Damietta University
Faculty of Science
Geology Department

Magnetic Exploration Course

For

First Year Geophysics Program

Code: 102 Geoph

Lecture 6: Data Aqustion Part 1

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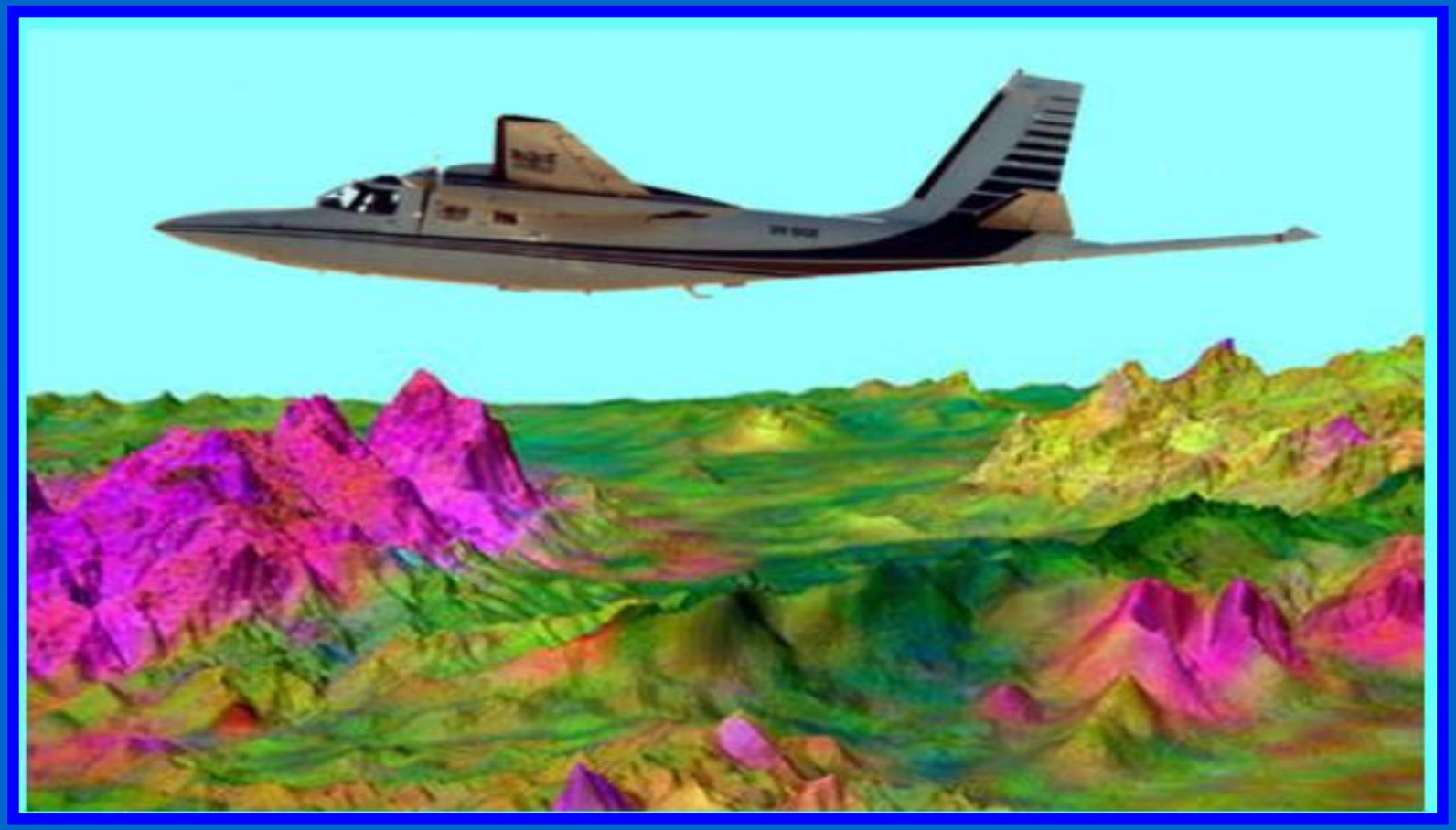
Acquiring magnetic observations

Magnetic observations collected using any one of three different field methods.

- Airborne
- Shipborne
- Ground

Airborne Survey



Advantages of airborne surveys

- It provide cost effective

  acquiring 1 km of data from an aeromagnetic survey is about 40% less than the cost of acquiring the same data on the ground.

- Rapid

  Cover very wide areas in a short time and data can be obtained from areas that are inaccessible.

- Combined with other methods

  (e.g. Radiometric and electromagnetic sensor).

Airborne magnetic survey

Magnetometers can be mounted within or towed behind aircraft, including helicopters.

Measurements times

Measurements are made at least once every second, and the system live time is automatically logged and output with the data stream.

Additional Equipments

Additional equipment usually includes:

- GPS navigation (real-time differential),
- radar altimeter,
- Barometer and Thermometer.
- Video camera.

Radar altimeter

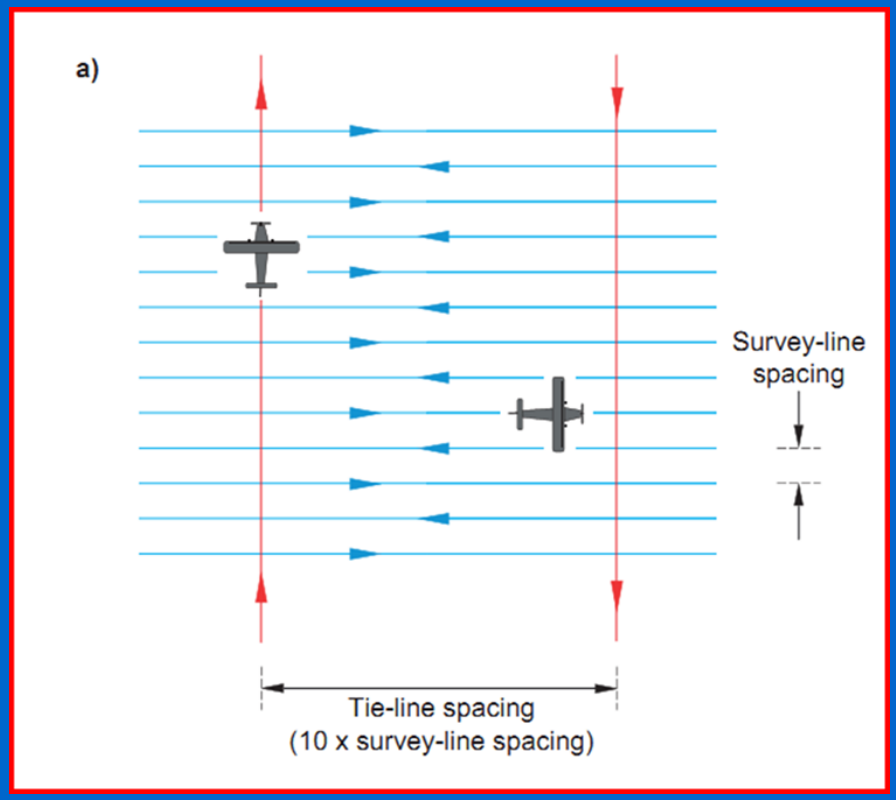
The GPS navigation equipment and radar altimeter record the instantaneous position and height of the aircraft every second.

GPS Navigation

Real-time differential GPS navigation is accurate to within about 5 m.

Survey methodology

Airborne geophysical surveys are normally flown on a regular grid along parallel lines ("flight lines").



Flight line spacing

The flight line spacing depend on:

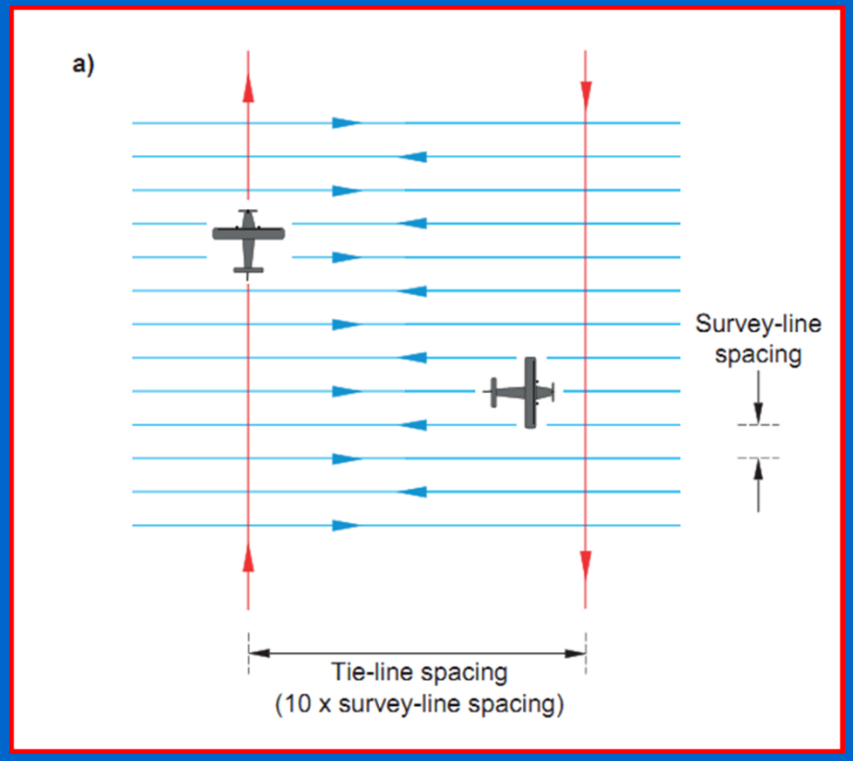
Object of survey.

Resolution of the data.

The cost of the survey.

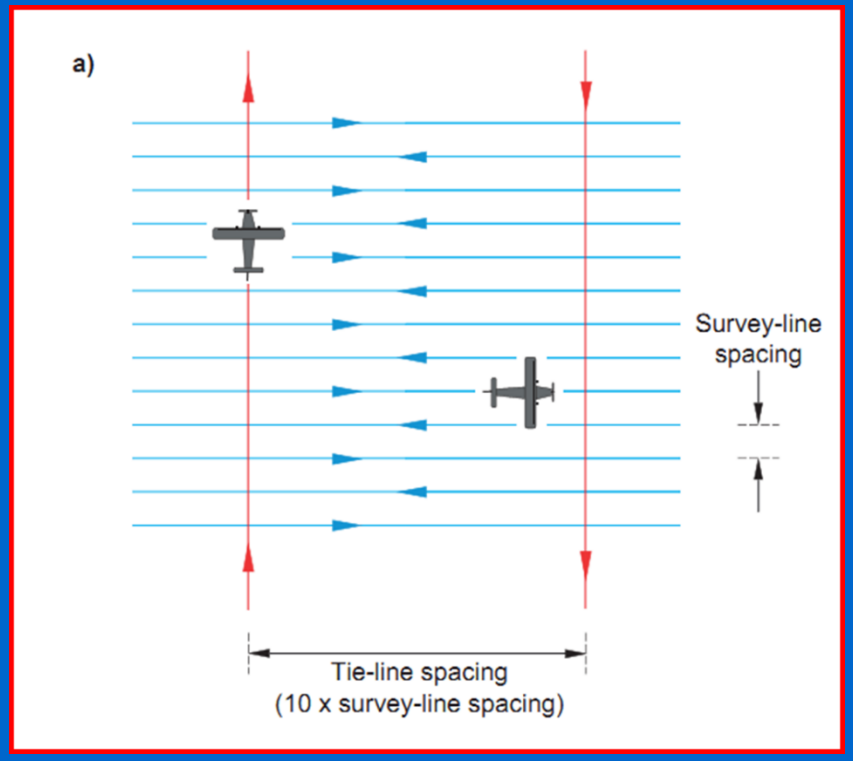
Flight line spacing

The flight line spacing depends on the object of survey.



Flight line spacing

The objectives can be defined as reconnaissance, regional, or detailed



Flight line spacing

- Reconnaissance surveys are those with widely spaced flight paths that are conducted to obtain broad tectonic and geologic characteristics of an extensive region at a minimum of cost.
- For example, faulted regions, areas of deep basement, or volcanic terranes may be identified.
- Flight line spacings typically are a kilometer or more and the altitude of the surveys less than the flight line spacing. Many nationwide surveys belong to this category.

Flight line spacing

- Regional surveys provide a more comprehensive and detail view of the geology and tectonics of a region than reconnaissance surveys.
- Often they are used in geological mapping at scales of the order of 1:100,000 based on measurements at altitudes of a few to several hundred meters and line spacing/flight altitude ratios of 1.5 to 5.0.

Flight line spacing

- High-resolution study based on attributes of special interest such as intrusive contacts, alteration zones, and basin structures.
- These detailed surveys are flown as close to the source of anomalies as possible.
- Safety concerns for surveys where the sources are close to the surface generally limit the flight altitudes to several tens of meters and use flight altitude/line spacing ratios of 2 to 1.

Flying height

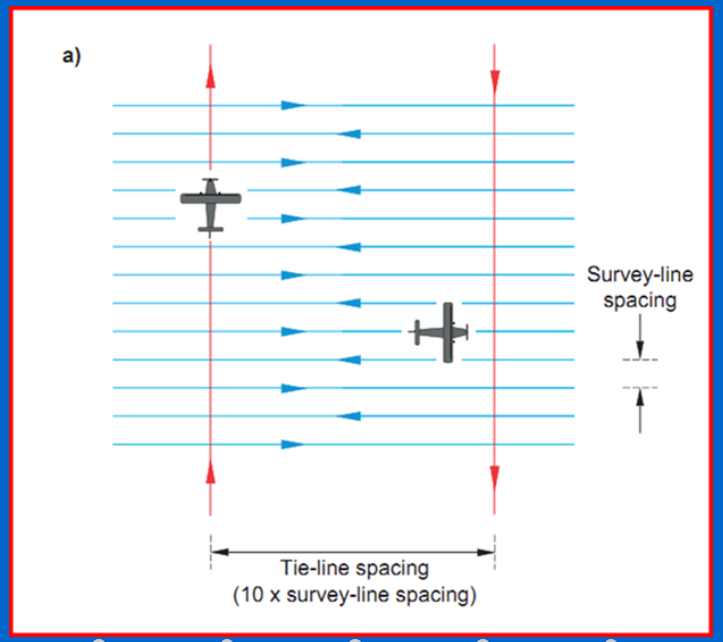
The flying height is usually related to the line spacing, but is limited by safety considerations.

Aircraft height

Surveys are typically flown at a constant height above the ground of between 40 m and 100 m, with helicopters able to fly considerably lower than most fixed-wing aircraft.

Tie lines

A complementary set of lines (“tie lines”) are often flown perpendicular to the flight lines, and with a line spacing about 5-10 times that of the flight line spacing.



The speed of the aircraft

The speed of the aircraft is about 50-60 m/s for fixed-wing surveys, but can be appreciably slower for helicopter surveys (25-30 m/s).

Other remotely sensed data

Airborne magnetic data are almost always collected along with other remotely sensed data - such as measurements of concentration of radioelements.

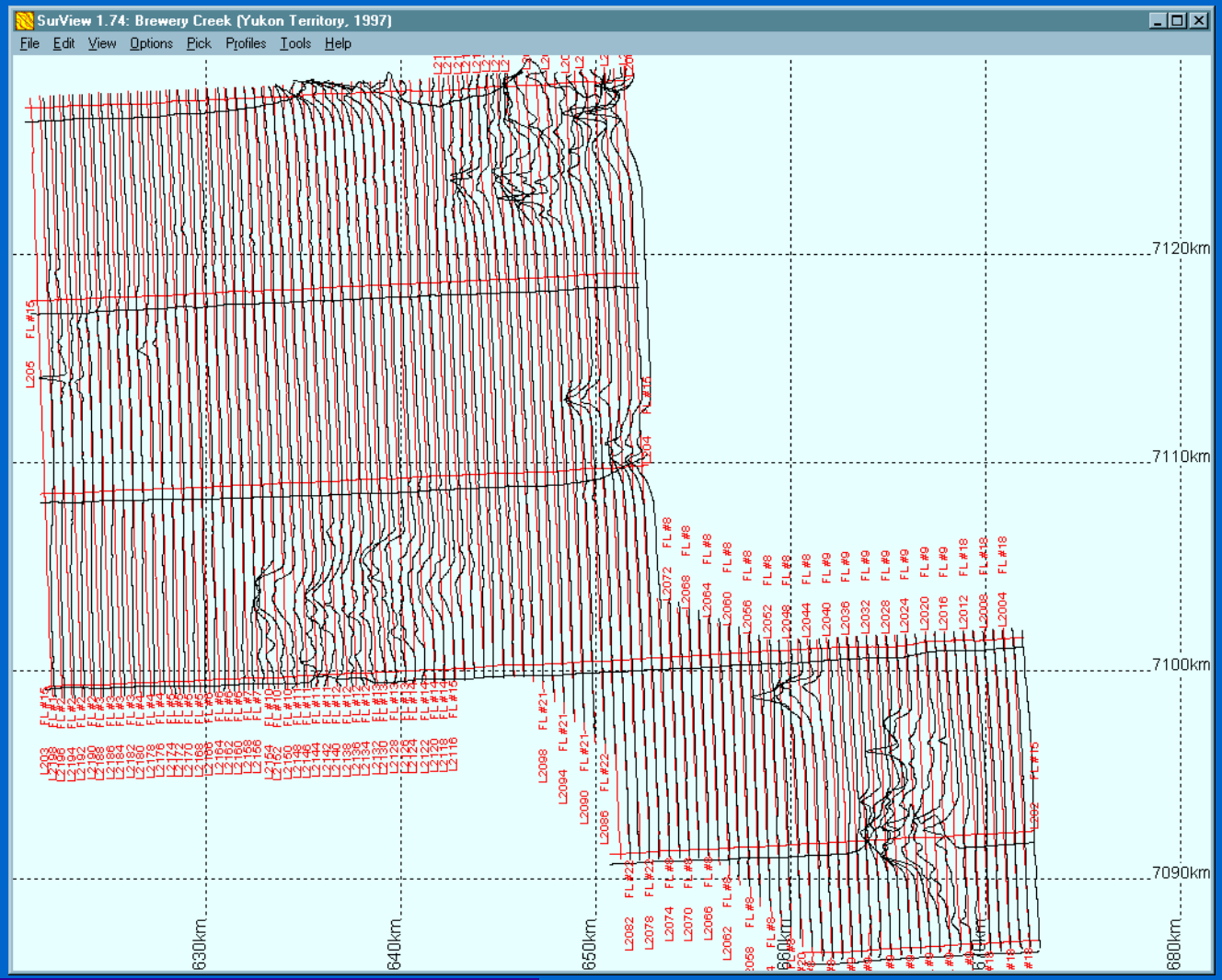
The survey design therefore is usually never optimized for a particular geophysical method, but is a compromise between the methods being used.

Sample interval

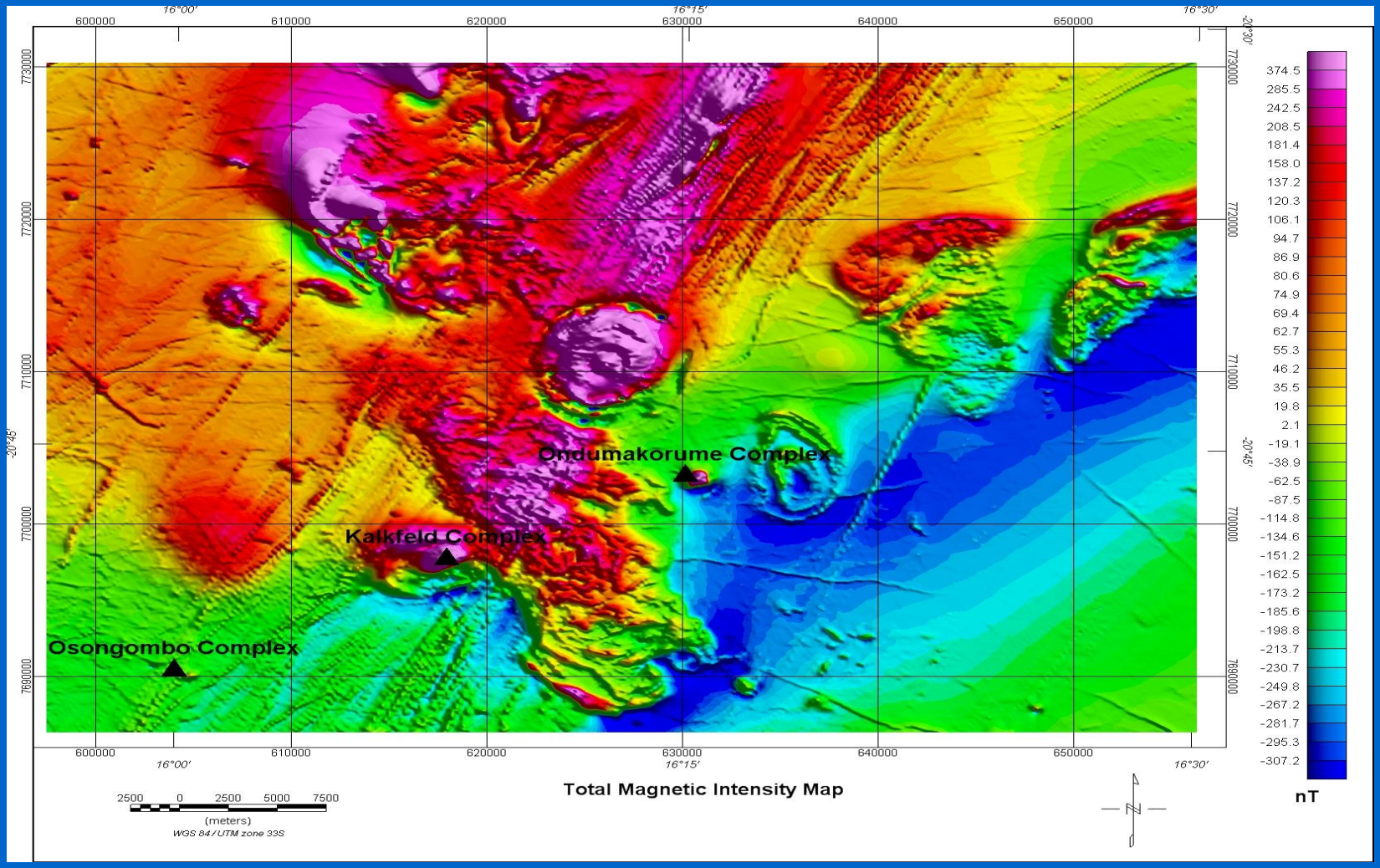
Magnetic data are usually acquired over a sample interval of 1 s.

During this interval a fixed-wing aircraft traverses about 55 m along the line.

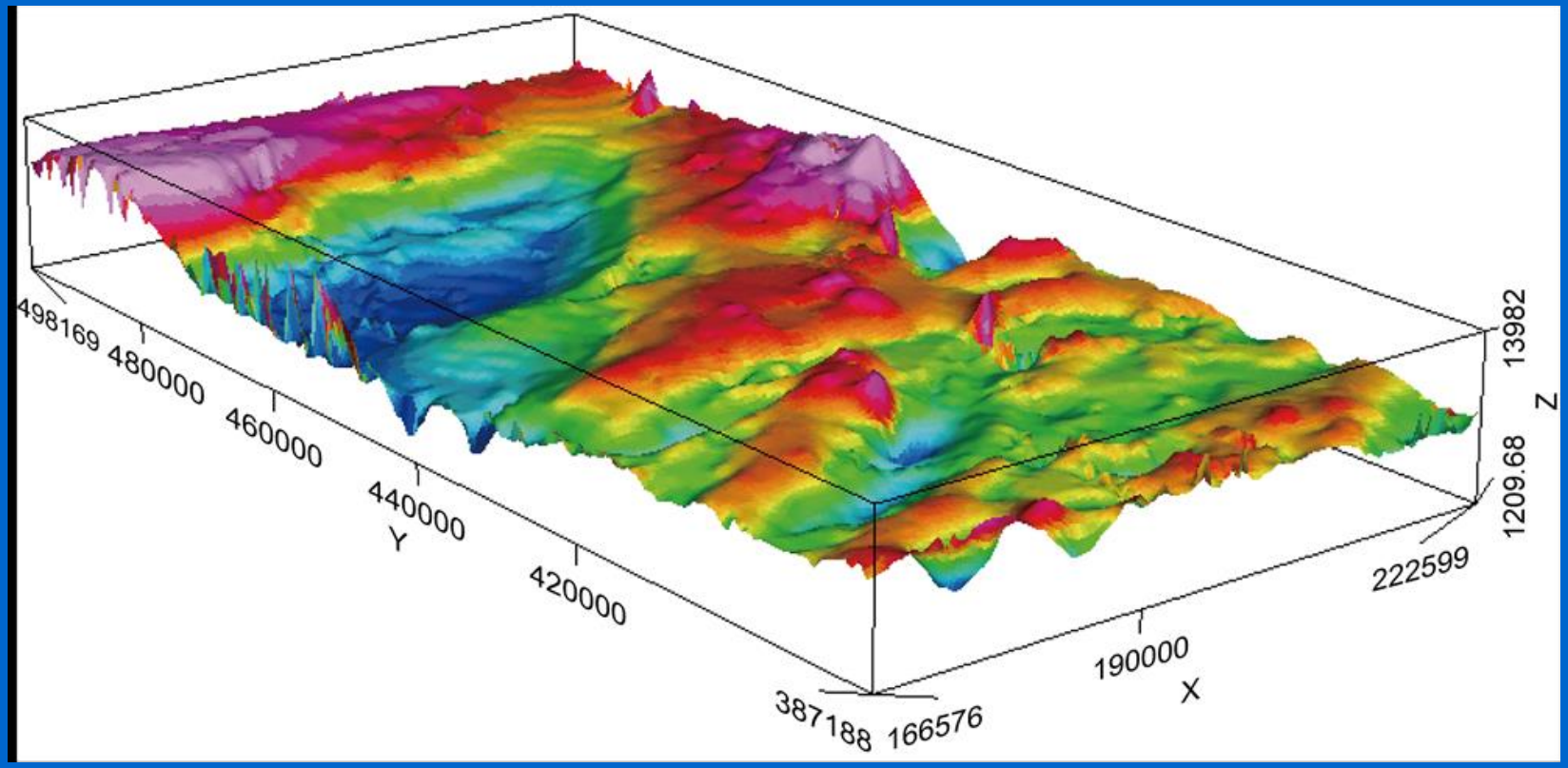
Stacked Profiles



Example of TMI map



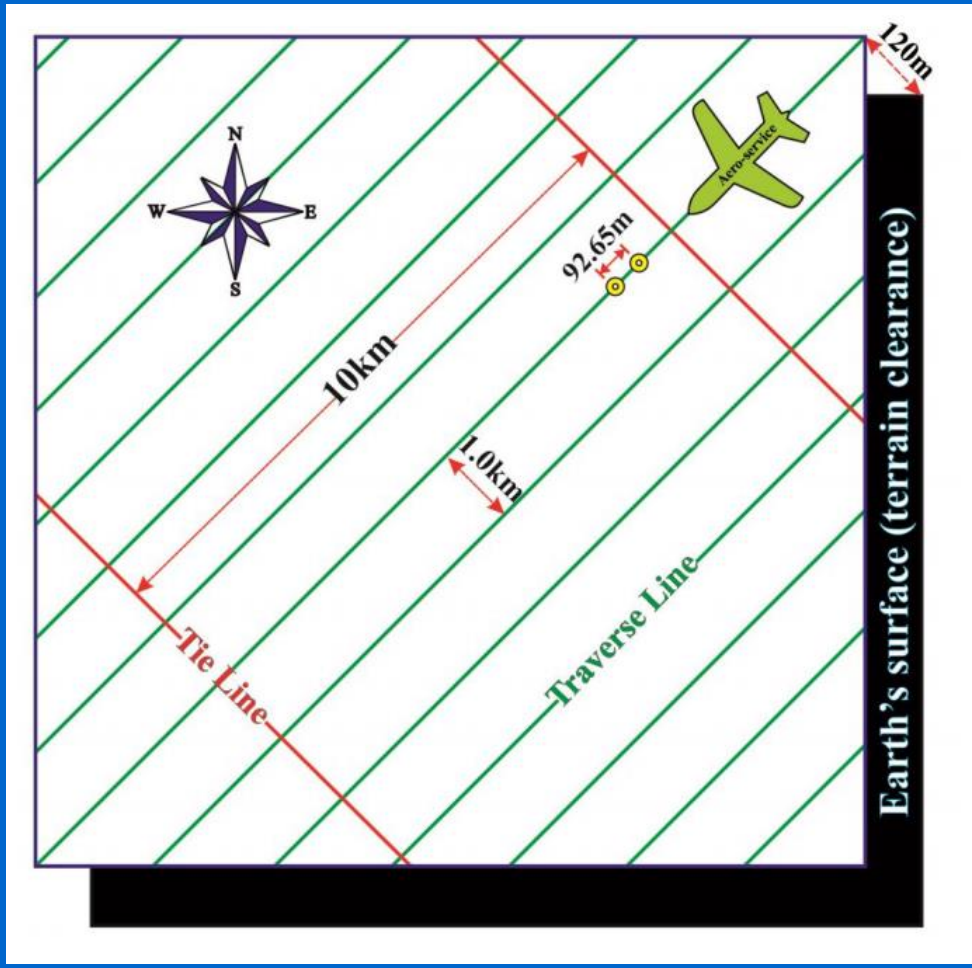
Example of 3D TMI map



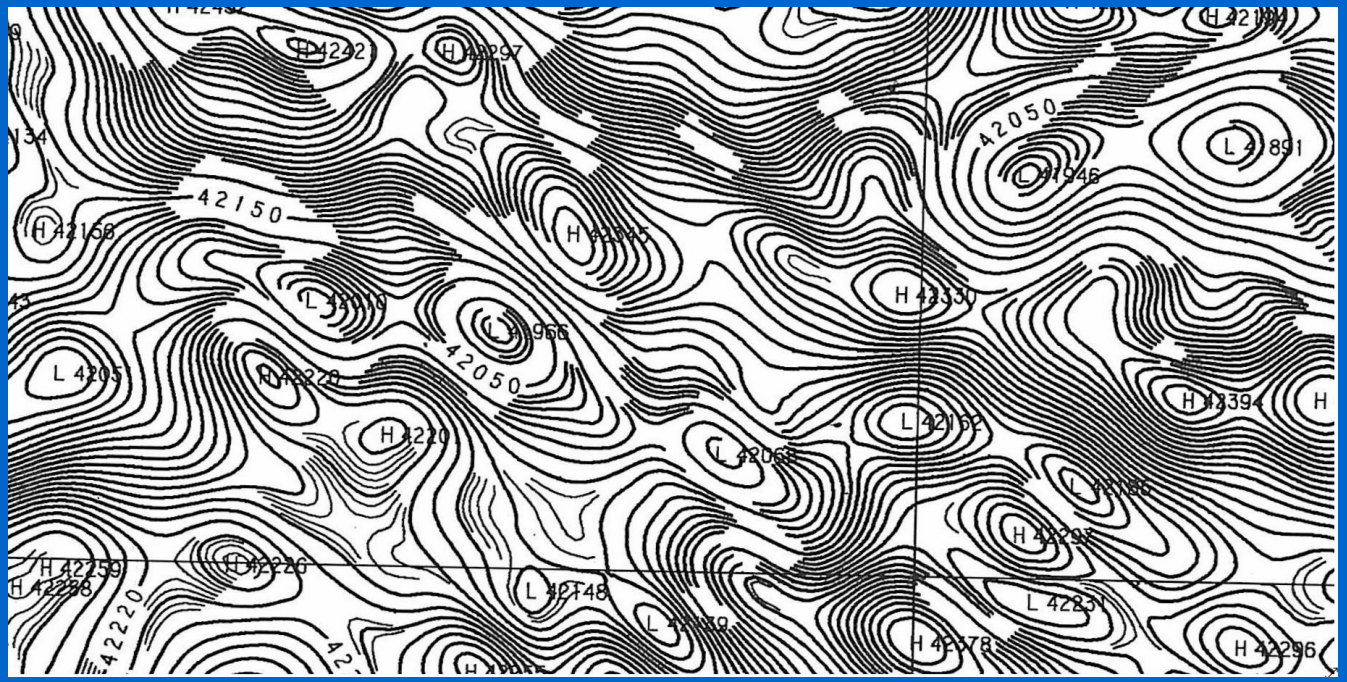
Example of Airborne magnetic survey

The traverse lines took N45^{o}E direction with spacing of 1.5 km approximately.

The tie lines were perpendicular to the traverse lines (took N35^{o}W direction) and spaced with about 10 km.



Contour Maps



CONTOUR MAP NUMBER 81

FLIGHT DIRECTION.....TRAVERSE 45/225 & TIE 135/315 DEGREES
FLIGHT ALTITUDE.....120 METERS TERRAIN CLEARANCE
FLIGHT INTERVAL.....TRAVERSE 1.0 KM. & TIE 10 KM.
MAGNETIC FIELD.....INCL 32.8 NORTH DECL 1.9 EAST
I.G.R.F. 1980 UPDATED TO 1983.98 .....INTENSITY 42425 GAMMA
CONTOUR INTERVAL.....2, 10 & 50 GAMMA
SURVEYED & COMPILED.....1983 & 1984
AERO SERVICE JOB NUMBER.....3609