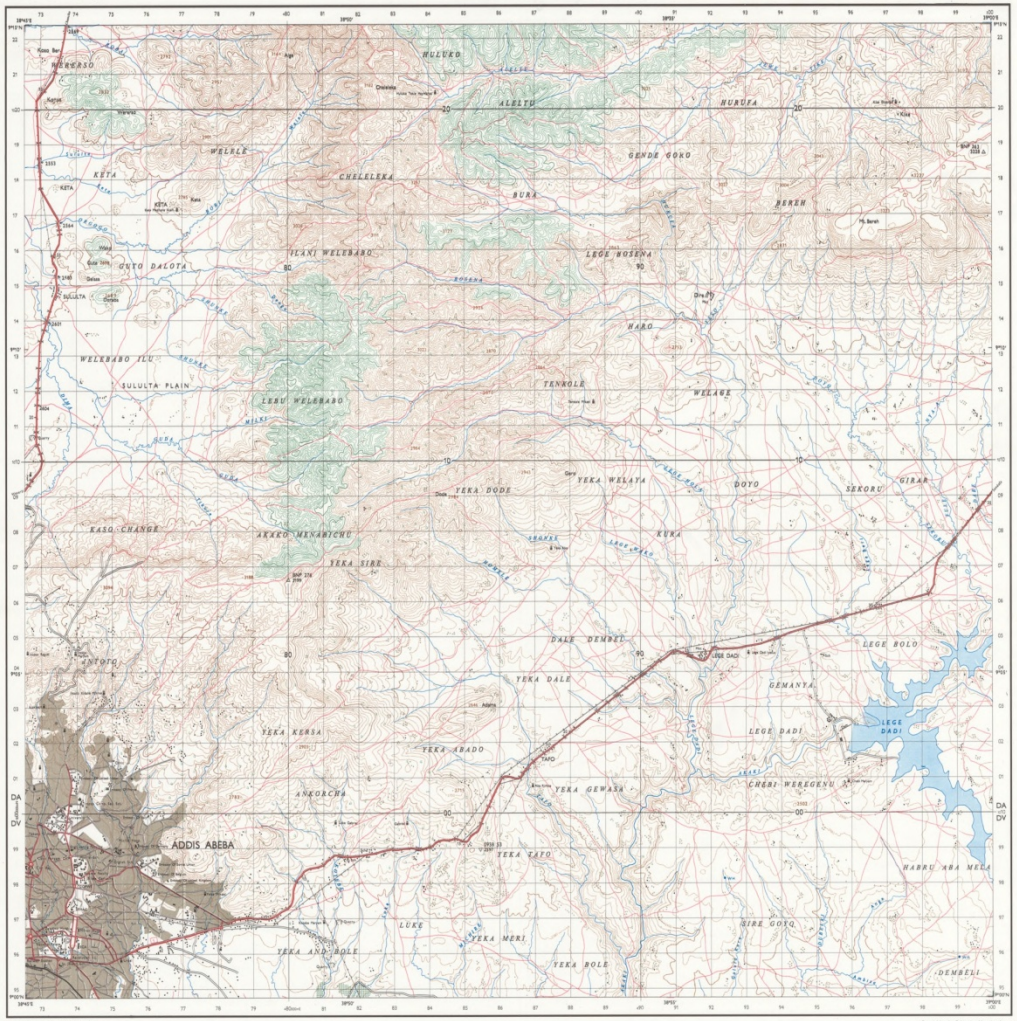
ETHIOPIA 1:50,000

ADDIS ABEBA NE



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SCALE 1:50000

HEIGHTS IN METRES

Printed by the Ethiopian Mapping Agency.
Users noting corrections or additions to this map are requested to annotate and send it to the Ethiopian Mapping Agency, P.O. Box 597, Addis Ababa, Ethiopia. The map will be replaced.

HOW TO ADD/ADJOINING SHEETS

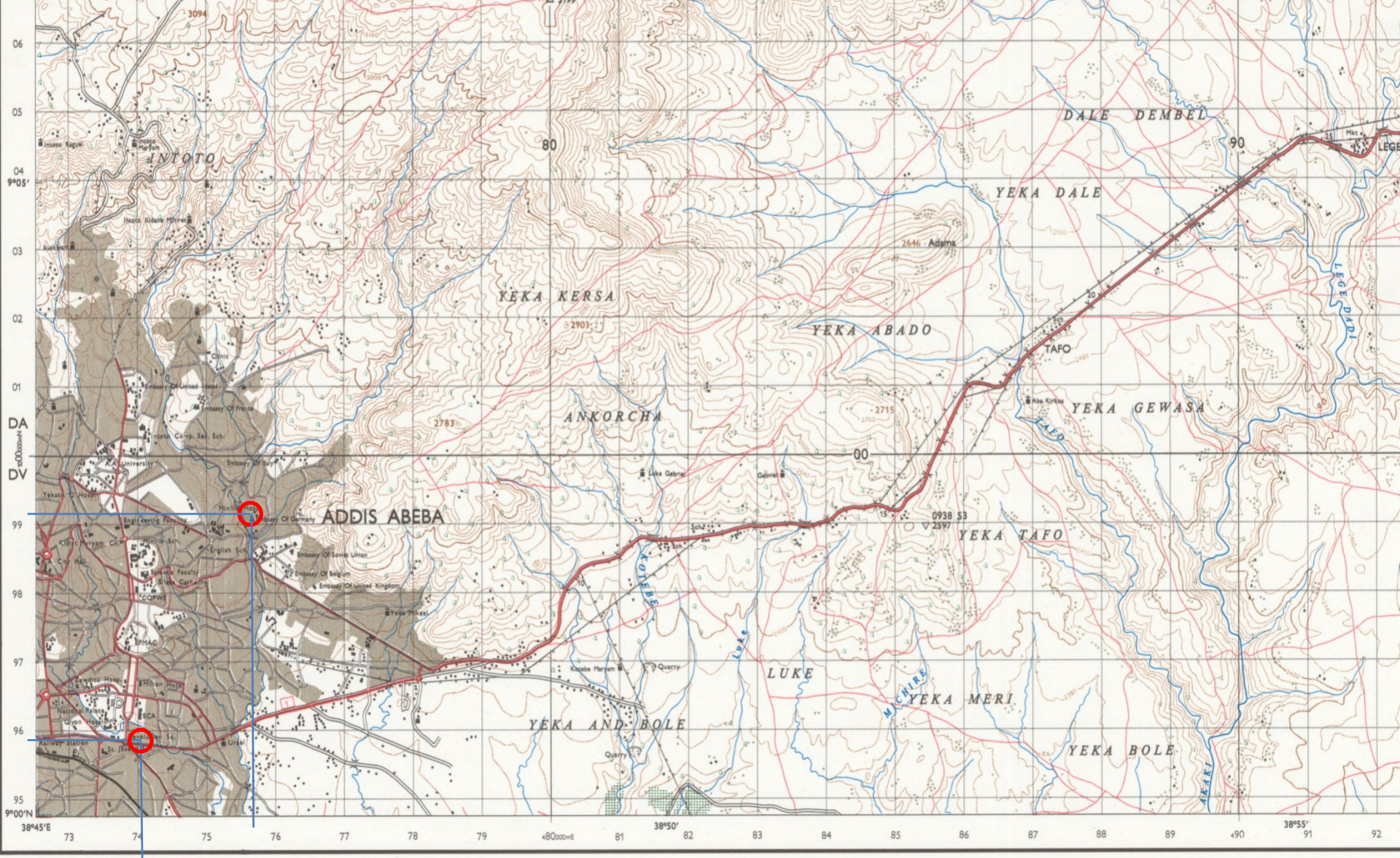
0938 D1	0938 D2	0939 C1
0938 C2	0938 D4	0939 C3
0938 B1	0938 B2	0939 A1

SHEET HISTORY

Edition 2 Prepared by the Ethiopian Mapping Agency 1982
Map Information 1972 by DPGSE
Air Photography 1962-1964
Field Completion by EMA 1979

Series 5TH 4
Sheet 0938 D4
Edition 2 EMA 1982

Copies of this map can be obtained from the Ethiopian Mapping Agency, P.O. Box 597, Addis Ababa, Ethiopia.



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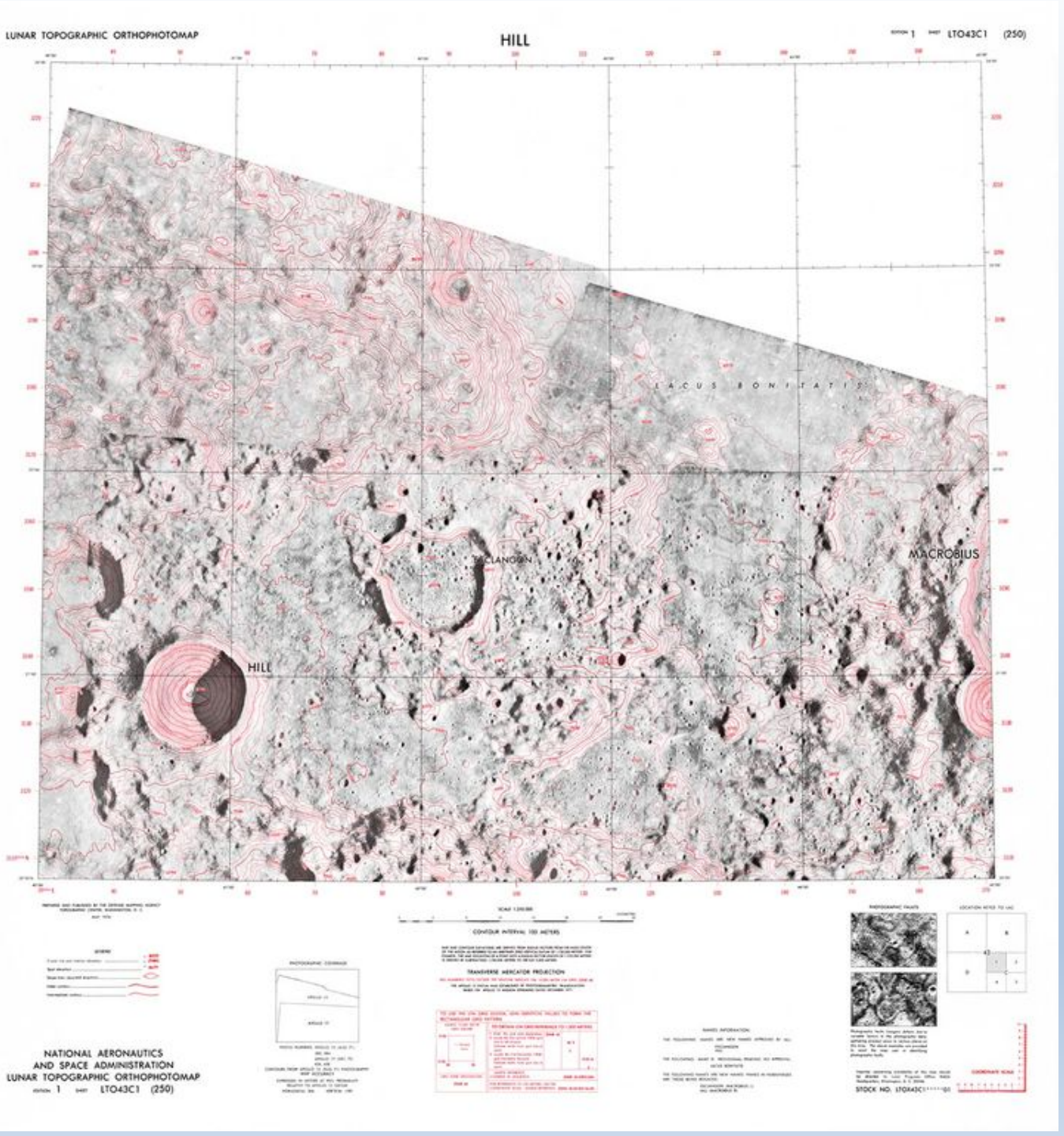
SCALE 1:50,000

METRES 1000 0 1 2 3 4 5 6 7 8 KILOMETRES

MILE 1 0 1 2 3 4 5 6 MILES

FEET 5000 2500 0 5000 10000 15000 20000 25000 30000 FEET

HEIGHTS IN METRES


LUNAR TOPOGRAPHIC ORTHOPHOTOMAP
HILL
LTO43C1 (250)
LACUS BONITATIS
MACROBIUS
HILL
CONTOUR INTERVAL 100 METERS
TRANSVERSE MERCATOR PROJECTION
NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
LUNAR TOPOGRAPHIC ORTHOPHOTOMAP
LTO43C1 (250)

photogrammetry

photogrammetry
(T. Schenk 2005)

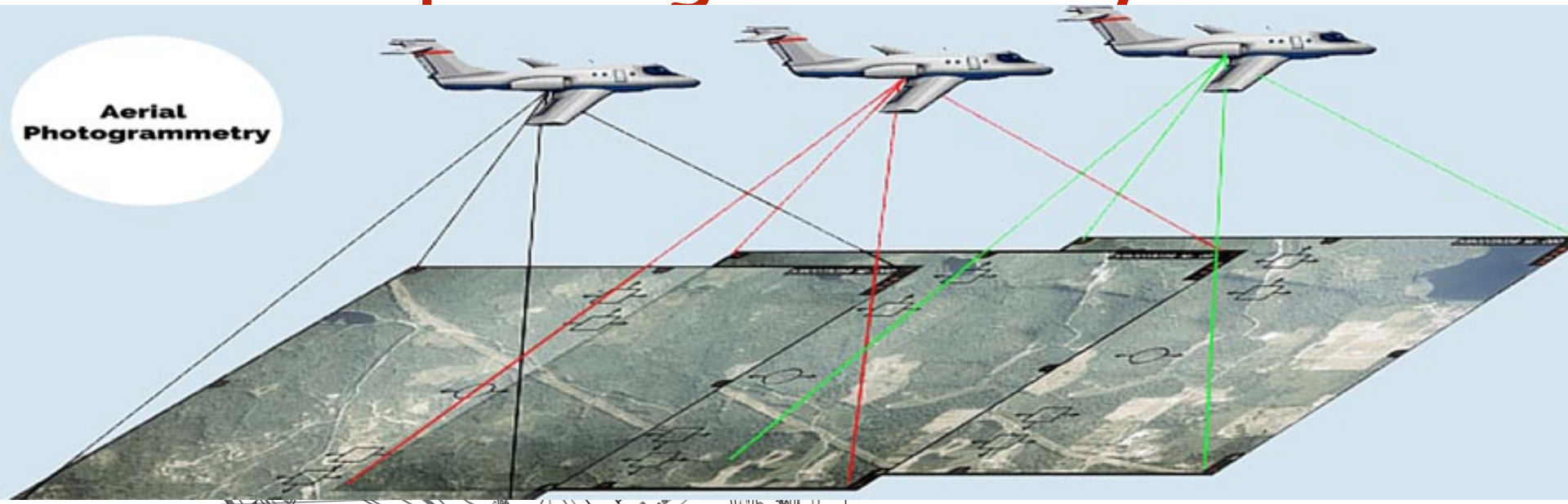
Photogrammetry is the science of obtaining reliable information about the properties of surfaces and objects without physical contact with the objects, and of measuring and interpreting this information.

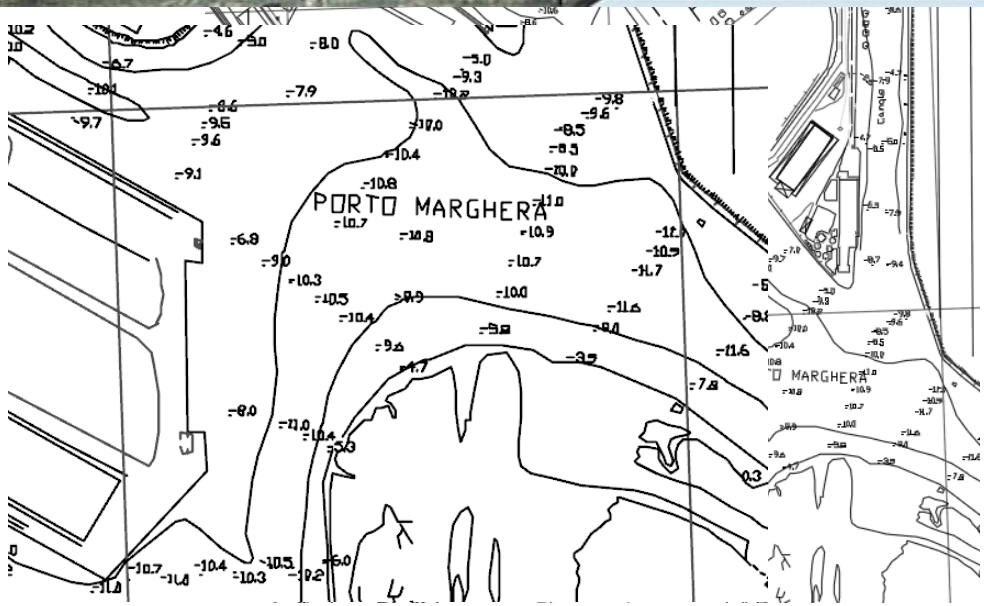
The name "photogrammetry" is derived from the three Greek words *phos* or *phot* which means light, *gramma* which means letter or something drawn, and *metrein*, the noun of measure.

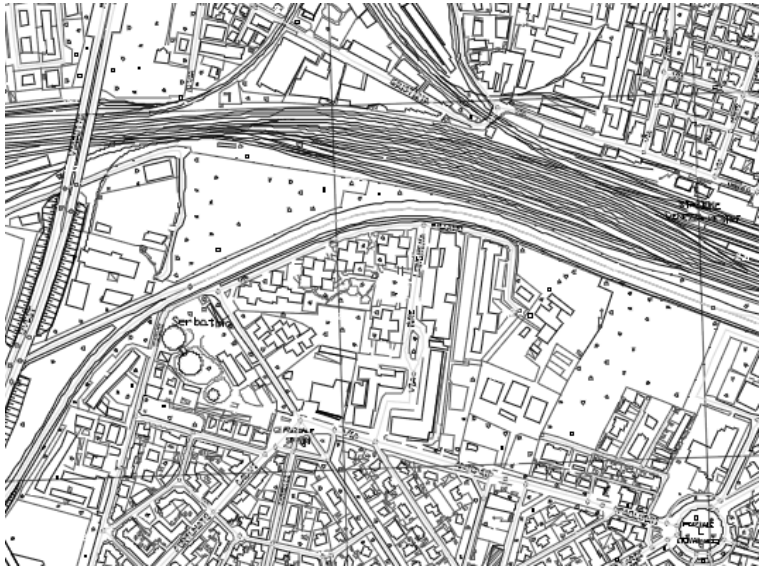
The first known aerial photograph was obtained by Gaspard Felix Tournachon (Nadar) from a tethered balloon 1,700-ft. above Paris, France in 1858.

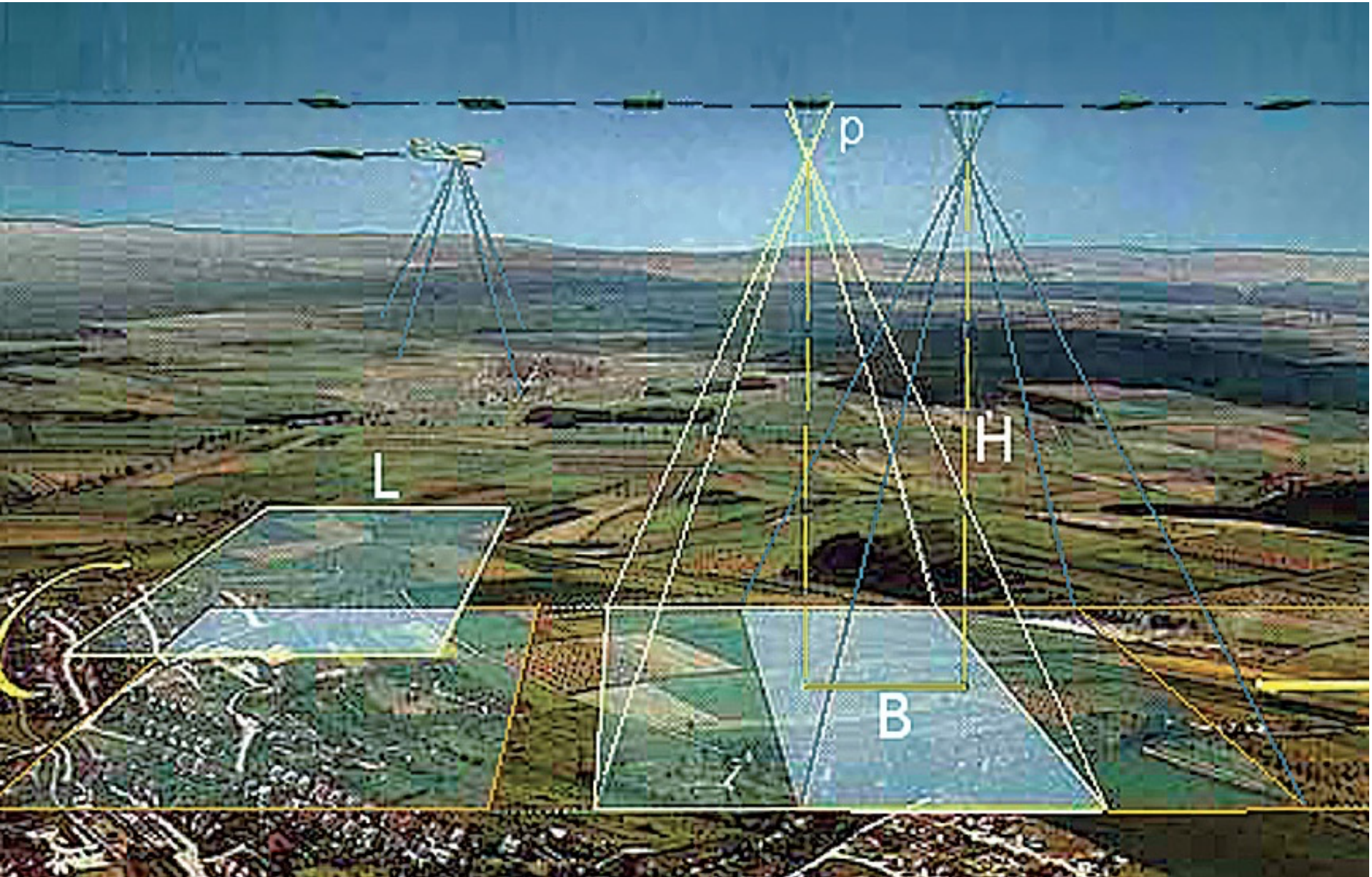
This is an oblique photograph obtained from the Hippodrome Balloon using a multiband camera.

photogrammetry








p
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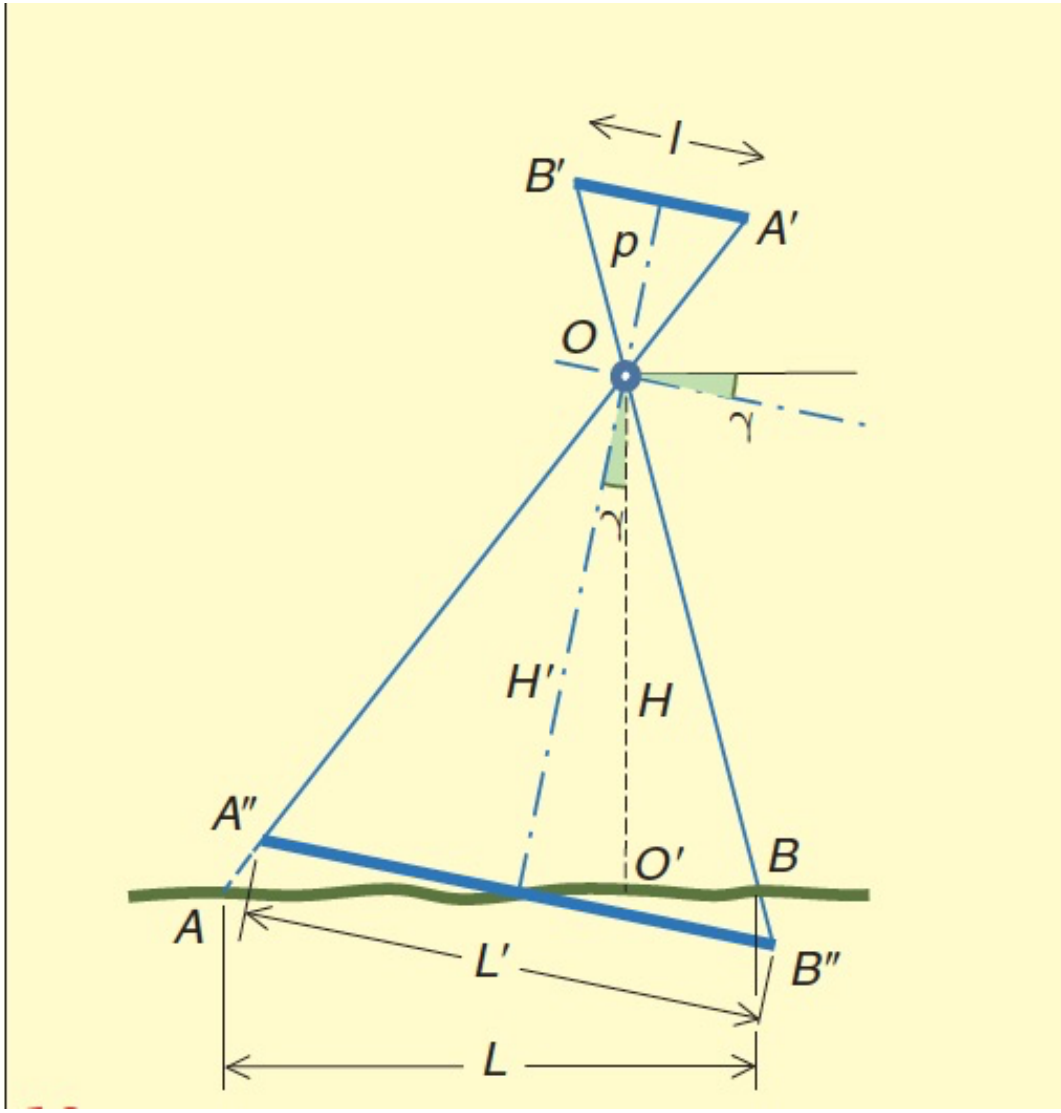

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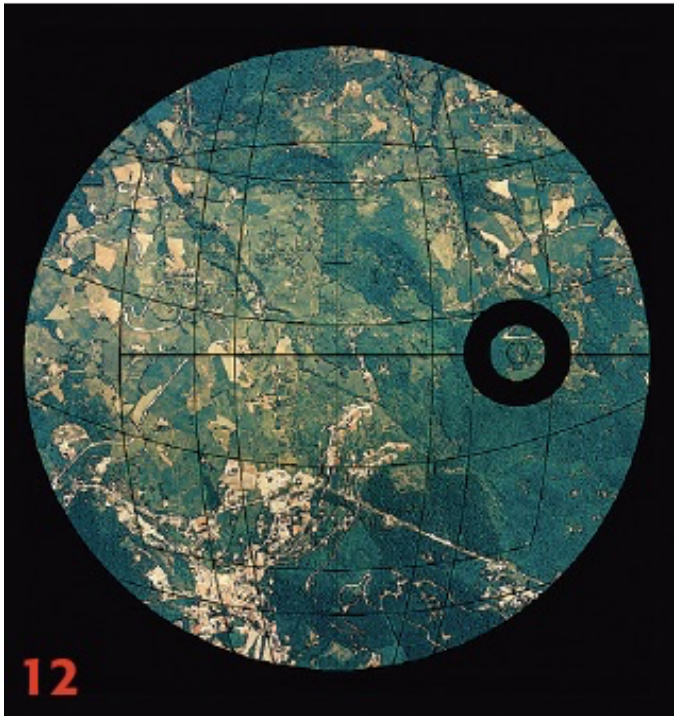

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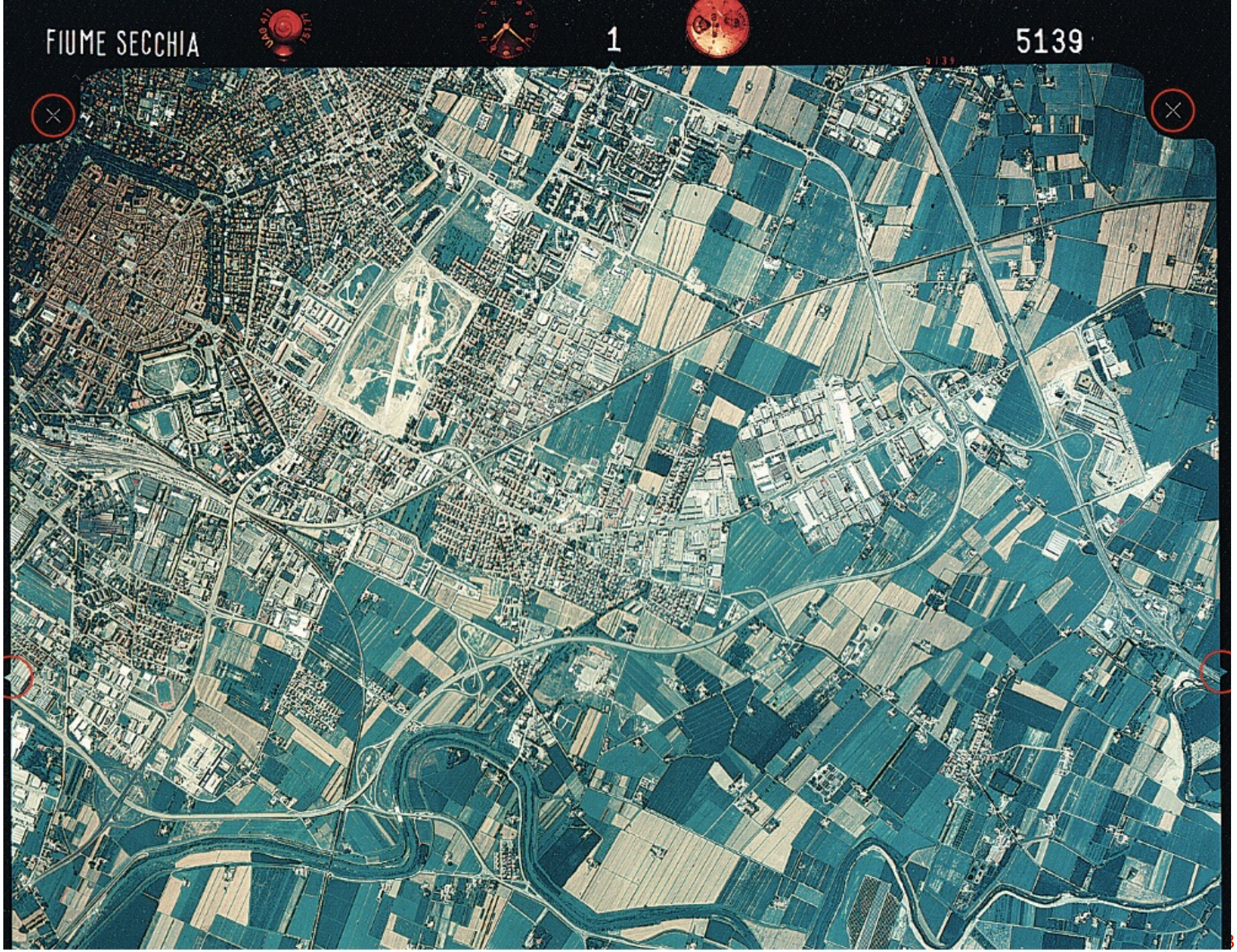
FIUME SECCHIA
1
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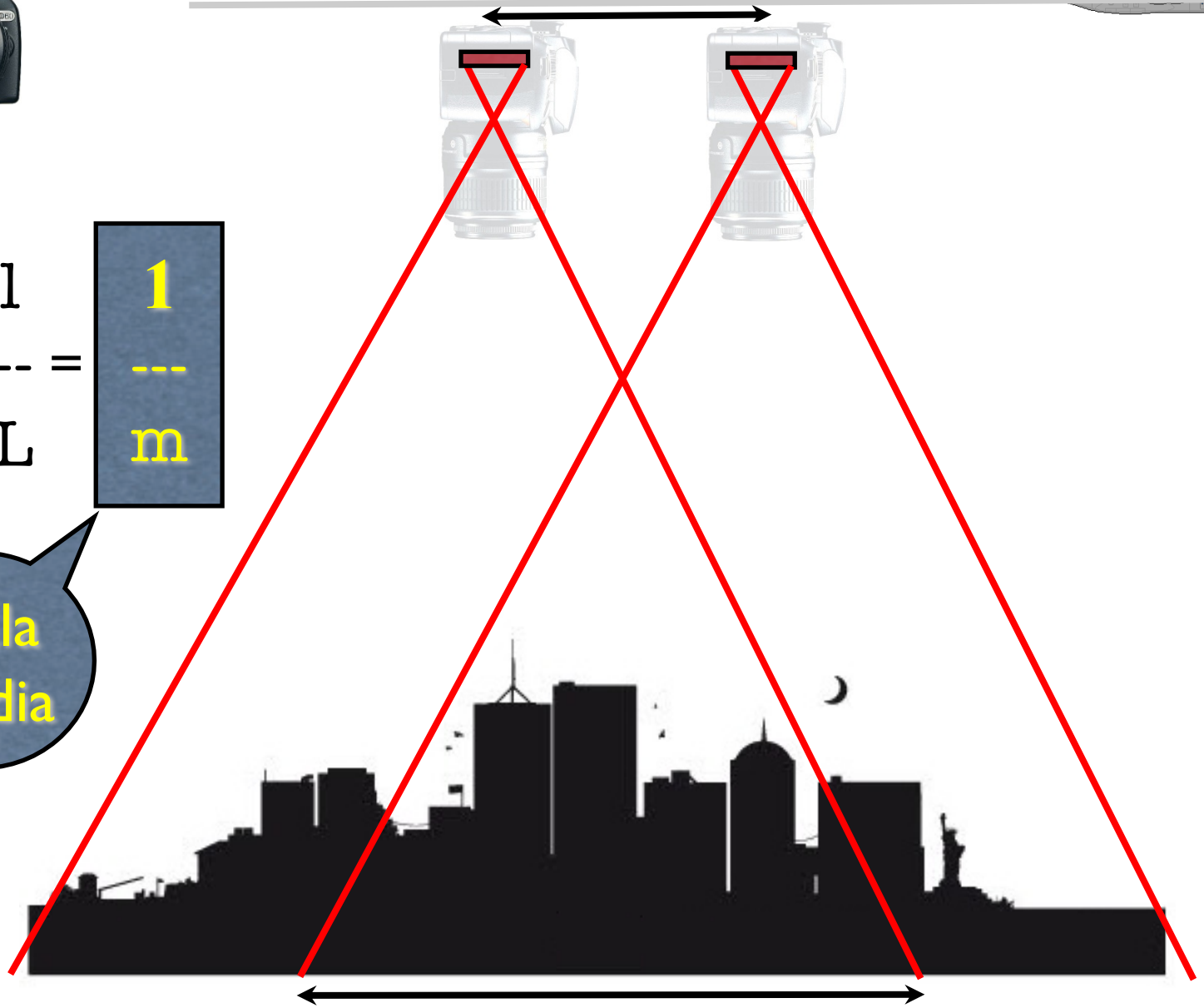
b= base di presa

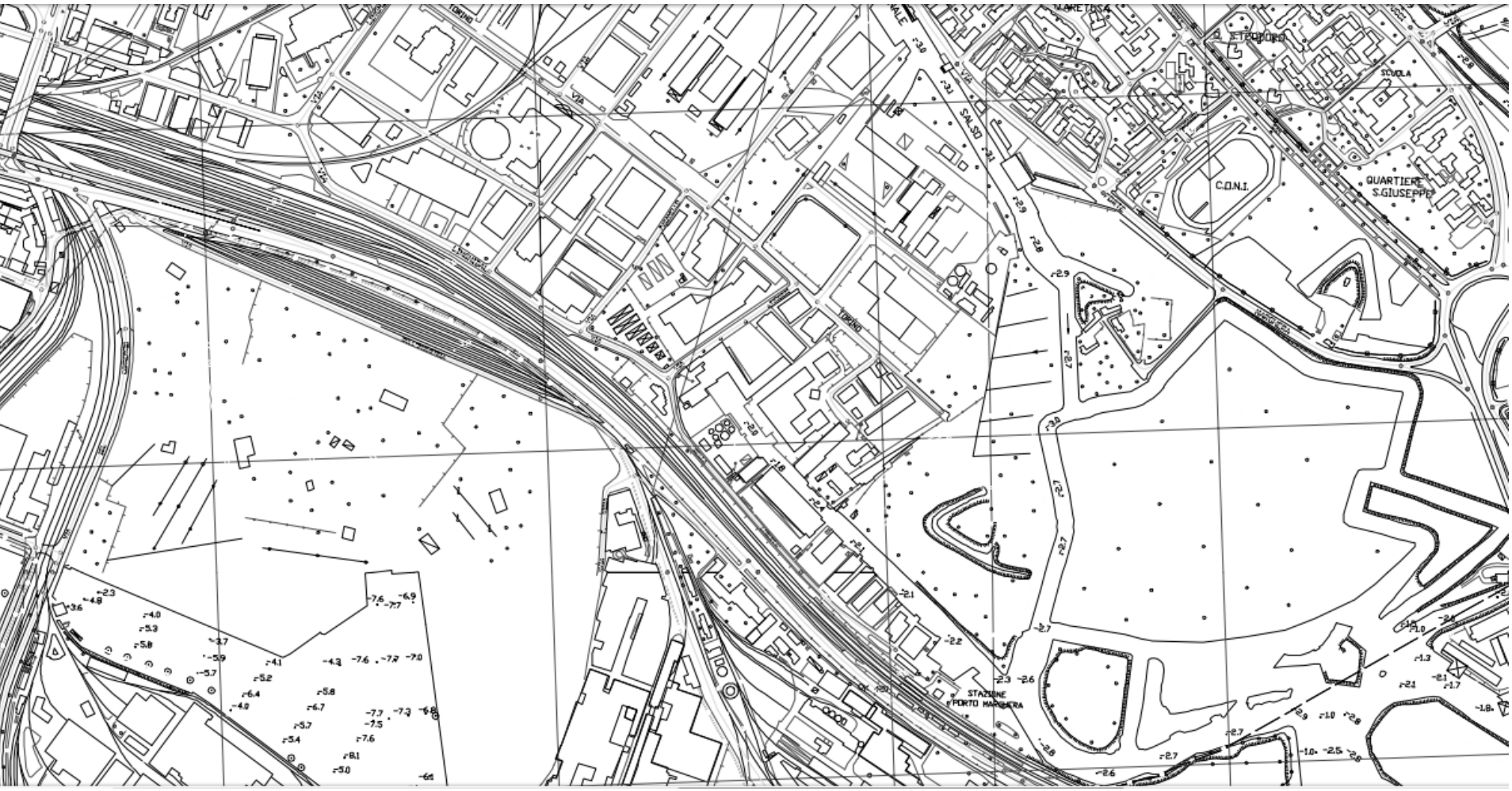
$$\frac{f}{D} = \frac{l}{L} = \frac{1}{m}$$

scala media



Lst= zona stereoscopica = 60% L

74


C.O.N.I.
QUARTIERE S.GIUSEPPE
S.TEODORO
SCUOLA
STAZIONE PORTO MARGHERA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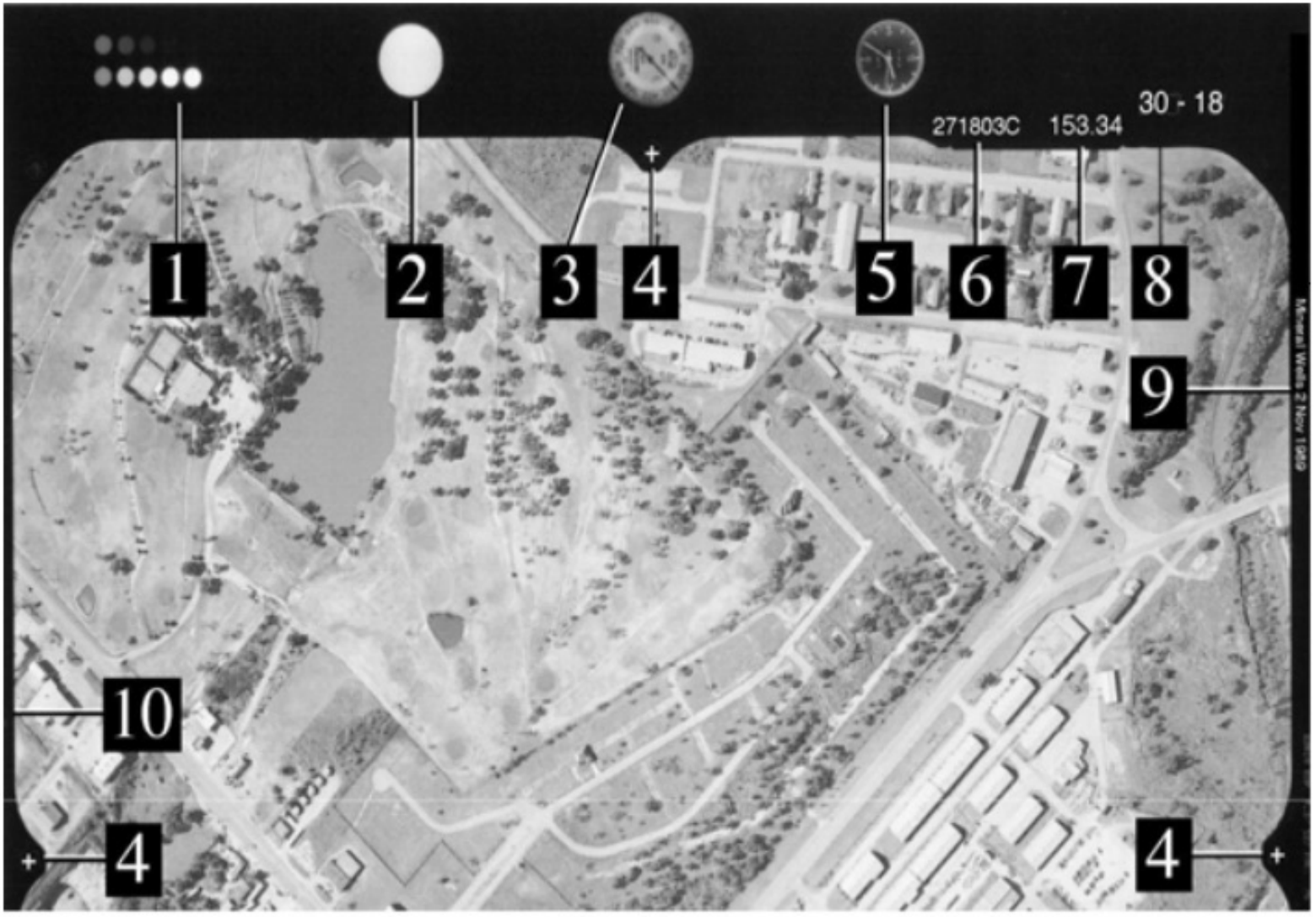
Annotation on the Perimeter of An Aerial Photograph

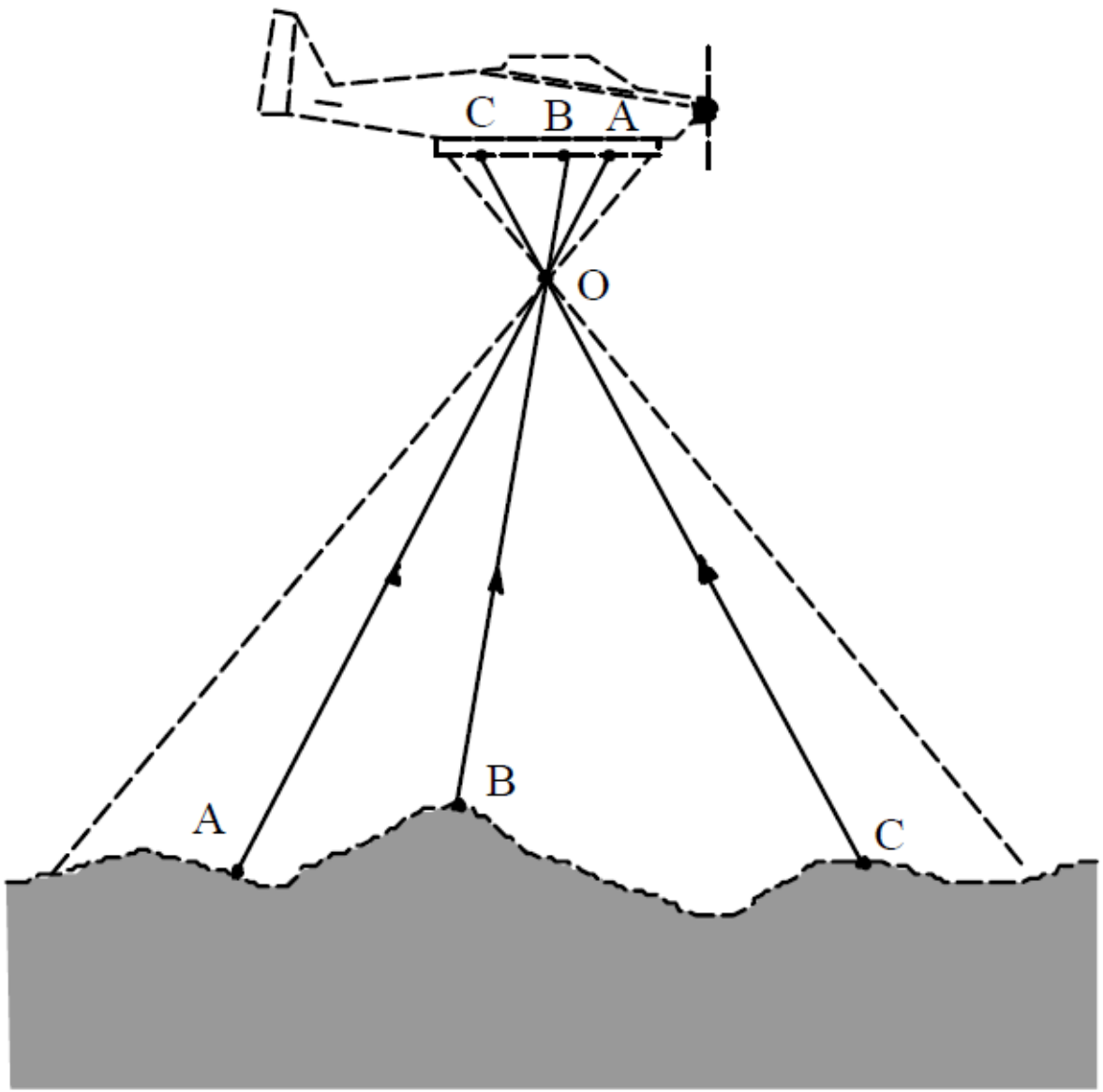


1. Grayscale
2. Notepad
3. Altimeter
4. Fiducial marks
5. Clock
6. Lens cone Serial #
7. Focal length
8. Frame Number
9. Mission Name & Date
10. Navigation Data

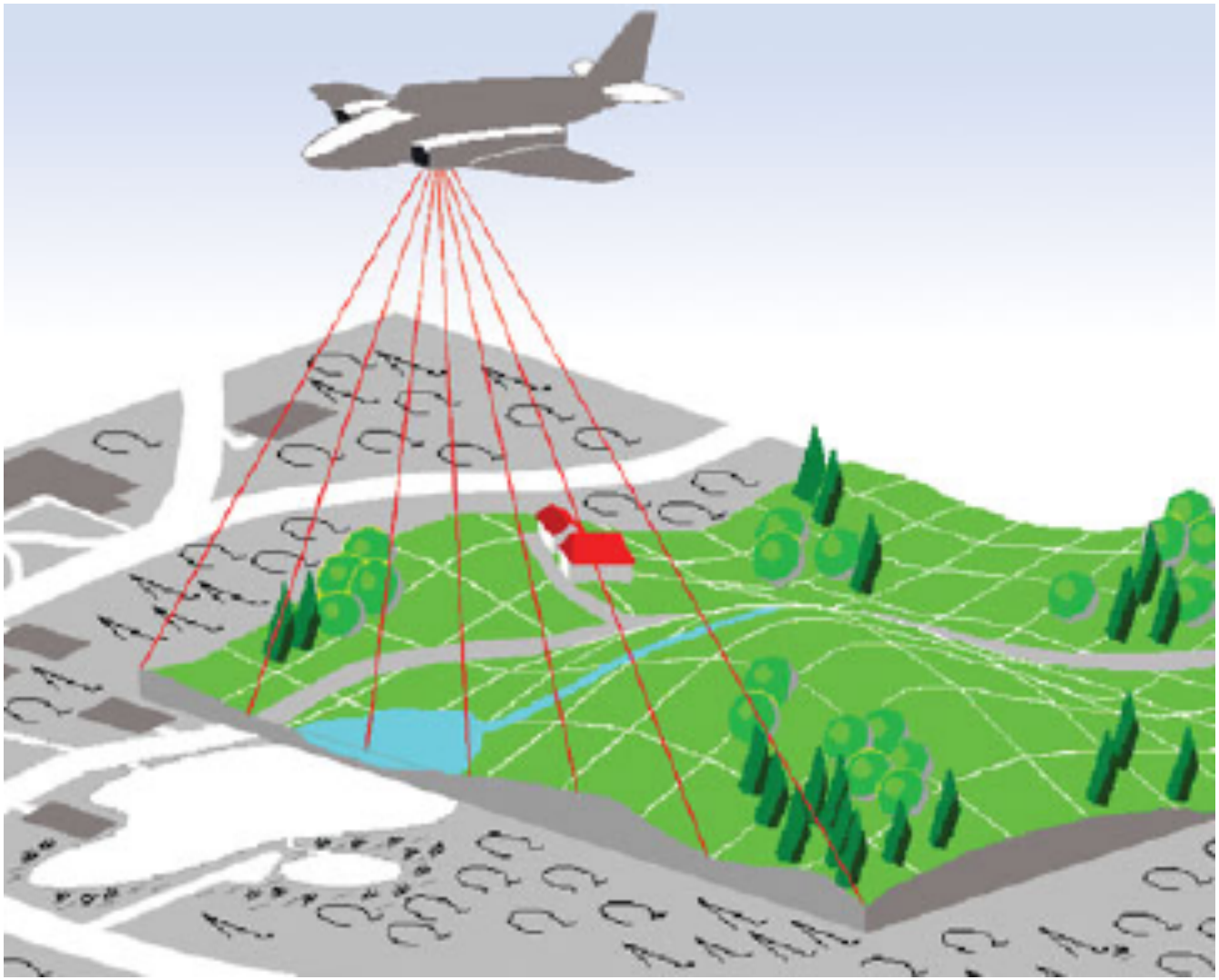
Aerial photo

Aerial photography provides a picture of the land.

Geometrically defines a central projection, because the rays that produce the images on the photograph from the ground all pass through the same point which is the center of objective O



not only photo with Aerial Survey



Airborne LIDAR Survey

LiDAR: What and Why?

- LiDAR stands for Light Detection and Ranging

- LiDAR is not only replacing conventional sensors, but also creating new methods with unique properties that could not be achieved before

LiDAR: How?

- Each time the laser is pulsed:
  - Laser generates an optical pulse
  - Pulse is reflected off an object and returns
  - to the system receiver
  - High-speed counter measures the time of flight from the start pulse to the return pulse
  - Time measurement is converted to a distance (the distance to the target and the
  - position of the airplane is then used to determine
  - the elevation and location)
  - Multiple returns can be measured for each pulse
- Up to 200,000+ pulses/second
- Everything that can be seen from the aircraft
- is measured

Traditional Photogrammetry vs. LiDAR

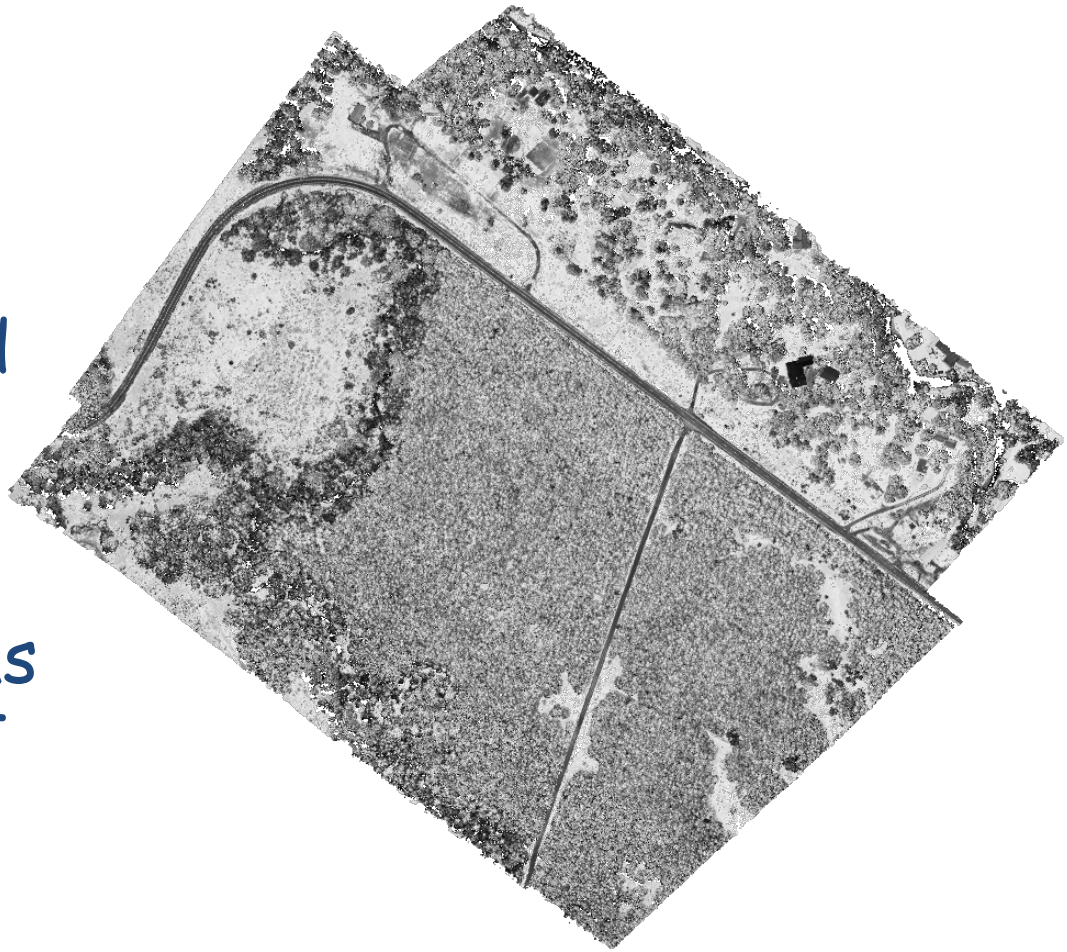
LiDAR	Photogrammetric
Day or night data acquisition	Day time collection only
Direct acquisition of 3D collection	Complicated and sometimes unreliable procedures
Vertical accuracy is better than planimetric*	Planimetric accuracy is better than vertical*
Point cloud difficult to derive semantic information; however, intensity values can be used to produce a visually rich image like product (example of an intensity image)	Rich in semantic information

***Complementary characteristics suggest integration**

Intensity Image

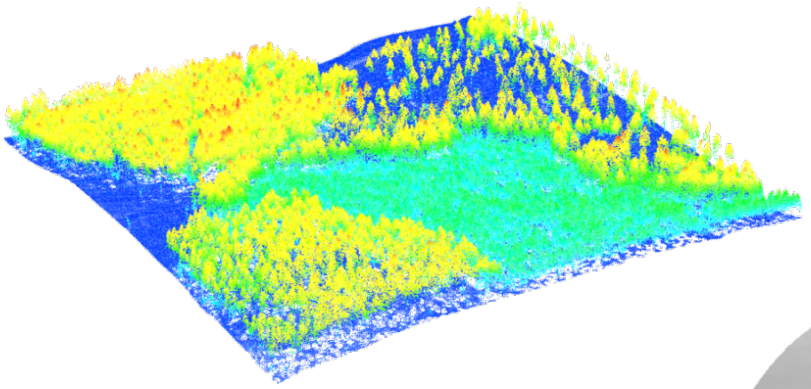
- Commonly unused bi-product of a LiDAR acquisition and is the intensity of object that the laser pulse is striking. This is an uncalibrated 8-bit (0-255) image that is ortho-rectified as therefore can be used as an orthophoto

- Not typically used in quantitative analysis as image gains always set to 'adaptive gain' setting when images are acquired

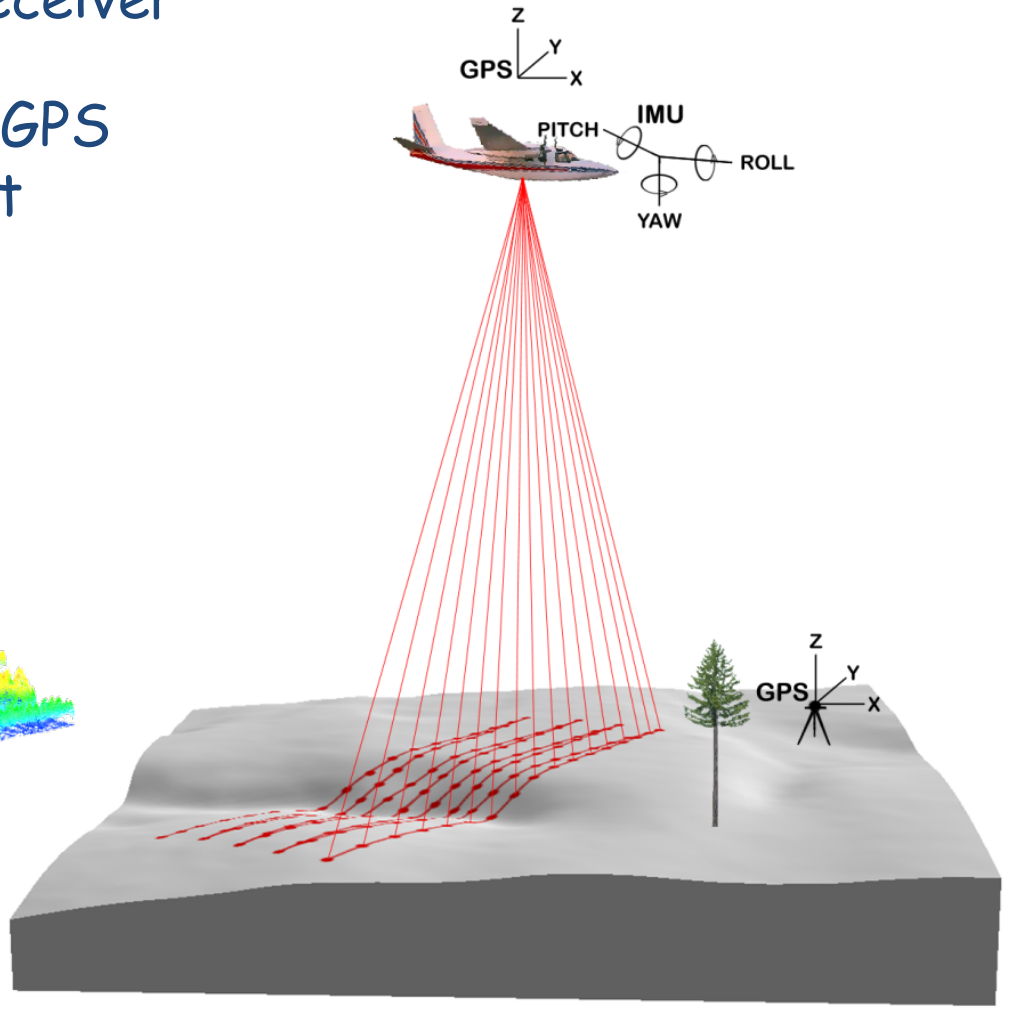


Aerial LiDAR System Components

- Aircraft
- Scanning laser emitter-receiver unit
- Differentially-corrected GPS
- Inertial measurement unit (IMU)
- Computer



LiDAR point data colored by height

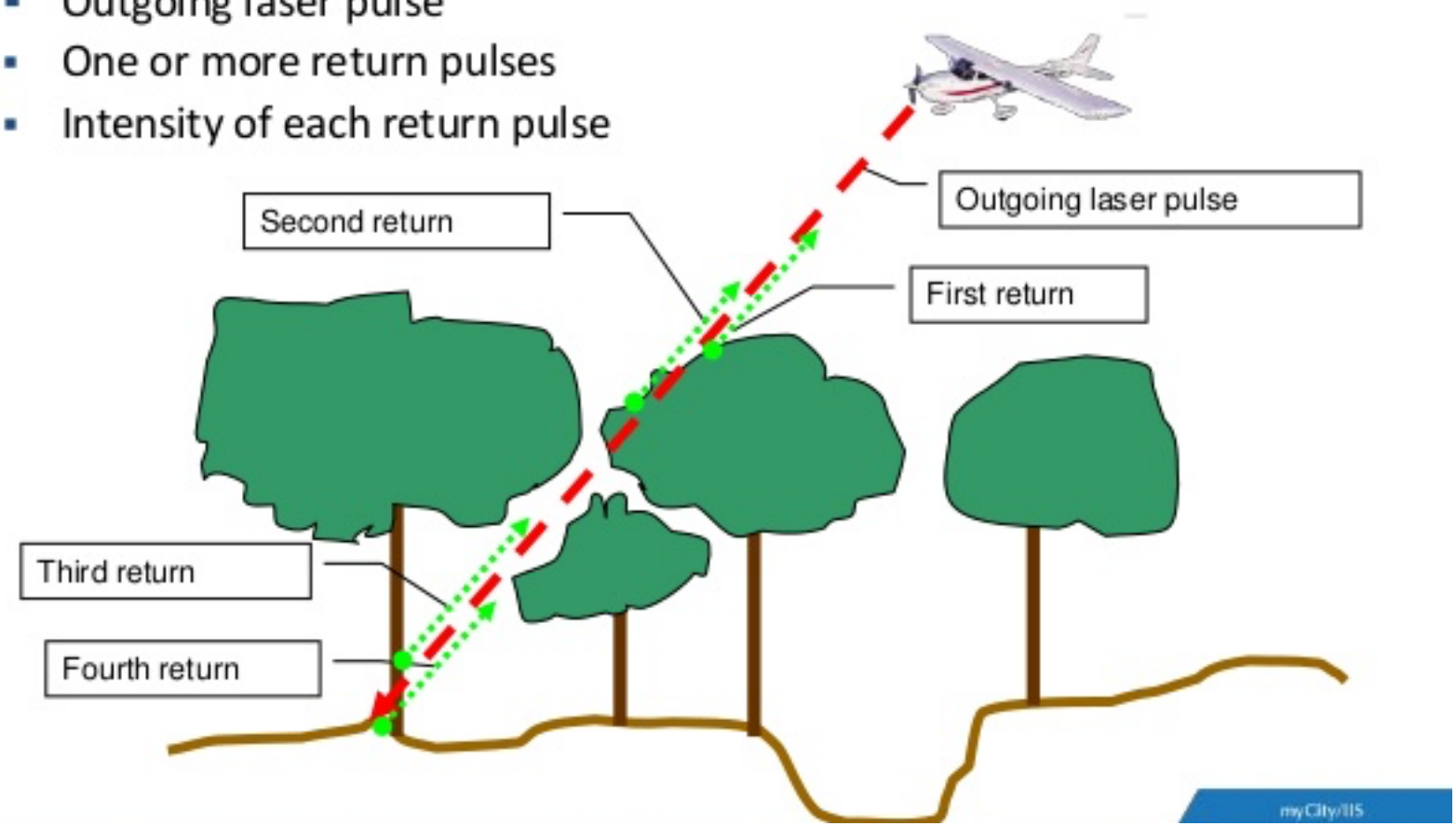


Figures from McMcGaughey
USDA Forest Service--PNW Research Station

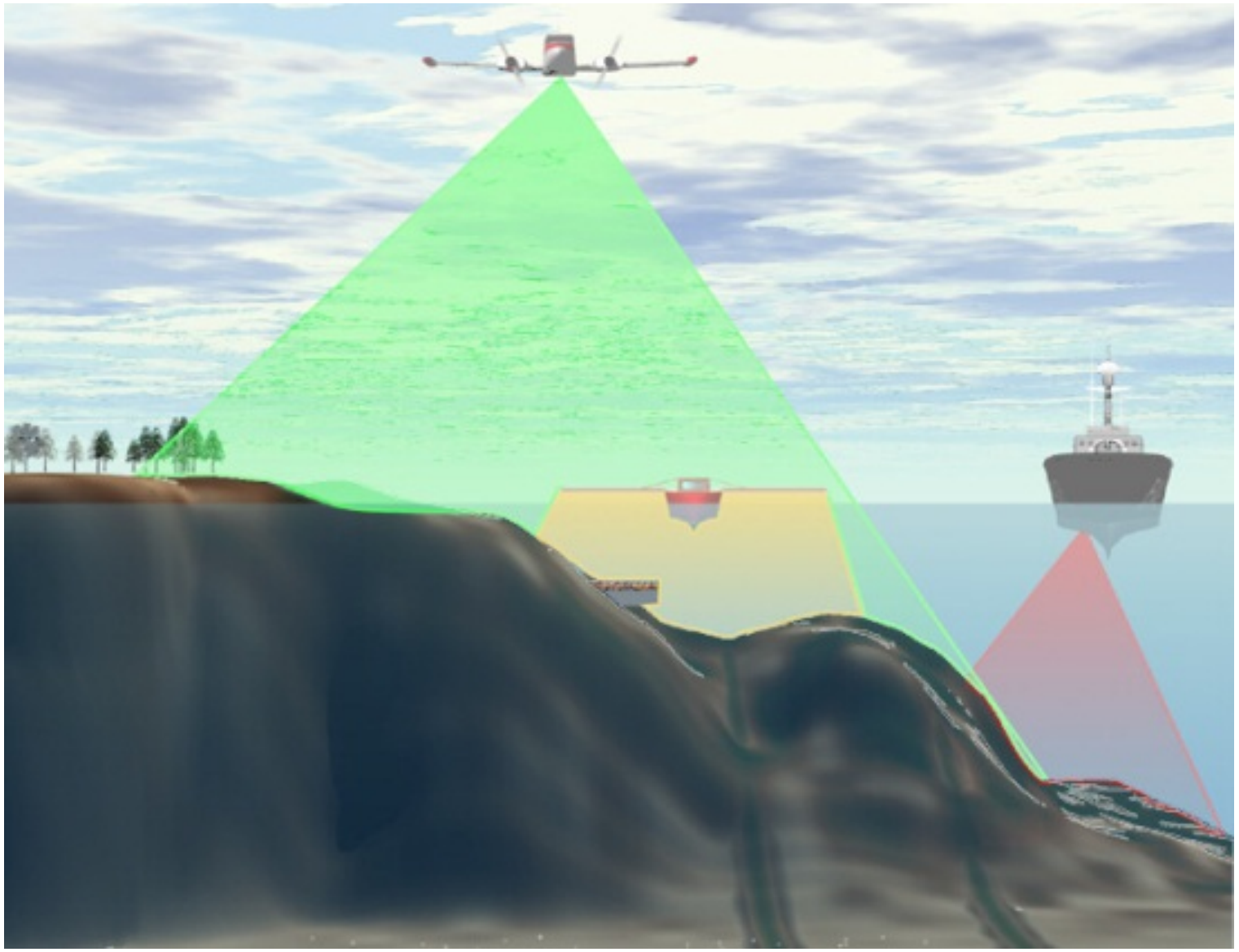
LIght Detection And Ranging

LiDAR Principles

- Outgoing laser pulse
- One or more return pulses
- Intensity of each return pulse



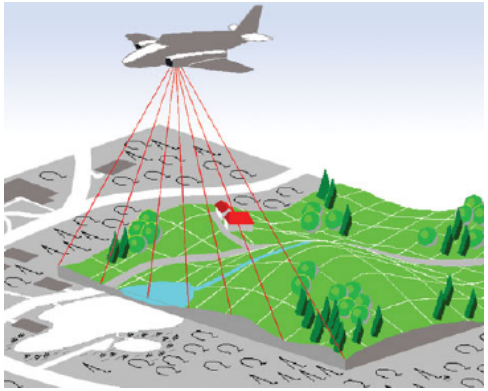
Special Services involving Aerial Survey



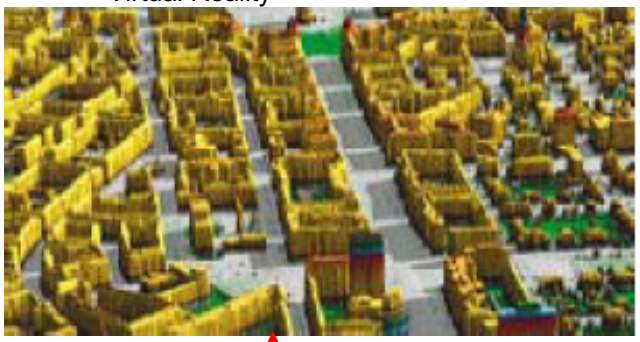
Airborne LIDAR Hydrography (SHOALS)

Special Services (LIDAR Survey)

Multi sensor system operated on-board an airplane or helicopter. Scanning the survey area strip by strip the position and altitude measurements are also recorded.
LIDAR and the Optical Scanner.



Virtual Reality

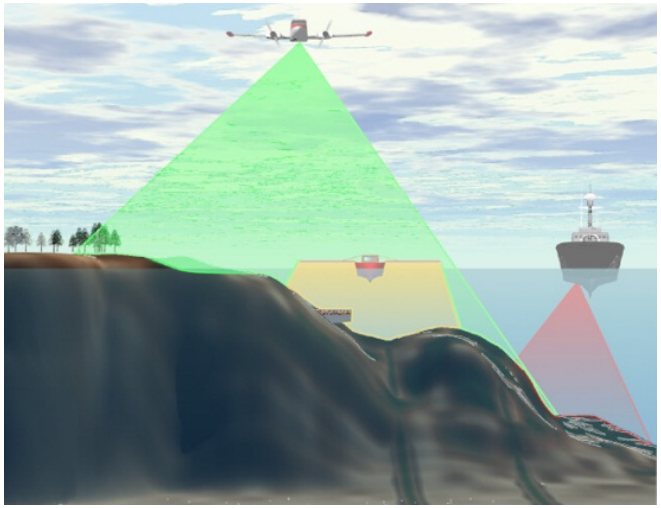


Applications:

- 3D City Models and Urban Planning
- Monitoring and Protection of Coastal Zones
- Corridor Mapping, Pipelines and Transmission Lines
- Forest Inventory and Precision Management
- Surface Mining and Deposits
- Flood Protection and Hydraulic Simulations
- Power lines

Special Services (LIDAR Bathymetry)

Airborne laser bathymeter system can survey over large areas, far exceeding the capabilities and efficiency of traditional survey methods. LIDAR has a unique capability to map shallow waters, shoreline and topography simultaneously, integrating land and water measurements in the same data set. This technology not only speed up the total survey mission and project turn around time, but also allow surveys over sensitive environmental coastal zones or inland water ways.



The products may include:

- Digital Terrain Models (DTM)
- Digital Surface Model (DSM)
- Ortho-photos and mosaics
- Topographic maps
- Other LIDAR data