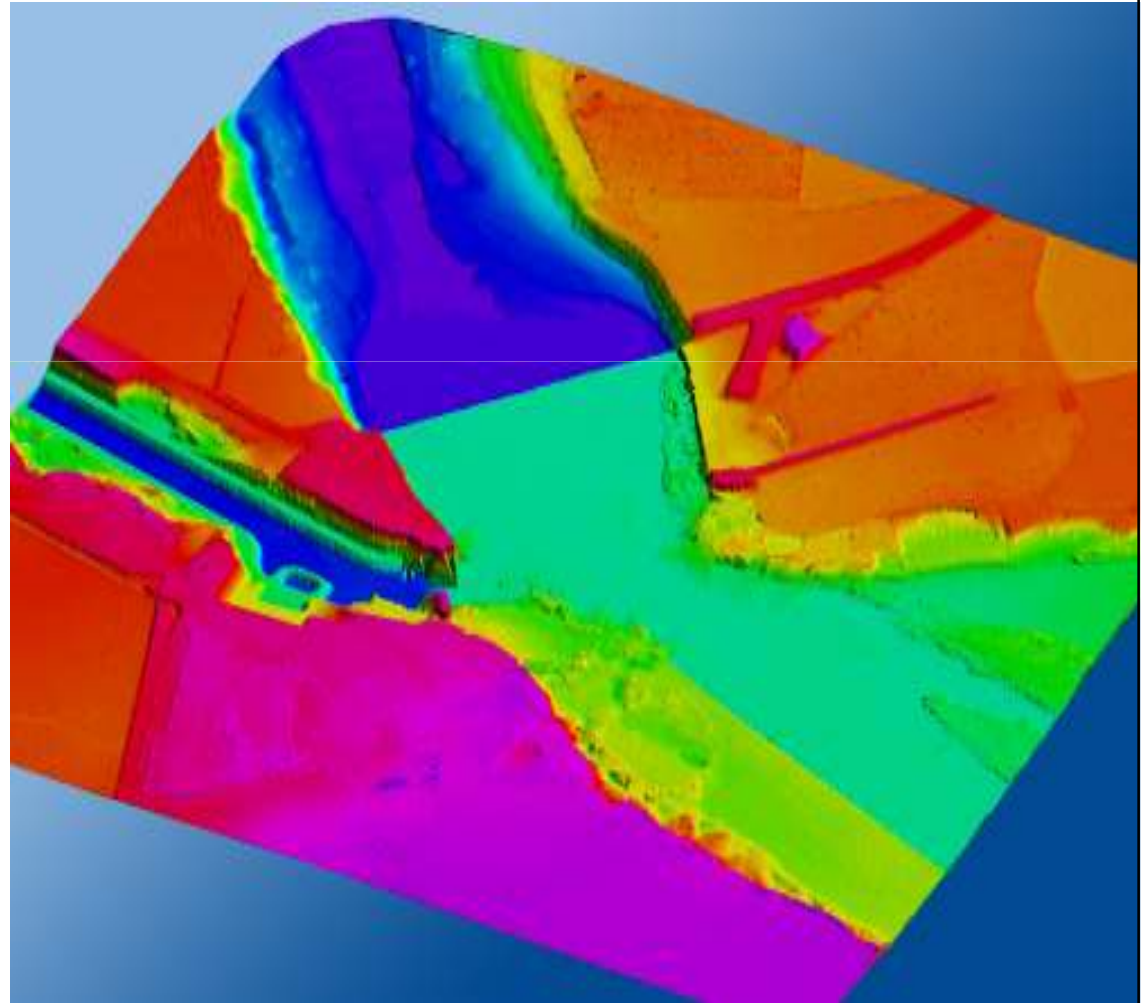


Selected Projects (Flood Management)

Spain, 2006

End product:, DTM

- Total area – more 700 sq.km
- Accuracy: vertical – 0,30 m
planimetric: 0,50 m
- Technologies of Airborne
Laser Scanning and Rollei
Digital aerial camera

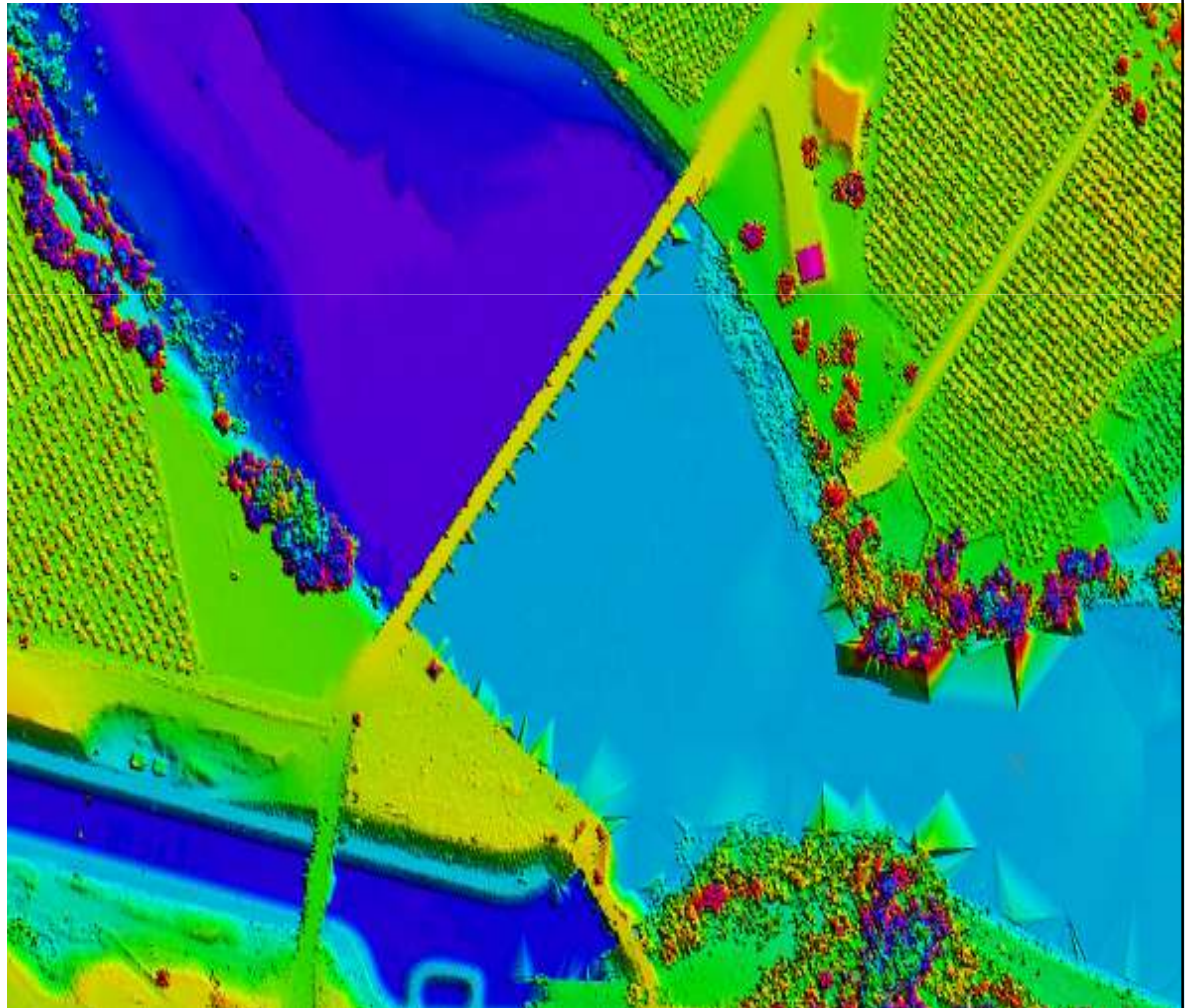


Selected Projects (Flood Management)

Spain, 2006

End product:, DSM

- Total area – more 700 sq.km
- Technologies of Airborne Laser Scanning and Rollei Digital aerial camera



Selected Projects (Flood Management, Urban Planning)

France, 2005

End product:, Orthophotoplan

- Total area –145 sq.km
- Technologies of Airborne Laser Scanning and Rollei Digital aerial camera

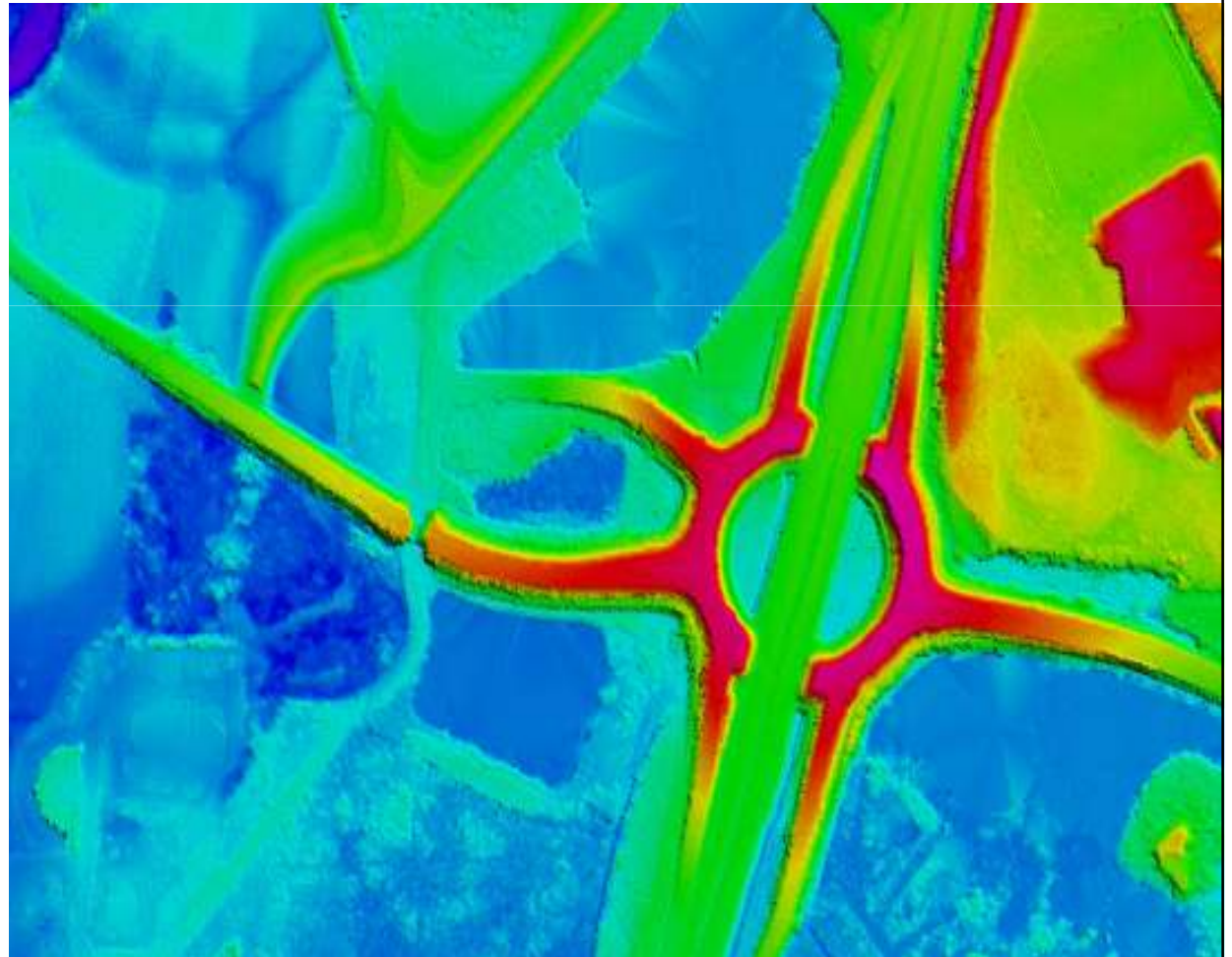


Selected Projects (Flood Management, Urban Planning)

France, 2005

End product:, DTM

- Total area – 145 sq.km
- Accuracy: Vertical: 0,20 m
Planimetric: 0,30 m
- Technologies of Airborne Laser Scanning and Rollei Digital aerial camera

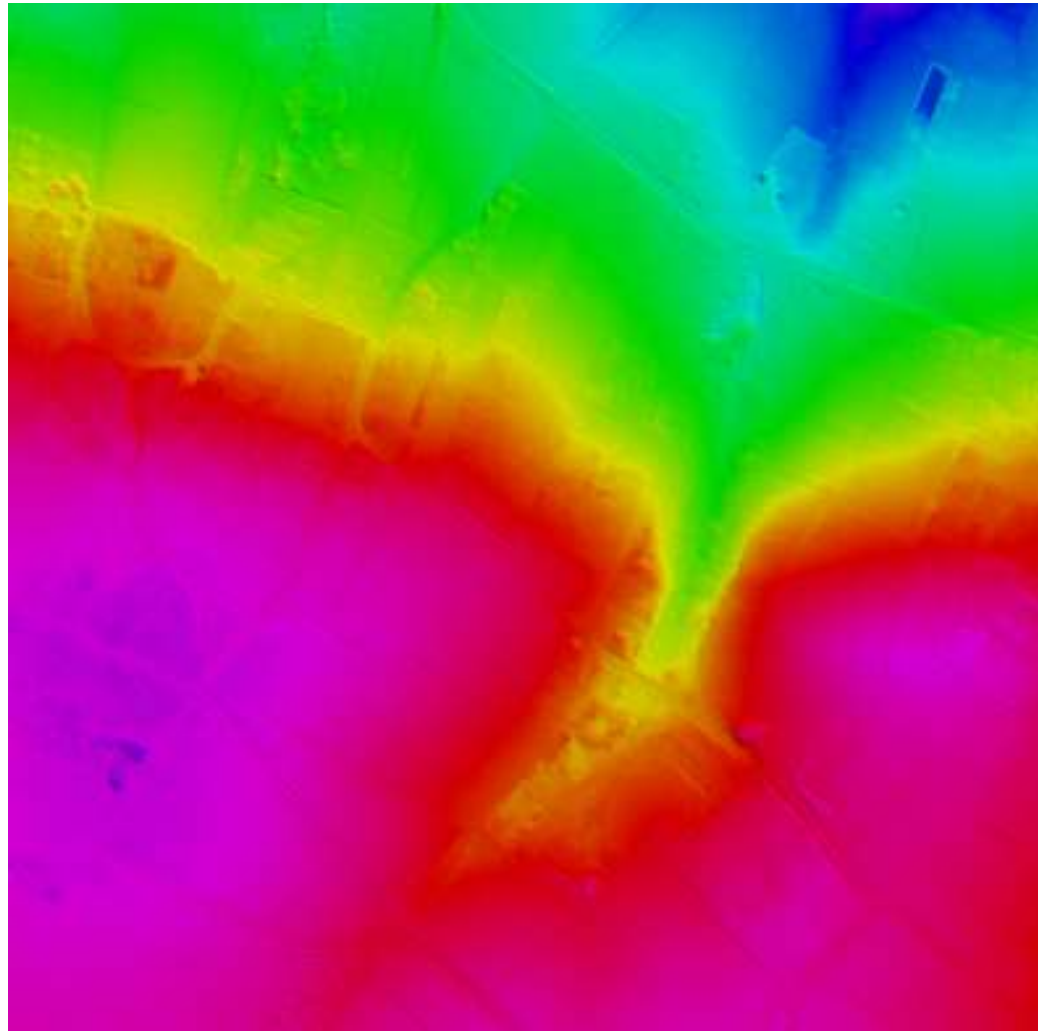


Selected Projects (Flood Management)

**France, City of Nante
2005**

End product:, DTM

- Total area – more 923 sq.km
- Accuracy
- Technologies of
Airborne Laser
Scanning and Rollei
Digital aerial camera

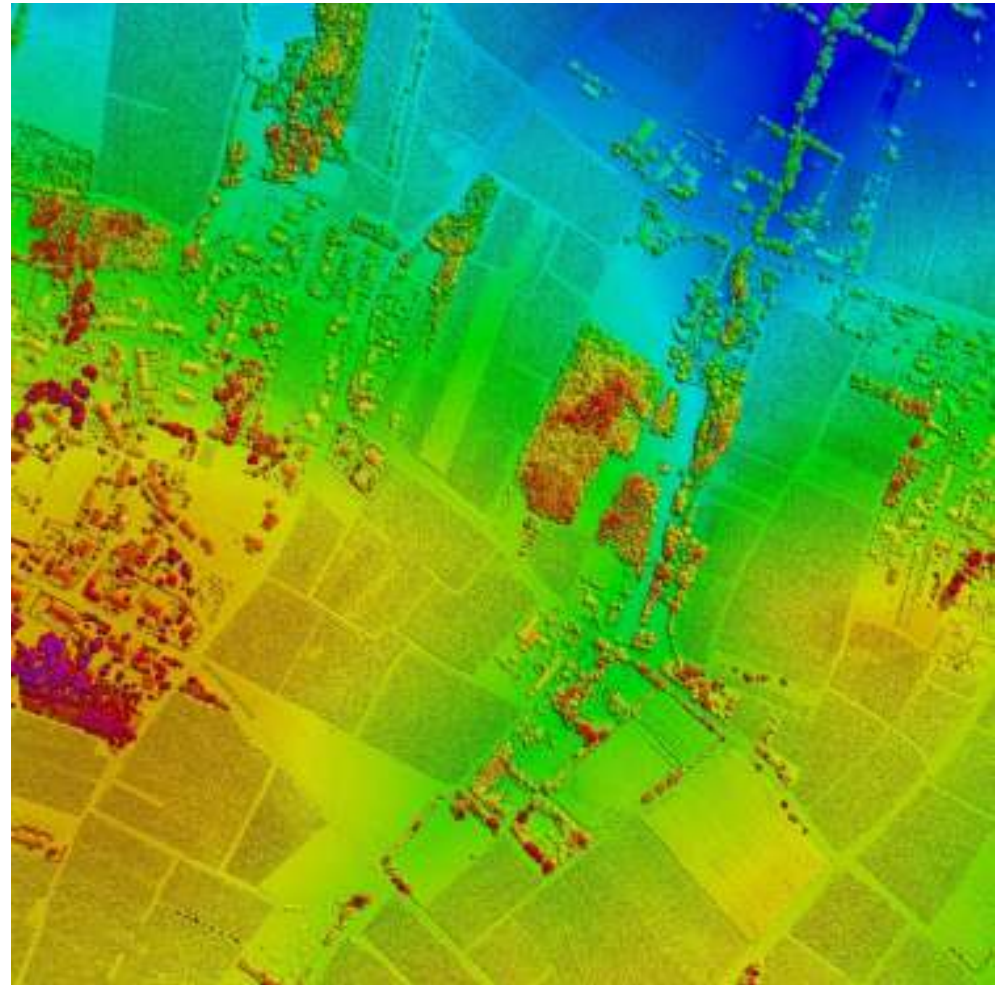


Selected Projects (Flood Management)

**France, City of Nante
2006**

End product:, DSM

- Total area – more 923 sq.km
- Accuracy
- Technologies of Airborne Laser Scanning and Rollei Digital aerial camera



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