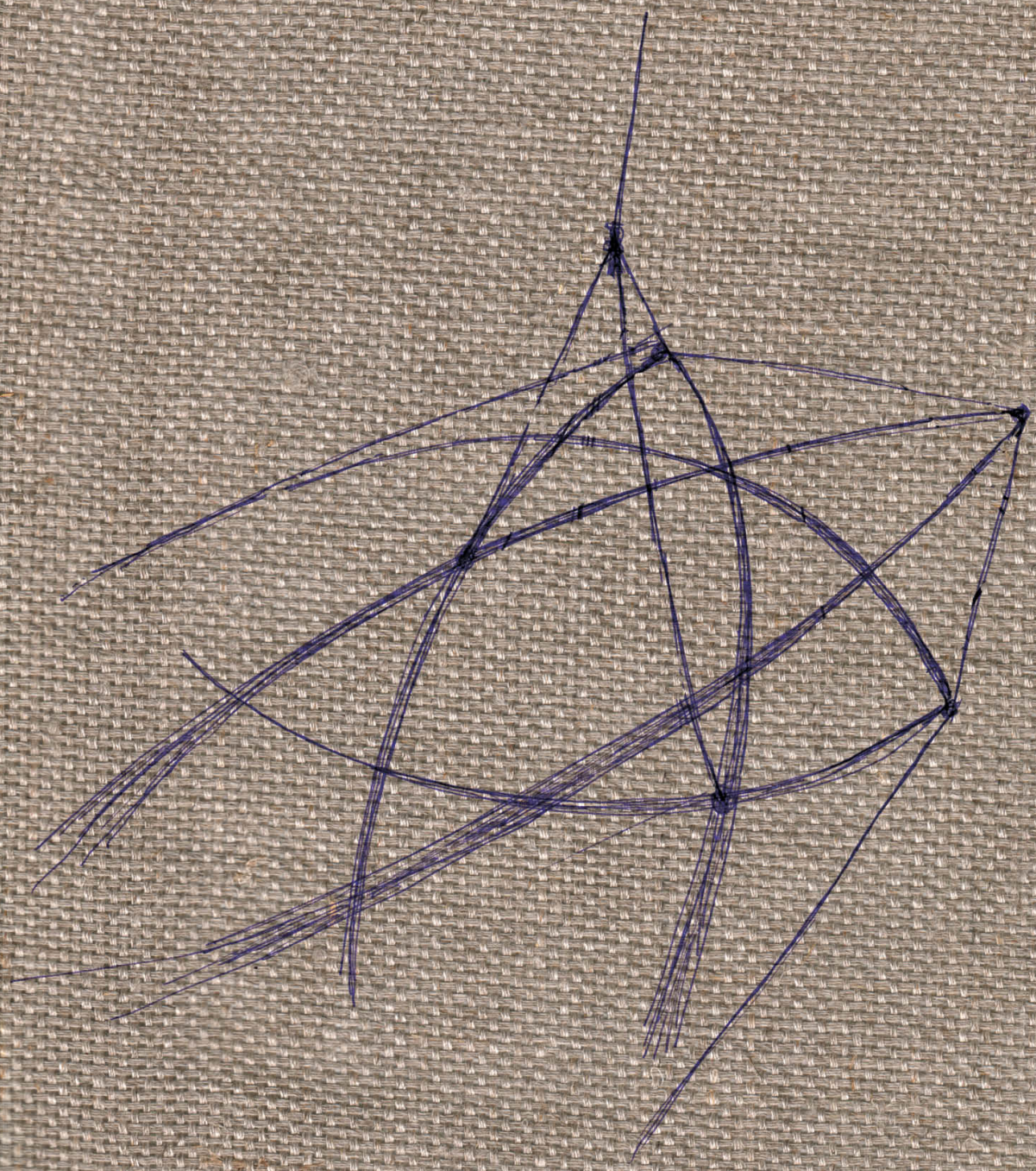
GEOTECHNOLOGIES 2011



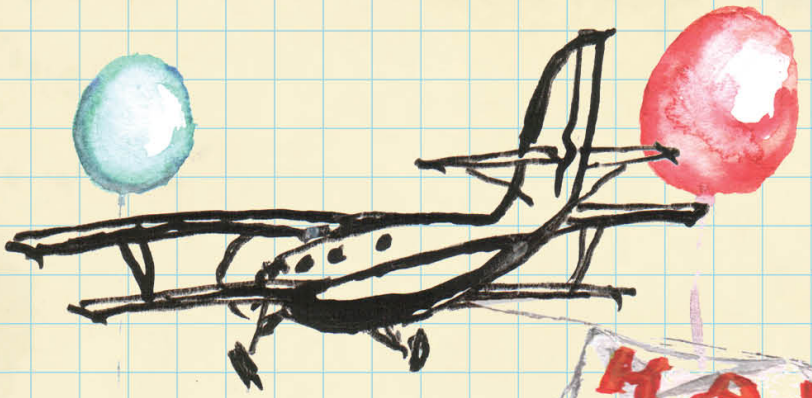
DEAR FRIEND!

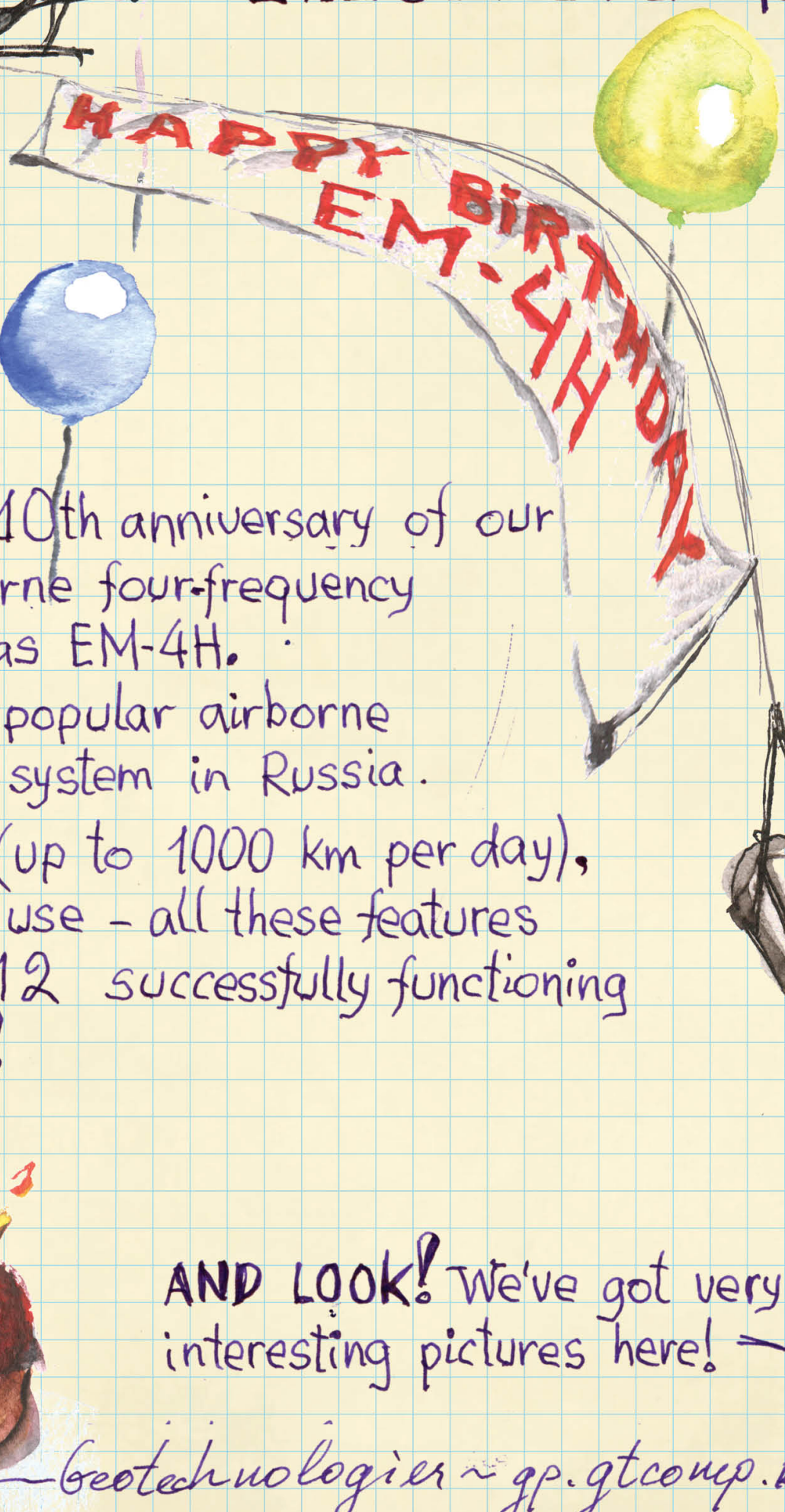
This notebook will tell you about our Russian company **GEOTECHNOLOGIES.** We work a lot and we take a great interest in what we do. Our company is well known in Russia. We have a lot of friends and partners there. Think you'll find something interesting in these pages and want to know more. And we'll be happy to share.

It is easy to find us:
PDAC Trade Show, booth #444
or

1, Derbenevskaya str.
Moscow, Russia 113114
tel: +7 (495) 7722-946
e-mail: gp@gtcomp.ru
web-site: gp.gtcomp.ru

AIRBORNE ELECTROMAGNETICS





Wow!

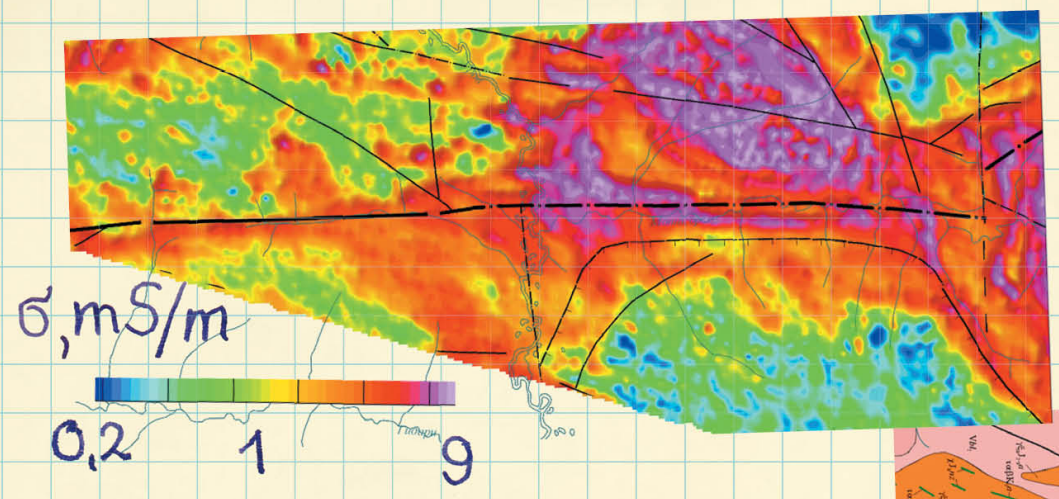
We celebrated 10th anniversary of our creation - airborne four-frequency system known as EM-4H.
It is the most popular airborne electromagnetic system in Russia.
High efficiency (up to 1000 km per day), reliable, easy to use - all these features are proved by 12 successfully functioning systems! Cheers!

AND LOOK! We've got very interesting pictures here!

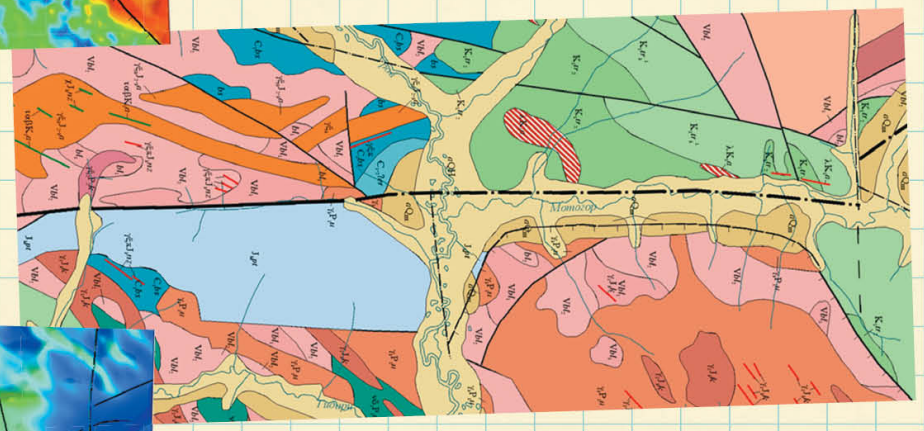
—Geotechnologiez ~ gp.gtcomp.ru—

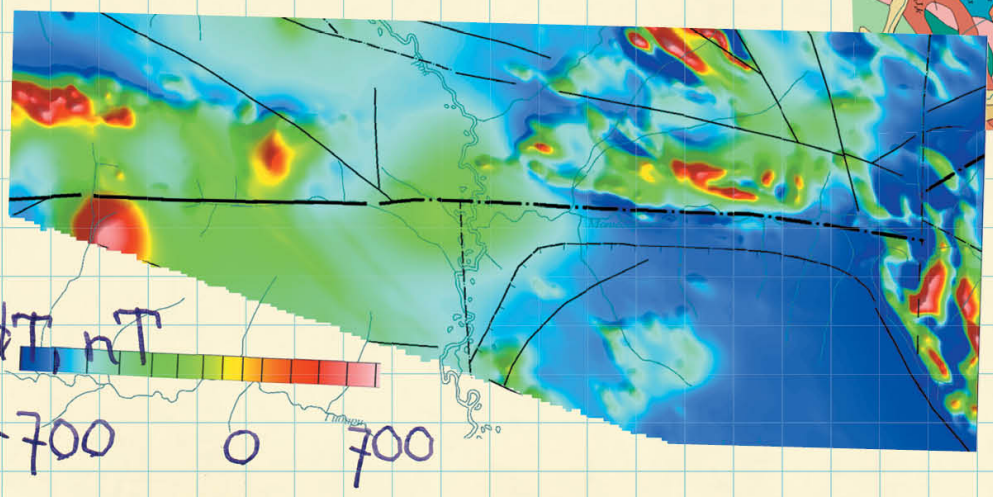
Airborne Electromagnetics

EM·4H measures full response vector as precise as 1%
and here are some results (courtesy of NF VSEGEI,
www.nfvsegei.com)



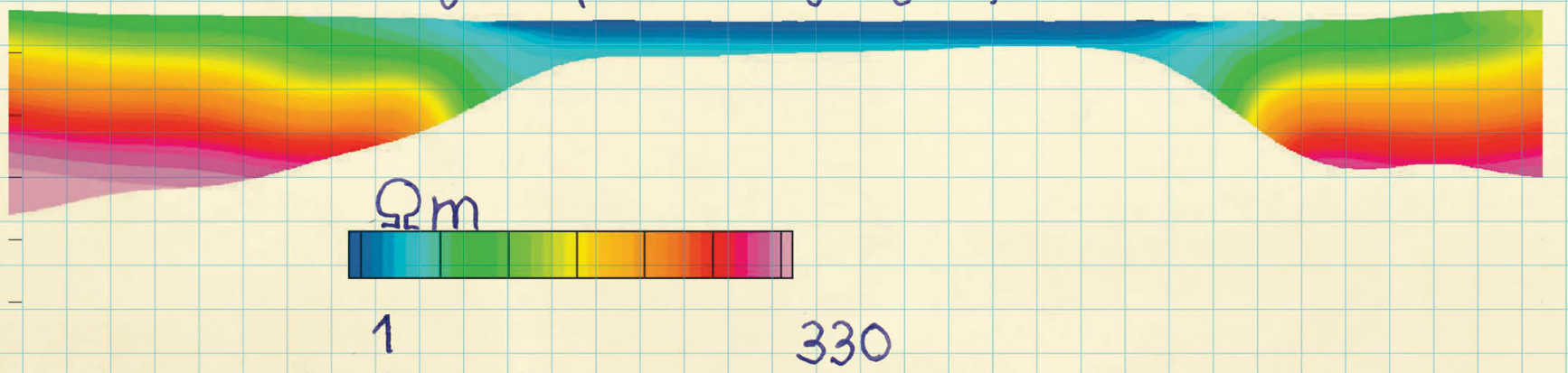
8 kHz conductivity map





Magnetic anomaly map

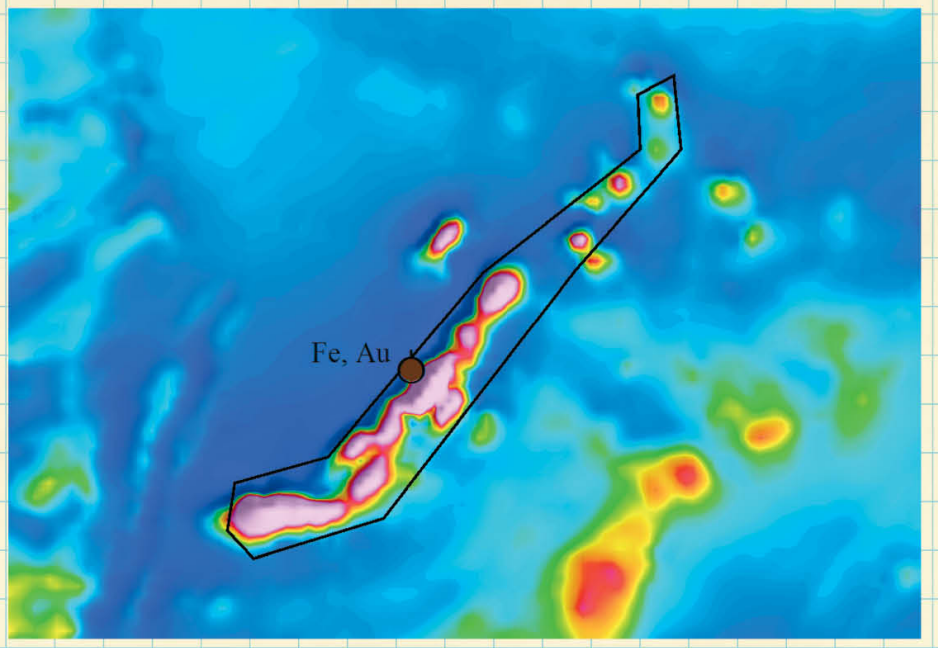
Resistivity depth imaging of salt lake Tus



Geotechnologies — gp.gtcomp.ru

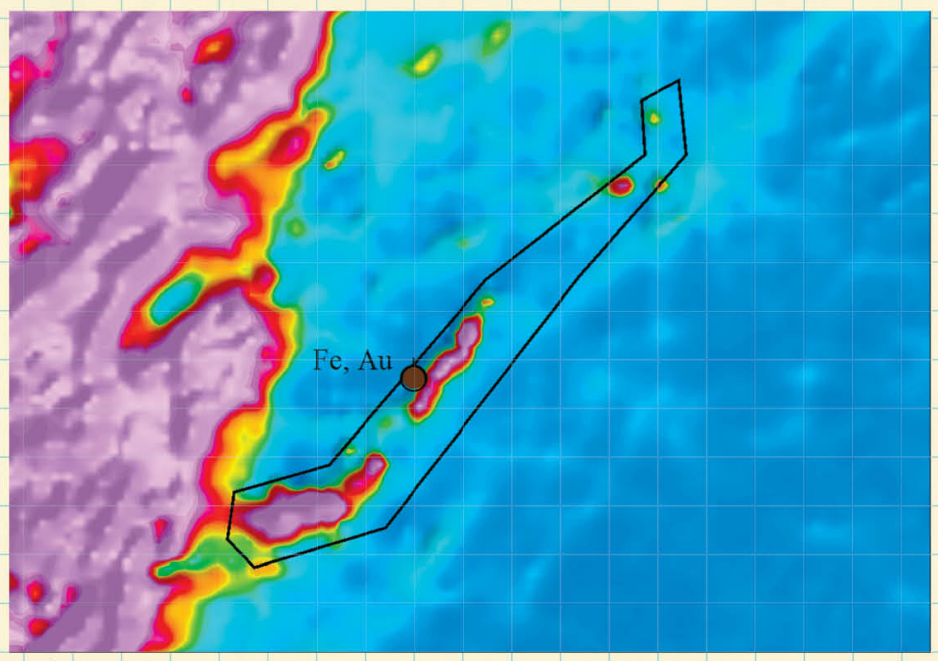
AIRBORNE ELECTROMAGNETICS

Magnetic anomaly map



dT, nT -2000 500 1000 15000

2080 Hz conductivity map



σ, S/m 0,0001 0,0012 0,1

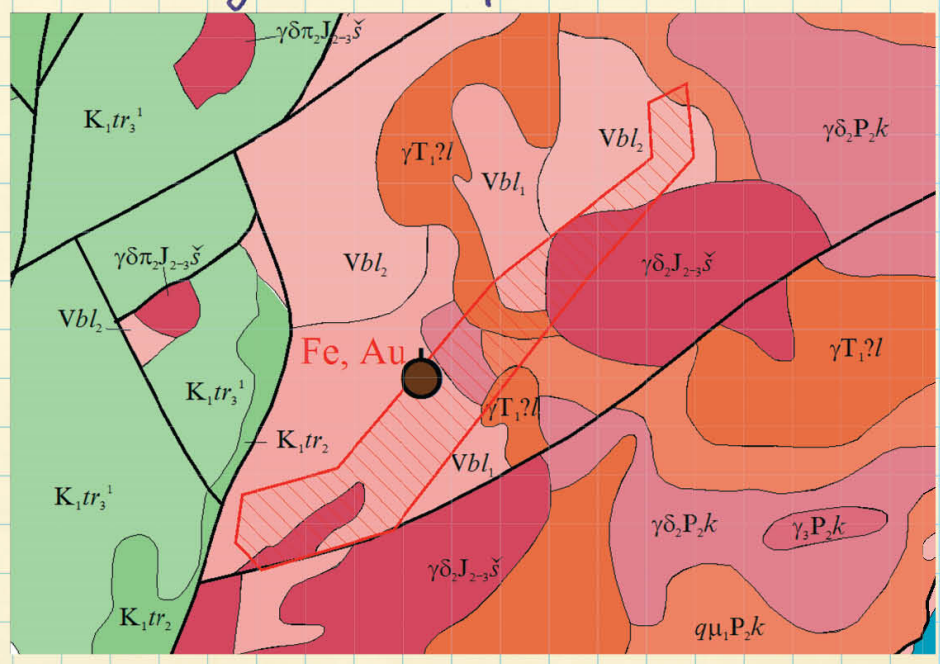
2,5 0 2,5 km

Boron-iron-ore deposit Zheleznii ridge is a contact metasomatic type of the deposit. It includes discontinuous magnetite ore bodies in sedimentary-metamorphic isolator layer along its' contact with granitoids.

86 ore bodies were located on deposit area. Their thickness variates from 5 to 50 m. The mixture of massive and impregnation ores mainly consists of ludwigite-magnetite and pyrrhotite-magnetite. Also there are gold-sulphide and pyrrhotite ores. Total iron in ores (tenor) is 53.3%. Total B2O3 in ludwigite-magnetite ores is up to 4.61%. Total sulfur variates from 3-7 to 20%. Single gold-ore bodies were picked out with total gold from 1-3 to 12.7 gram per ton.

Highly gold linear residual soil up to 10-15 m depth was picked out in mineralized zones. Its average concentrate of gold is 37.2 gram per ton.

Geological map



Thanks to NF VSEGEI www.nfvsegei.com

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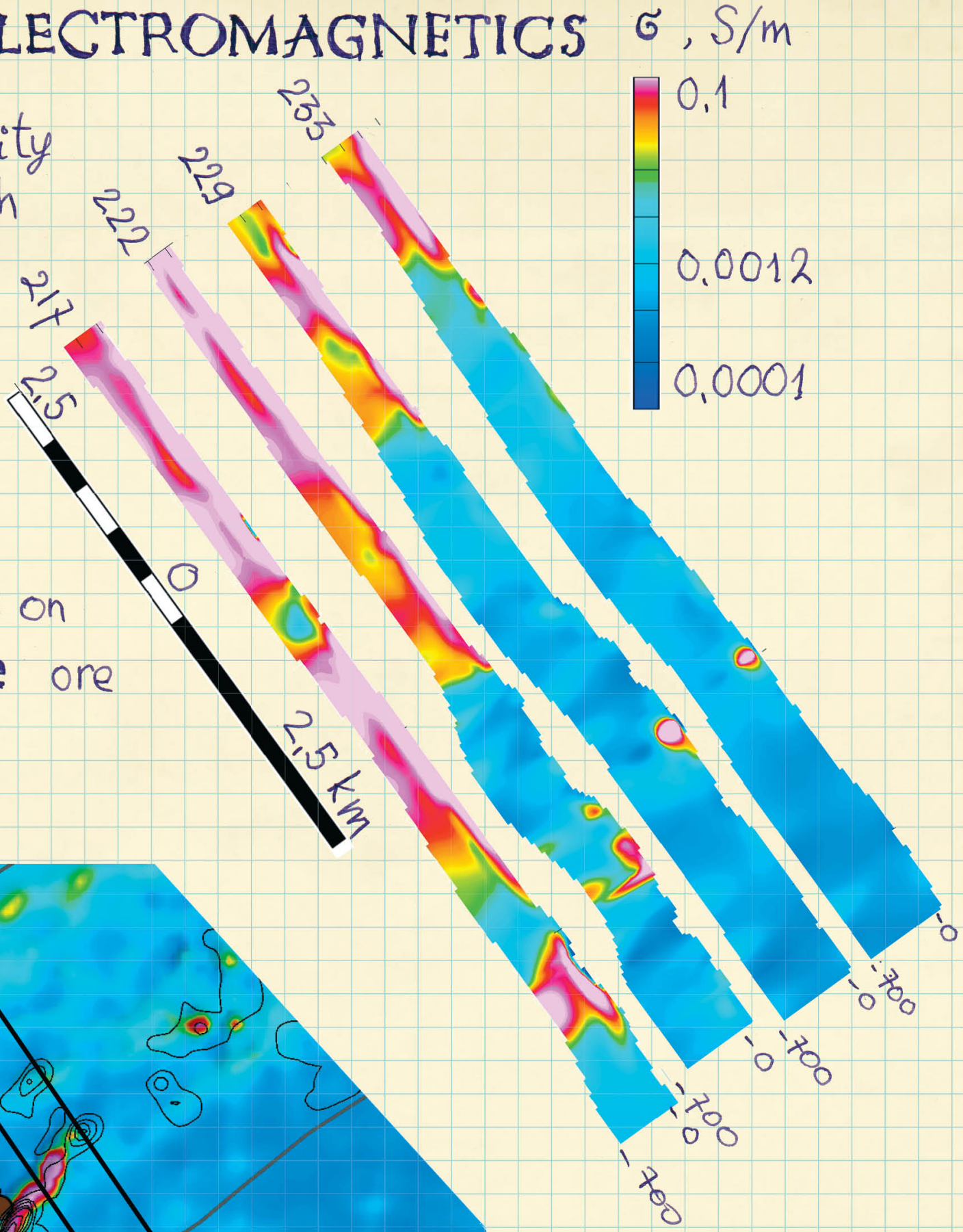
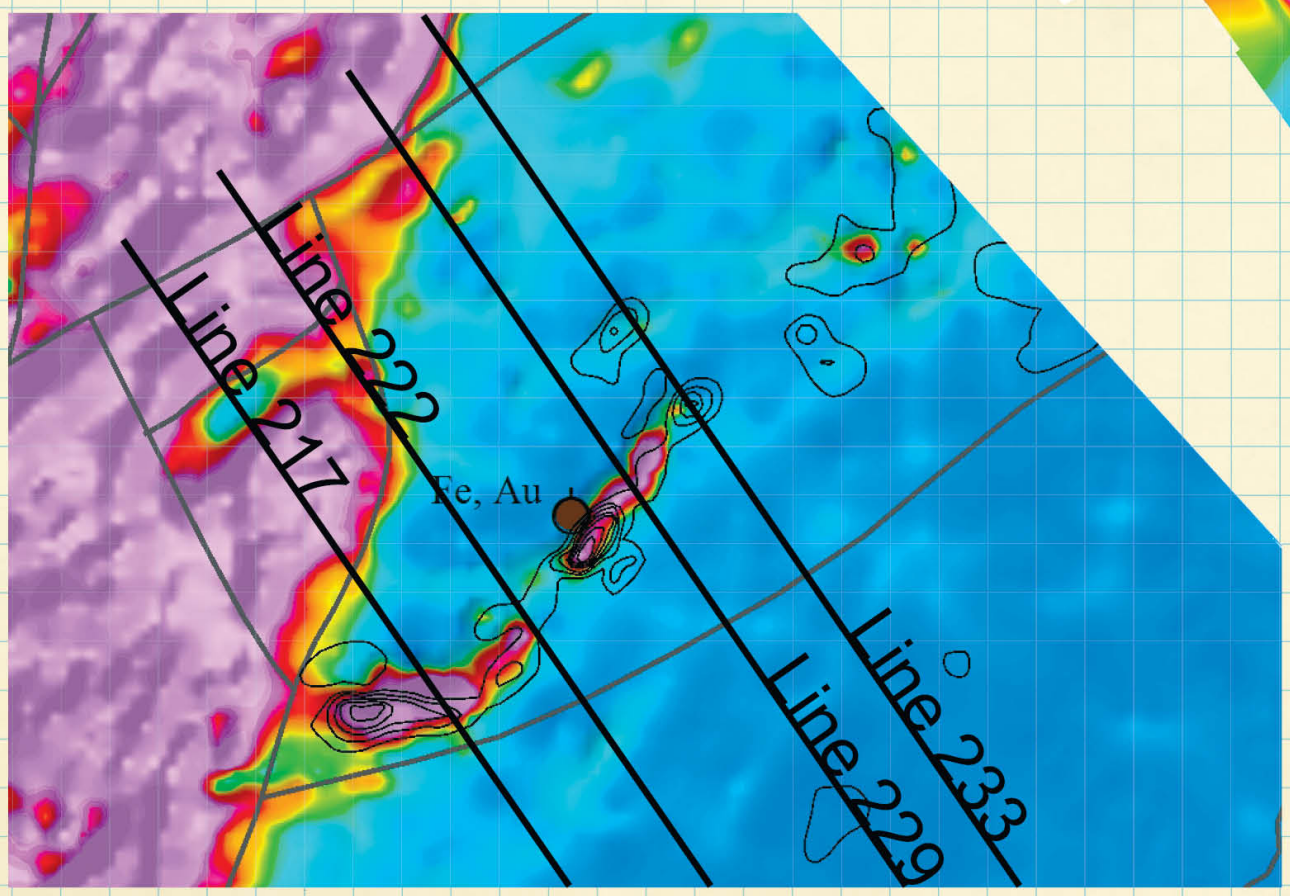
AIRBORNE ELECTROMAGNETICS

Apparent conductivity map combined with anomaly magnetic field,

outlines of main tectonic structures

and pseudosections on **Zheleznii ridge** ore deposit





Thanks to
NF VSEGEI
www.nfvsegei.com

AIRBORNE ELECTROMAGNETICS

EQUATOR

The technology of Time-domain EM and high precision magnetic survey

The system is compact but powerful and its performance is extremely high

To be exact:

Statistics of one survey
2 000 line kilometers
Scale 1:5000
for 7 days including installation
average productivity 600 km/day
average speed on a route 140 km/hr

AIRBORNE ELECTROMAGNETICS

EQUATOR Surveys

October 2010
2000 line kilometers

September 2010
1500 line kilometers

July 2010
1200 line kilometers

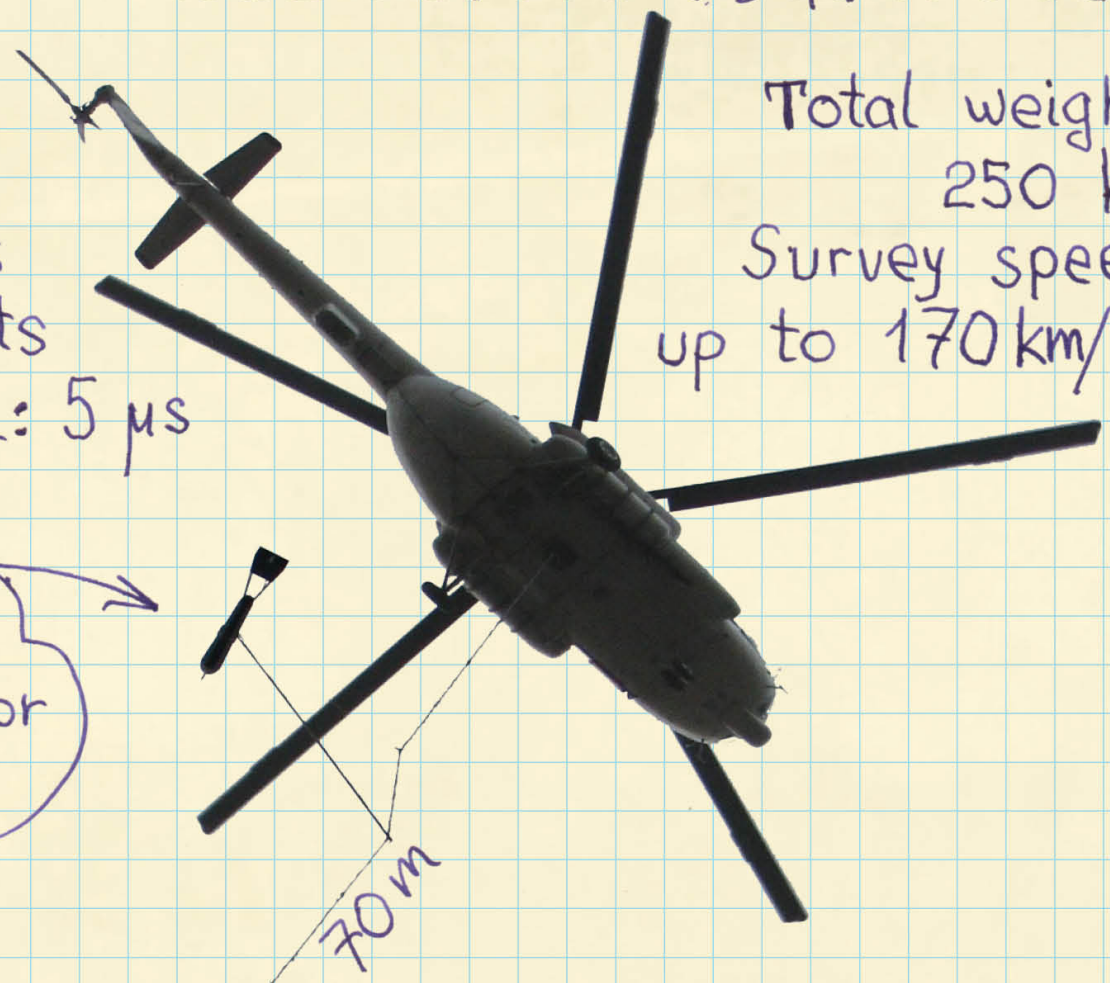
AIRBORNE ELECTROMAGNETICS

EQUATOR

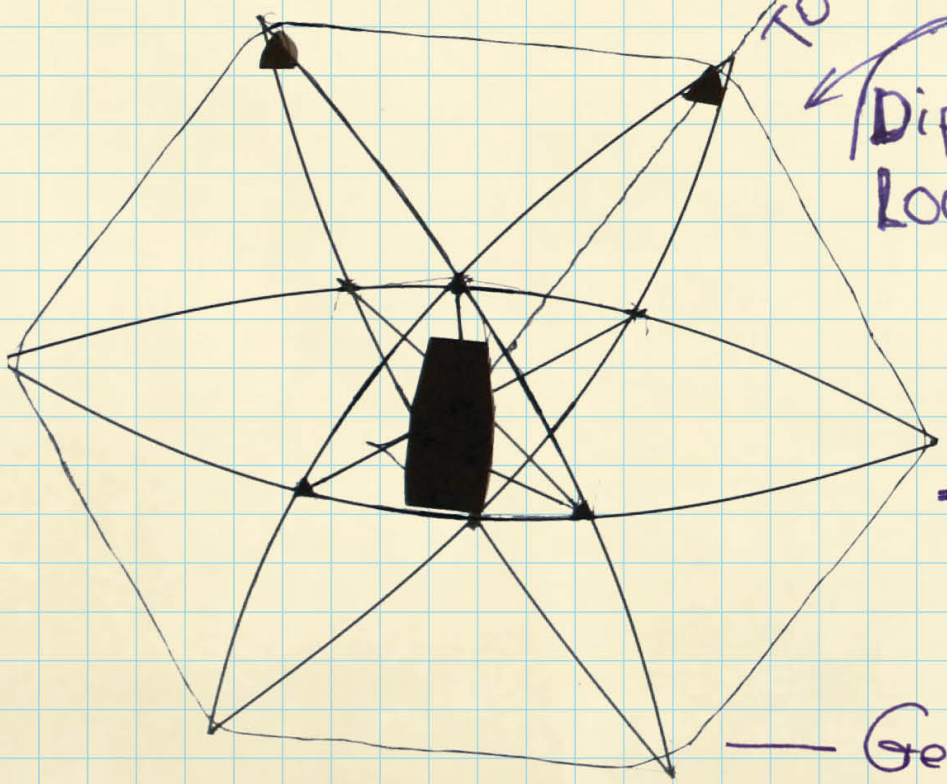
Technical Details

Base frequency 77Hz
Full-time measurements
First off-time channel: 5 μs

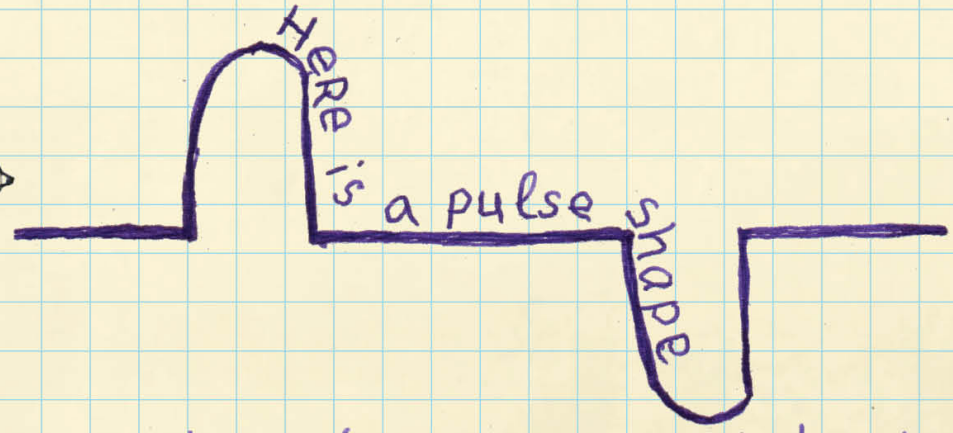
Total weight
250 kg
Survey speed
up to 170 km/hr



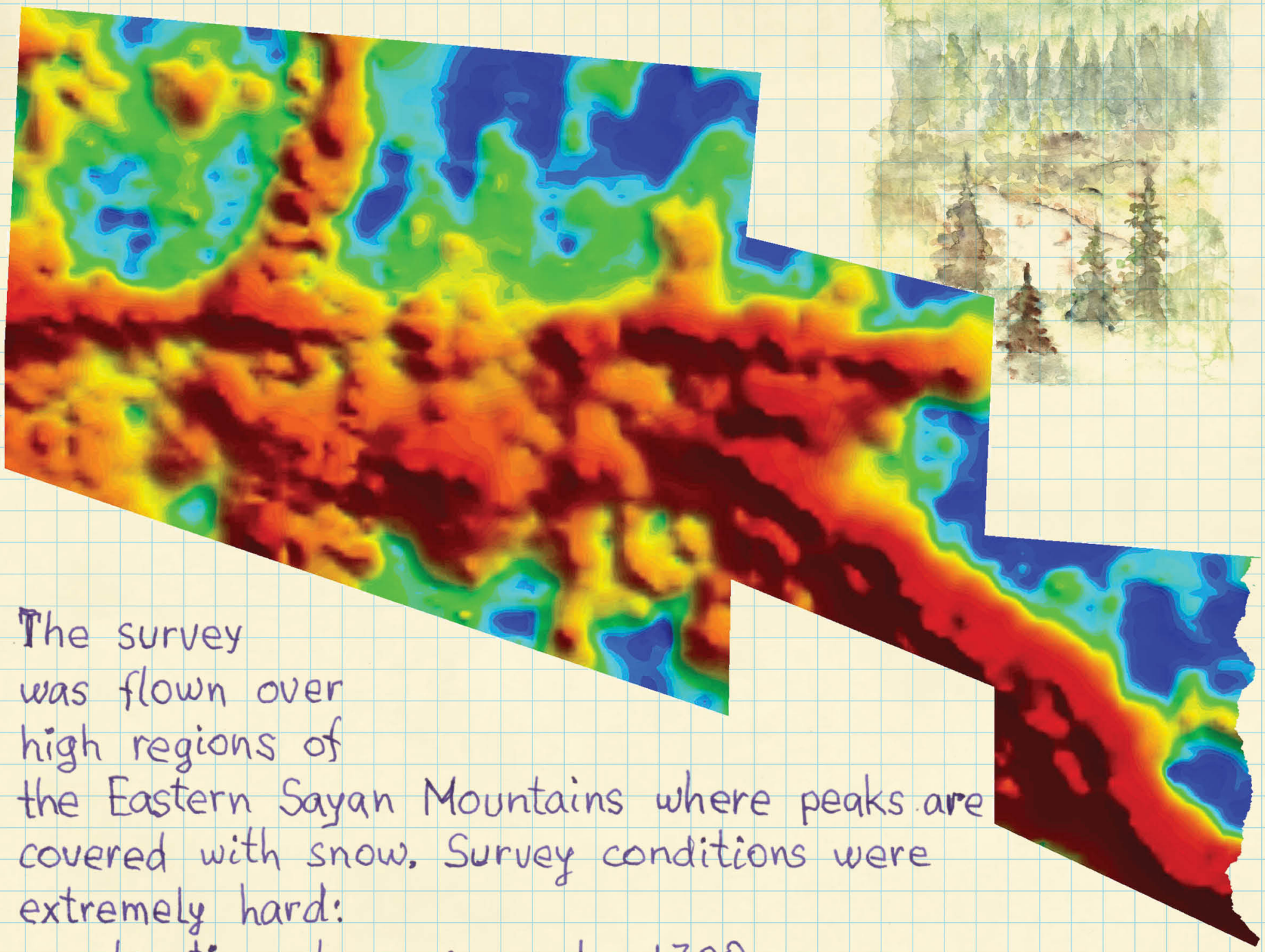
Towed Bird
- Magnetic sensor
- EM receiver
- GPS receiver

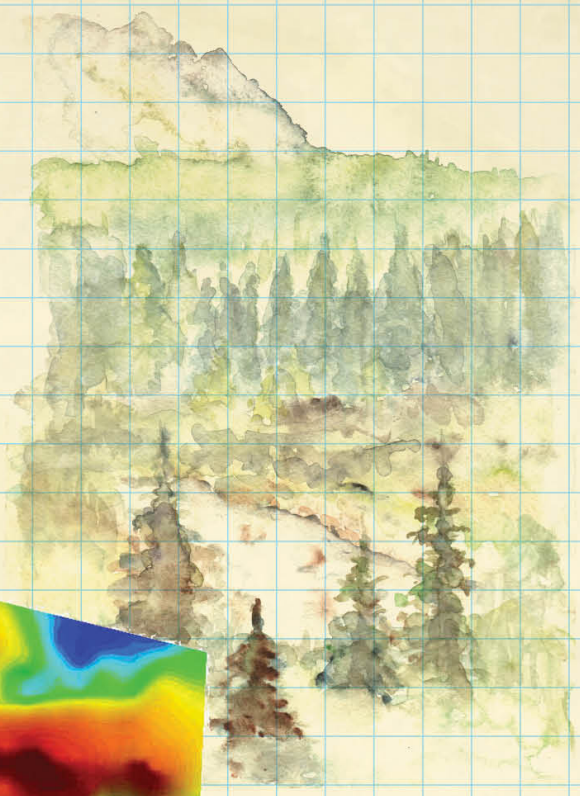


Transmitter
Dipole moment 100 000 Am²
Loop diameter 7.5 m



EQUATOR AIRBORNE ELECTROMAGNETICS

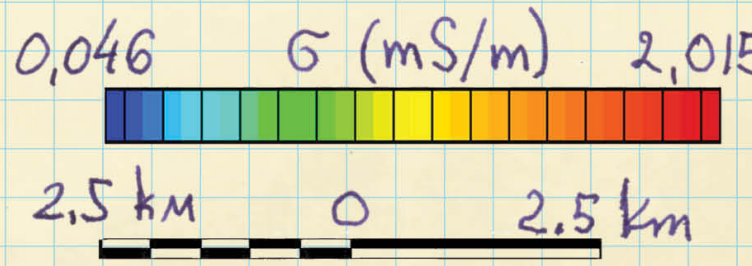




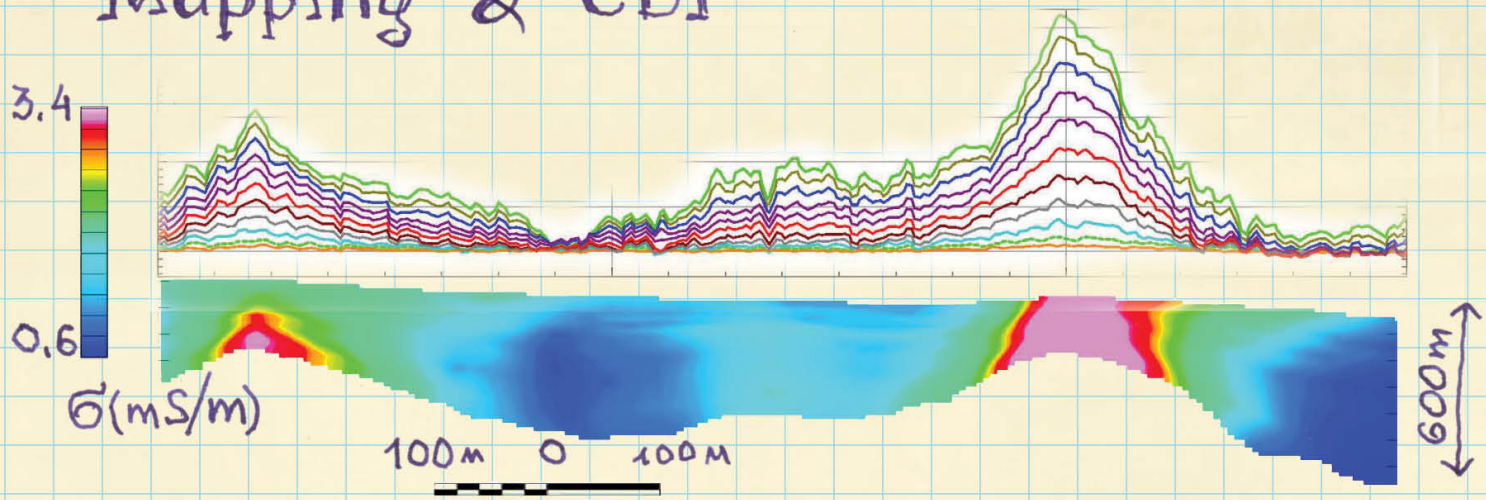
The survey was flown over high regions of the Eastern Sayan Mountains where peaks are covered with snow. Survey conditions were extremely hard:

- elevation change is up to 1300m
- the survey area is characterized by very low conductivity (approx 0,5 mS/m) and survey target objects are low-conductive too (approx 5 mS/m)

"DIELECTRIC inside DIELECTRIC"

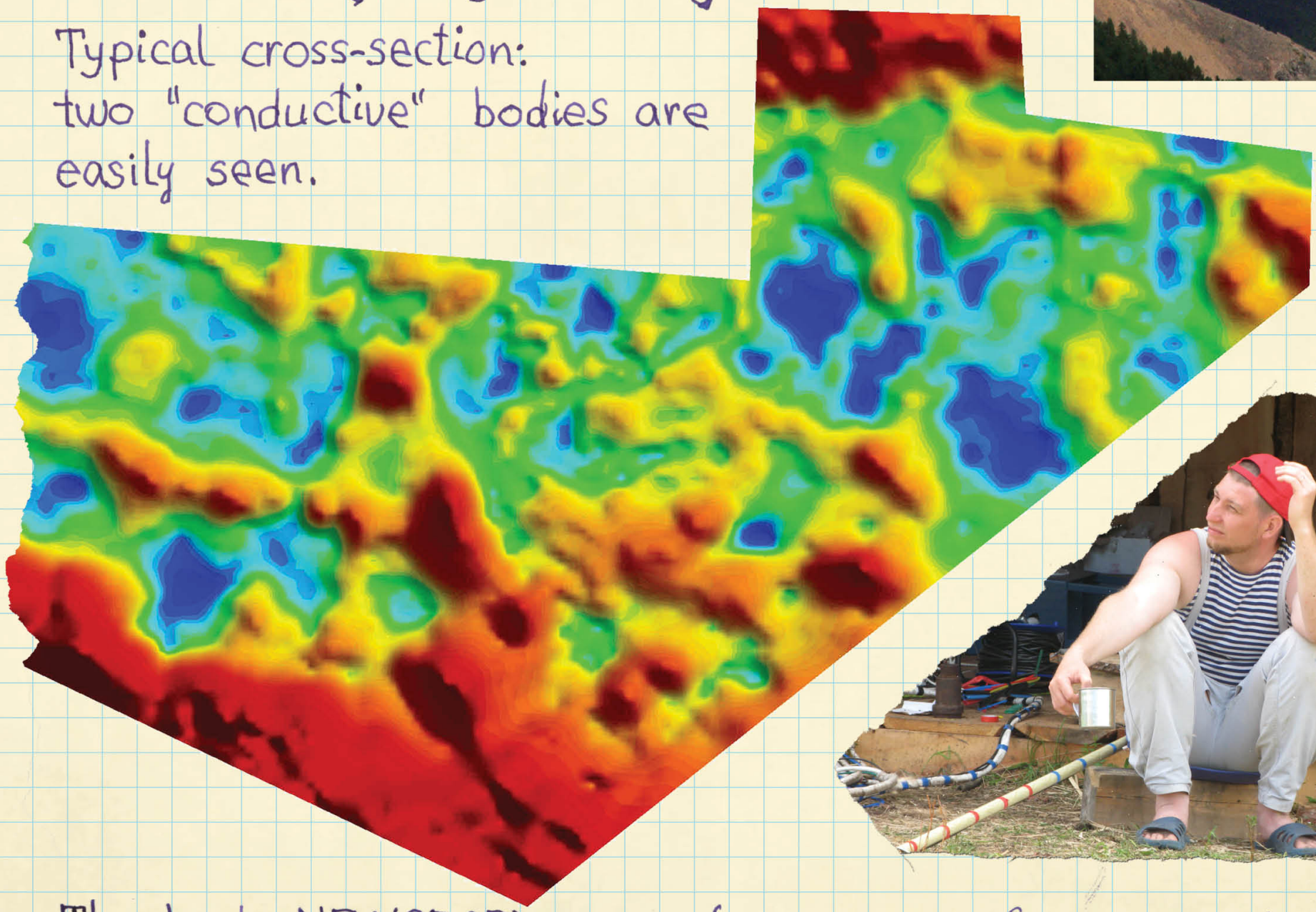


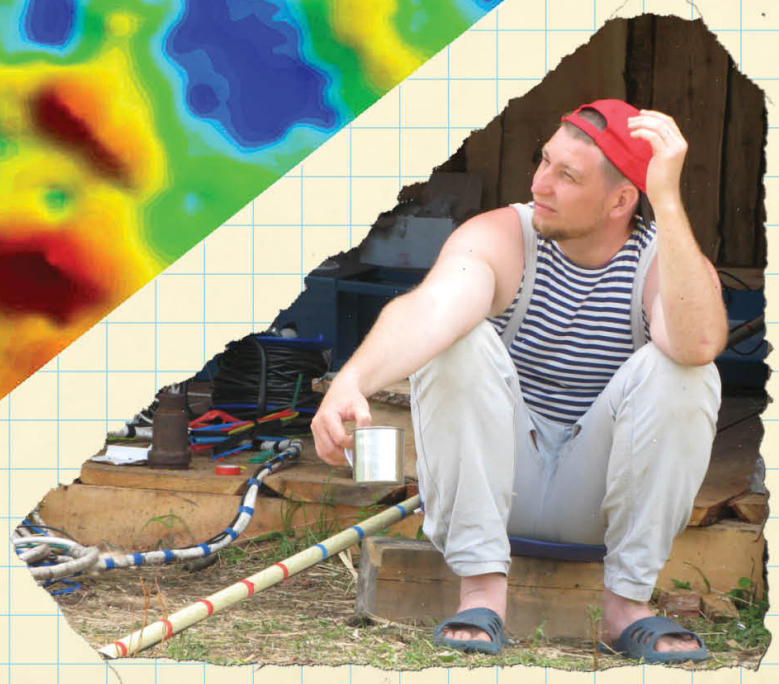
Apparent Conductivity Mapping & CDI



Conductivity-Depth Imaging

Typical cross-section:
two "conductive" bodies are easily seen.

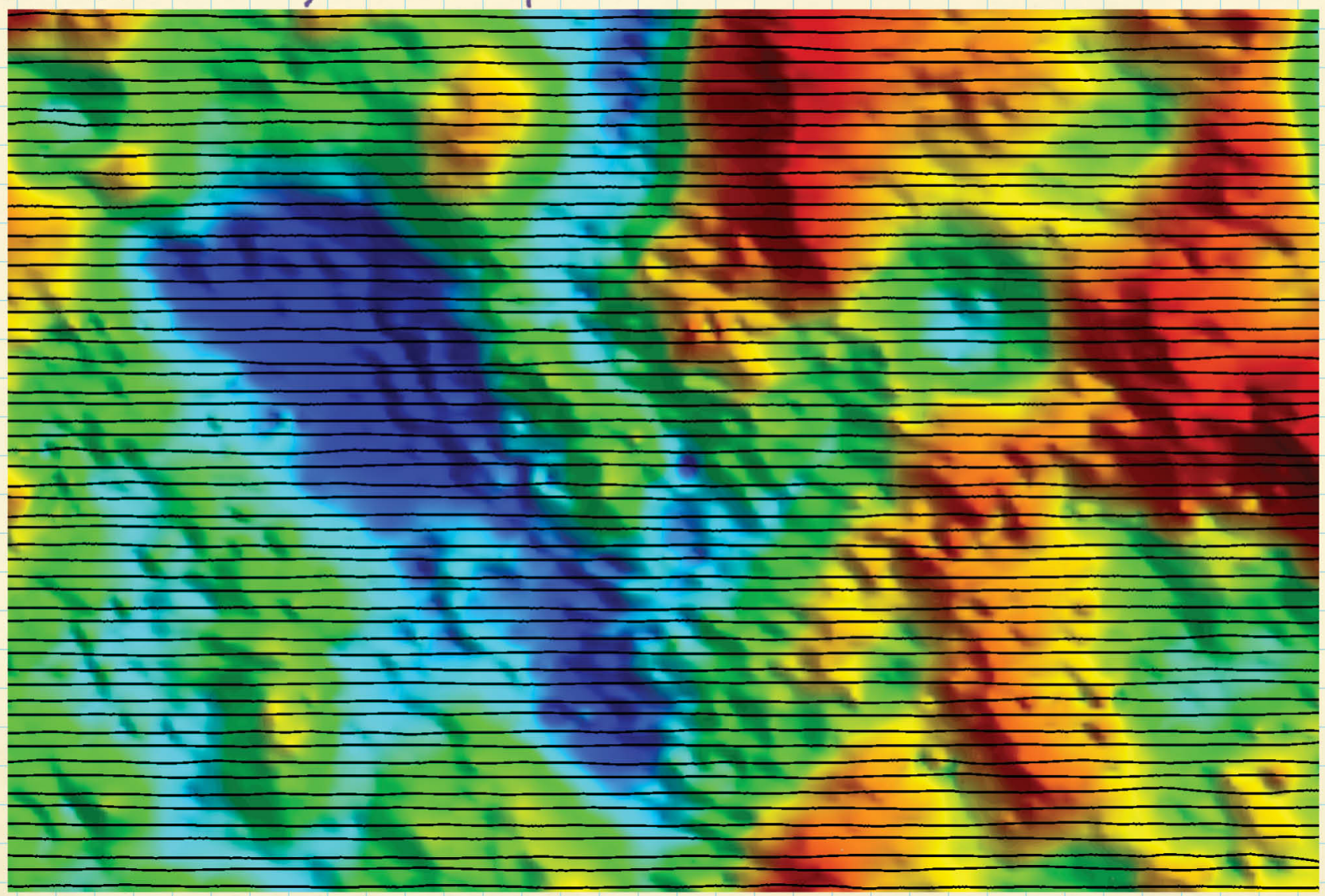




Thanks to NF VSEGEI www.nfvsegei.com for cooperation
Published with permission of MMC INTERGEO

In the photo:
EQUATOR in the woods of Arkhangelsk region
FIND IT!

Results of EQUATOR detailed survey are shown on the image below. AEROGEOPHISICA JSC conducted the survey with the support of our specialists and kindly granted the materials for the publication.

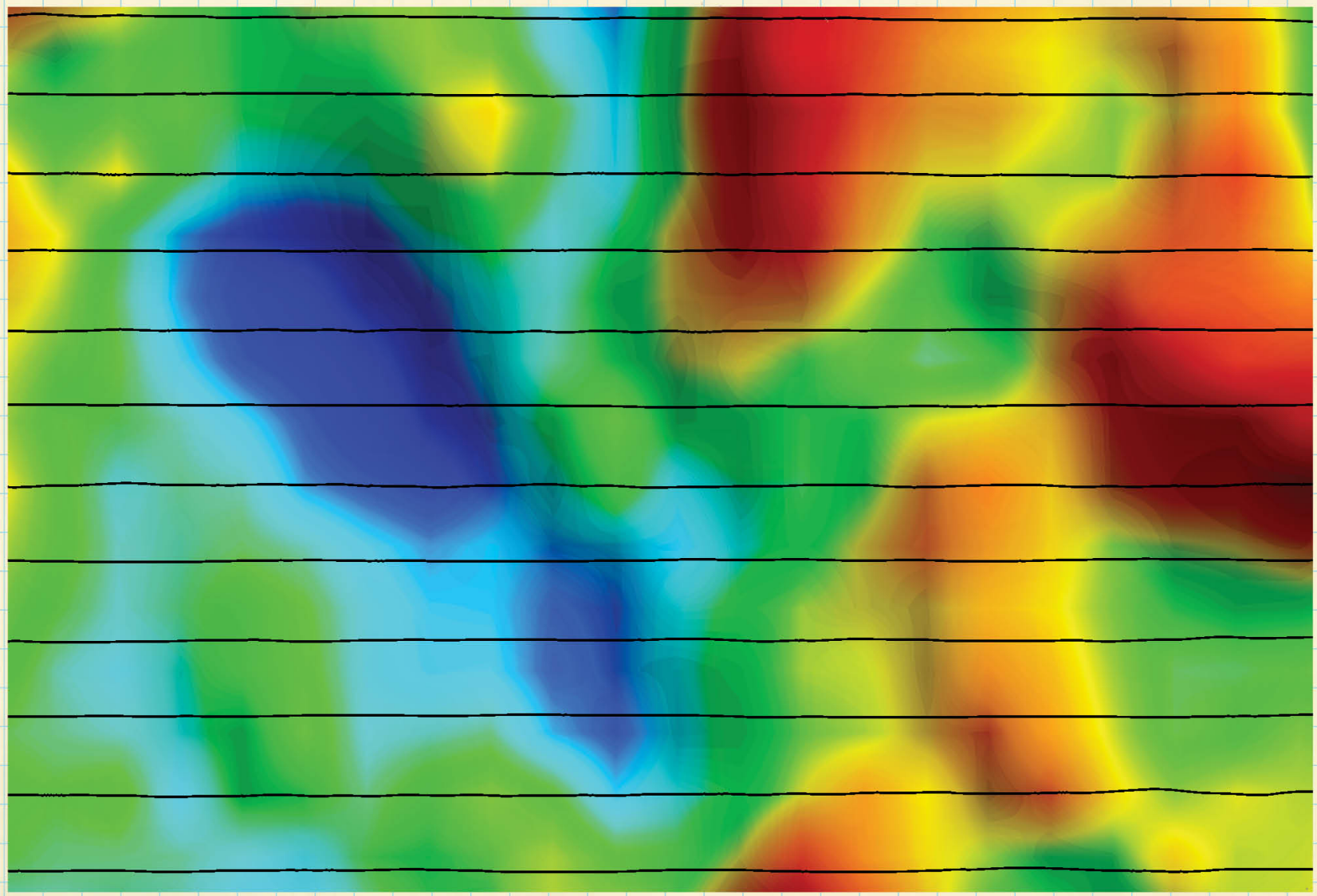


Detailed Mapping

AIRBORNE ELECTROMAGNETICS

The experience showed that **EQUATOR** can be used for EXTREMELY detailed mapping. Pay attention to the accuracy of navigation along flight path lines. The distance between routes is only **50** meters!

COMPARE THESE MAPS! The map on the left is of **1:5000** scale and on the right - **1:25000**. The same data were used for both but for the right one only every fifth route was taken.

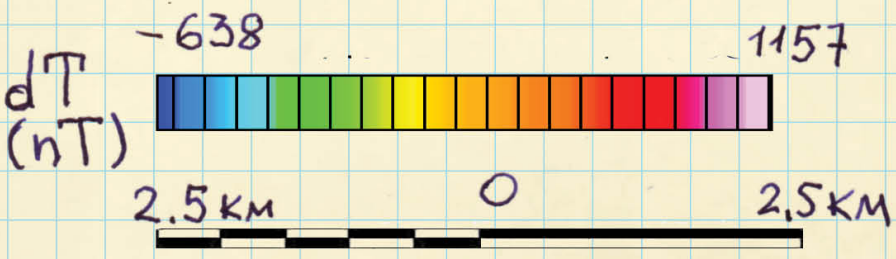


EQUATOR AIRBORNE MAGNETICS

Powerful EM transmitter doesn't affect quality of magnetic data. This is achieved by the use of the unique measurement technology

The technology provides:

- high accuracy **0.2** $pT/\sqrt{Hz}$
- extremely high sample rate **1000** samples per second



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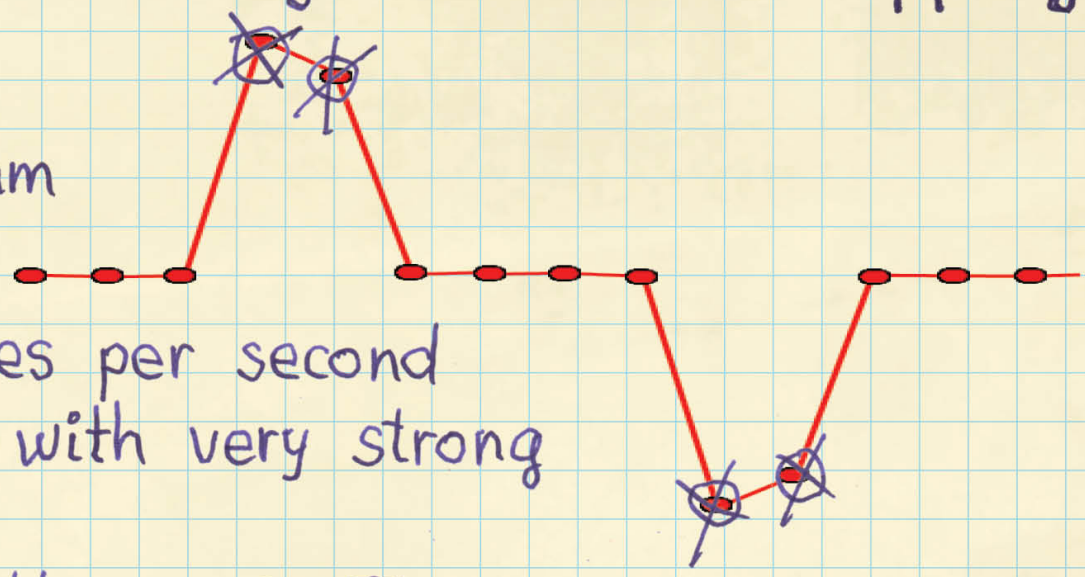
Magnetic Field Mapping

It works like that.

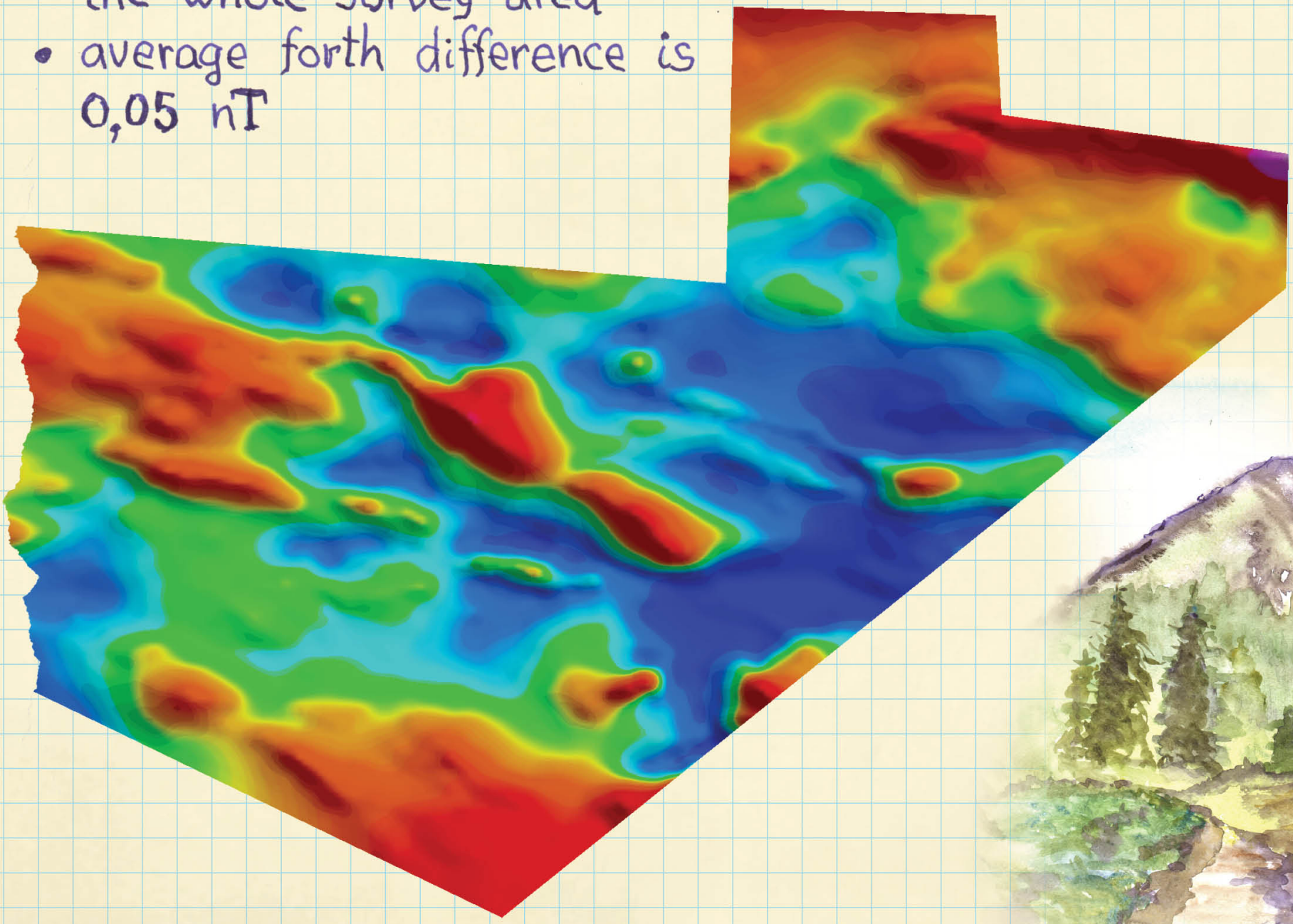
We just strike on-time samples out of data stream

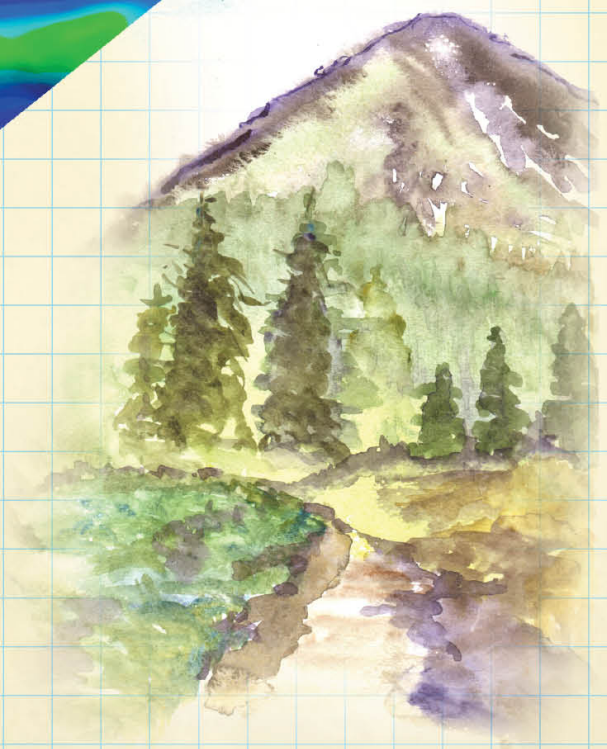


"Distilled" data

sample rate is **25** samples per second and data quality comply with very strong requirements:

- forth difference is less than **0,3** nT on the whole survey area
- average forth difference is **0,05** nT





EQUATOR AIRBORNE MAGNETICS

Here are some technical details.

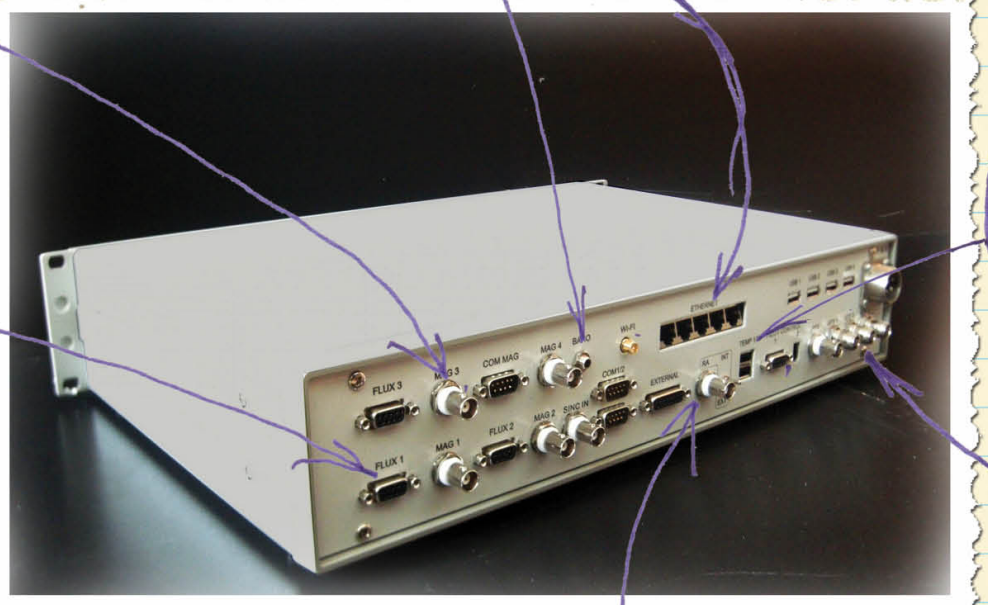
- sensitivity 0,2pT/$\sqrt{Hz}$
- sample rate up to 1000 Hz
- data acquisition software NAVDAT

At the picture below you can see what can be connected to the GT-MAG

Barometer flexible pipe

Computer

Cesium-vapor sensors up to 4



Thermometer up to 2

Fluxgate sensors up to 3

GPS up to 3

Radar altimeter

EQUATOR
CRASH TEST

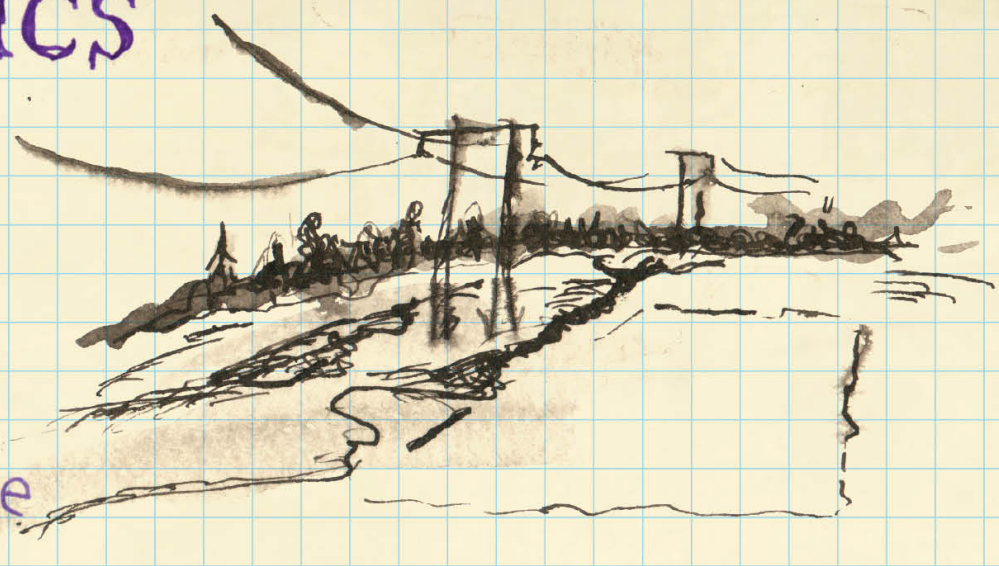
10:00 am
During the survey over rigorous mountains EQUATOR hit the ground. When it was back we could hardly recognize it.

11:00 am
Despite of our emotional shock we started to fix it immediately. And we didn't notice how quickly the time passed.

3:00 pm
We can fly again!!!

AIRBORNE ELECTROMAGNETICS

GROUND MAGNETICS



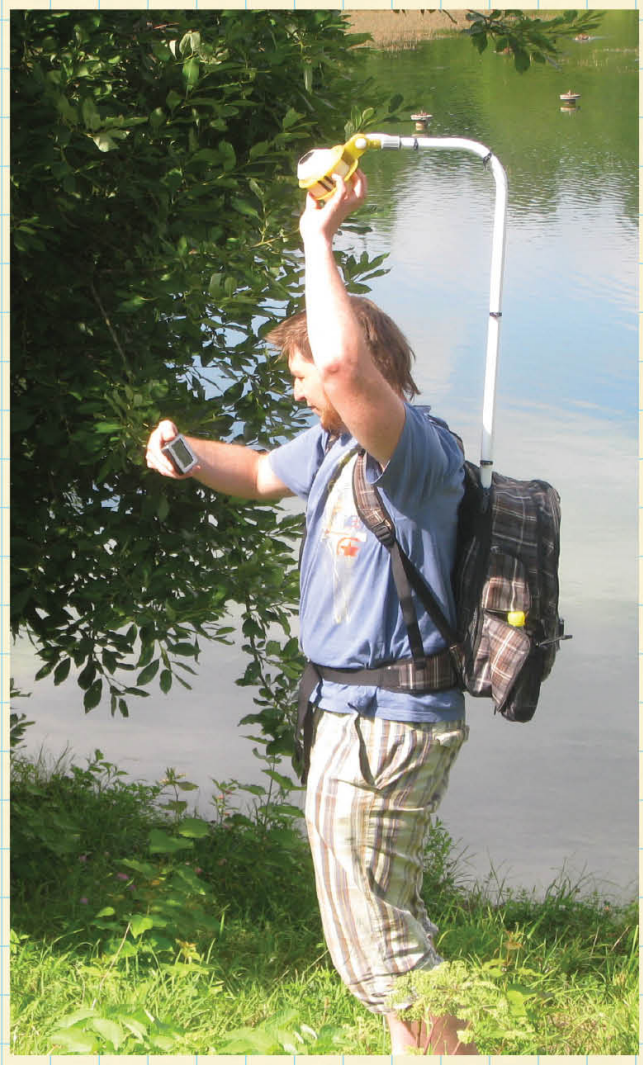
PROBLEM: Industrial noise

ANSWER:
Magnetometer **GT-MVS-SB**

WHY? Because its sample rate is up to **500** samples per second. This allows to remove **50** or **60Hz** noise.

Other details:
Internal GPS receiver
USB flash drive for data recording.

Weight (including batteries) 10kg
Sensitivity: 0,2 $pT/\sqrt{Hz}$



LOOK!
There's no wires: for all operations Wi-Fi connection is used and an operator uses PDA

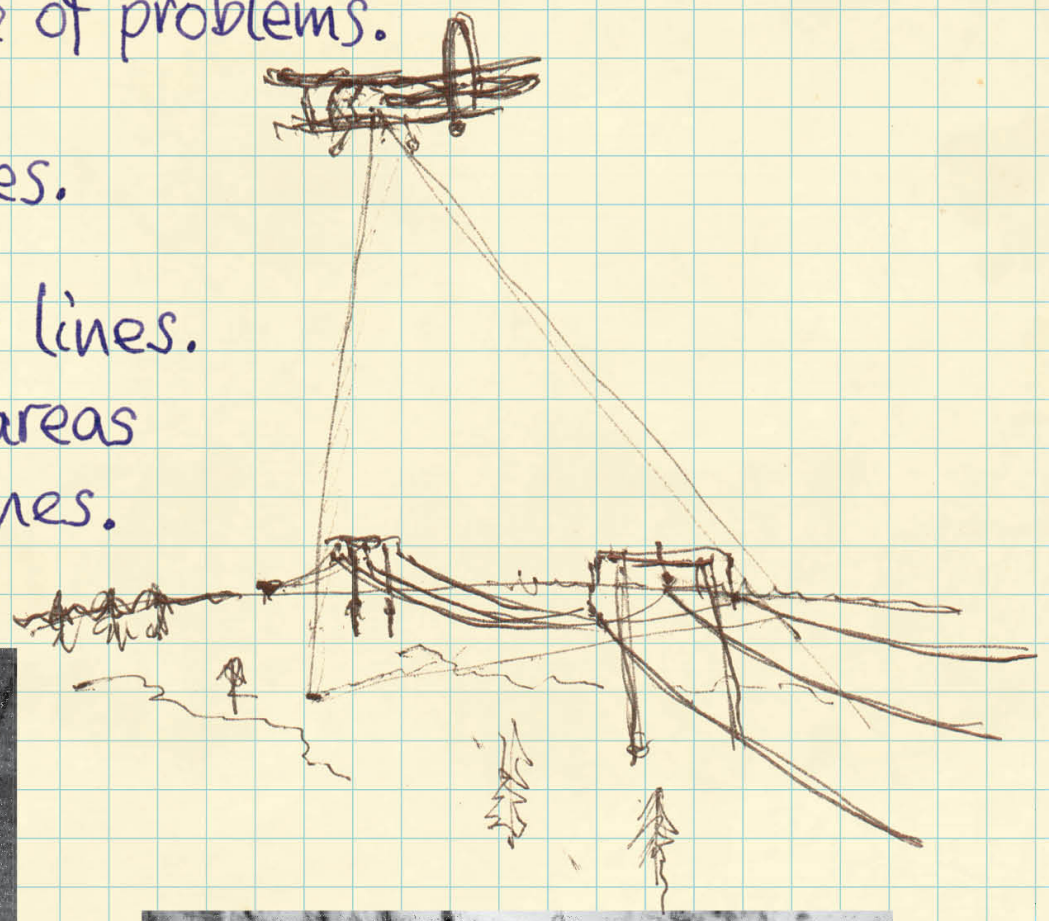
AIRBORNE INFRARED IMAGING

This is an airborne infrared scanner **SCAN-T**

It can solve a wide range of problems.

Here are some examples.

Electric loss in power lines.
We can detect problem areas
by flying along power lines.

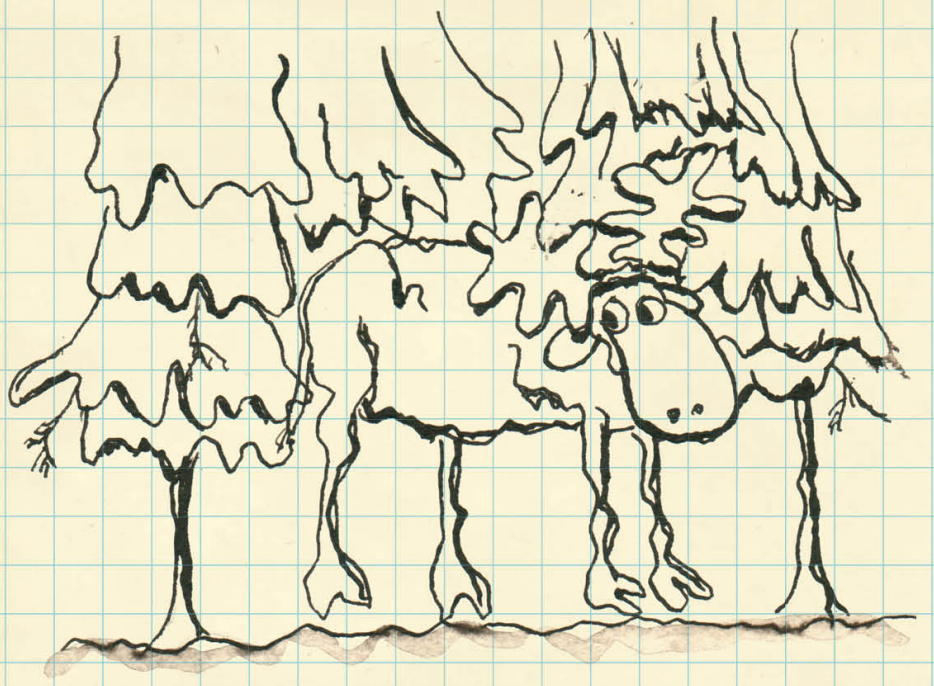


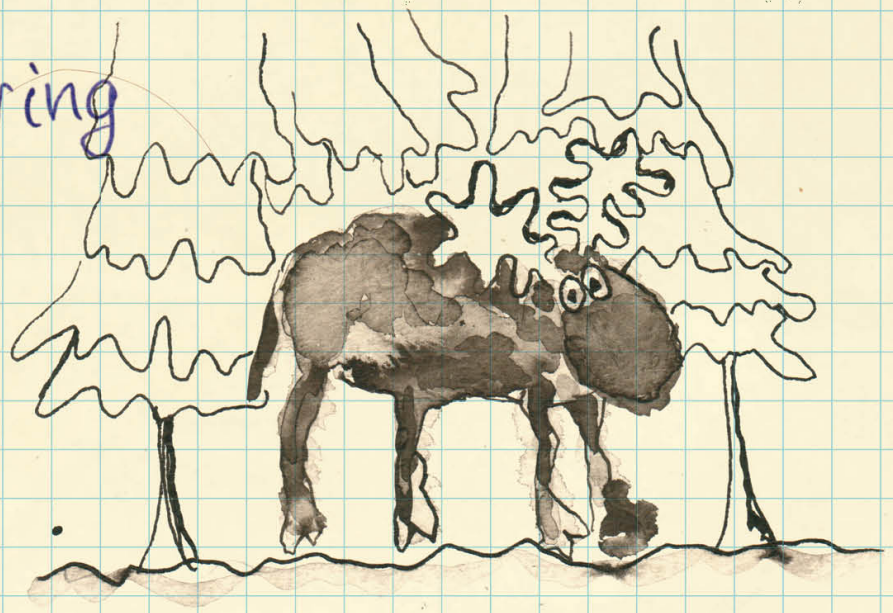
Infrared thermal image

Photo

AIRBORNE INFRARED IMAGING

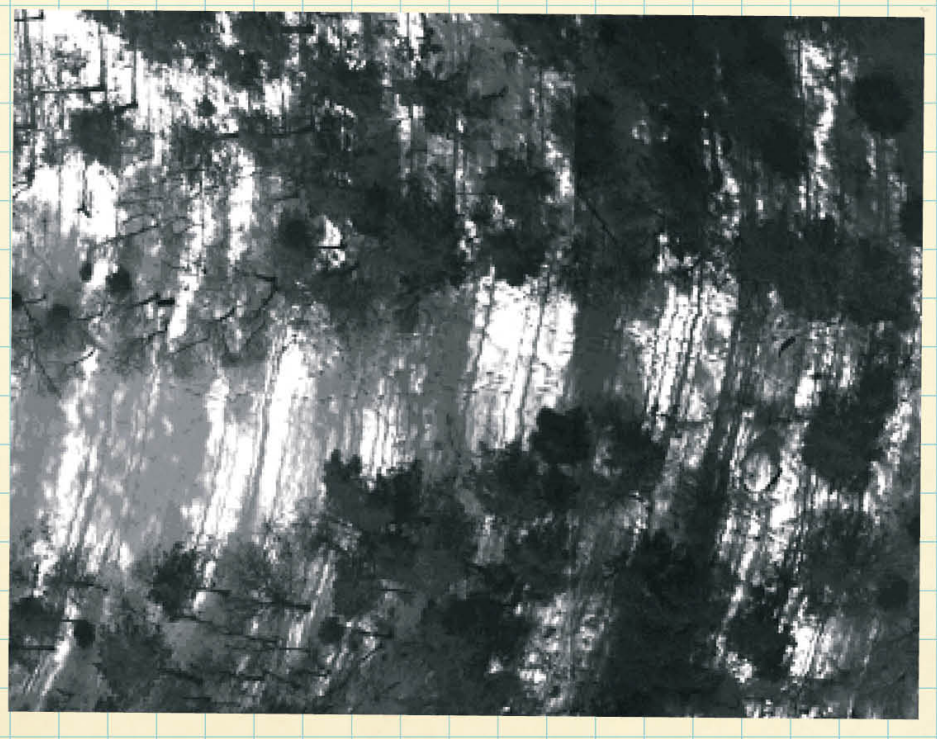
Animal population monitoring

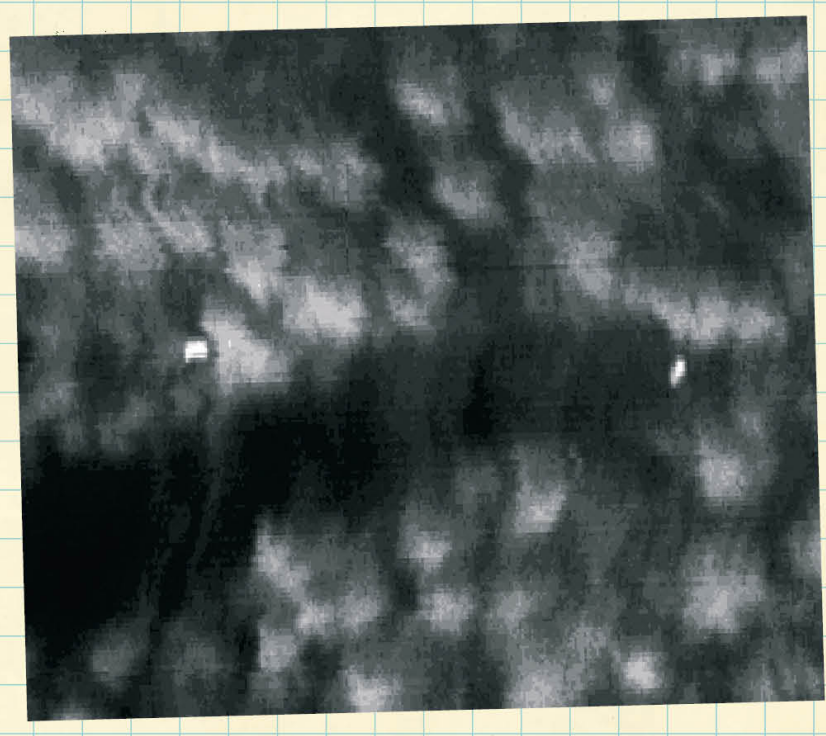




Heat emission allows to locate animals.

Try to spot elks on this photo It's rather difficult Isn't it?

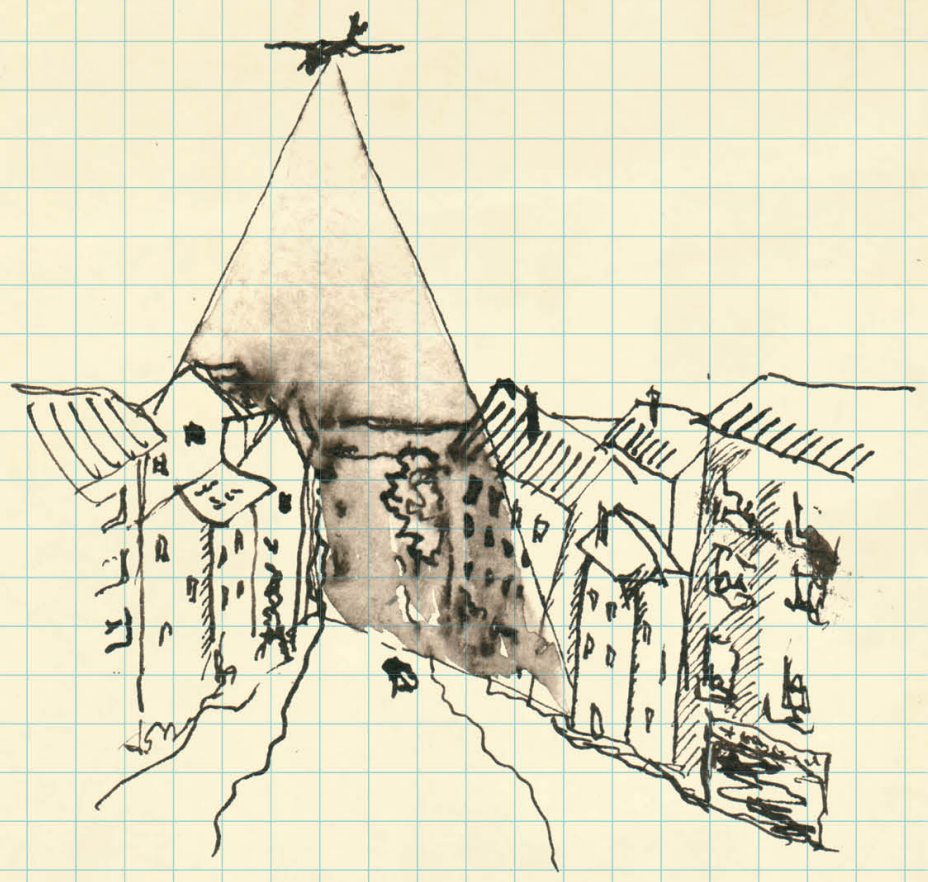




But look on the infrared image. Here they are!

AIRBORNE INFRARED IMAGING

Heat supply network monitoring



Problem zones of underground network

In addition:

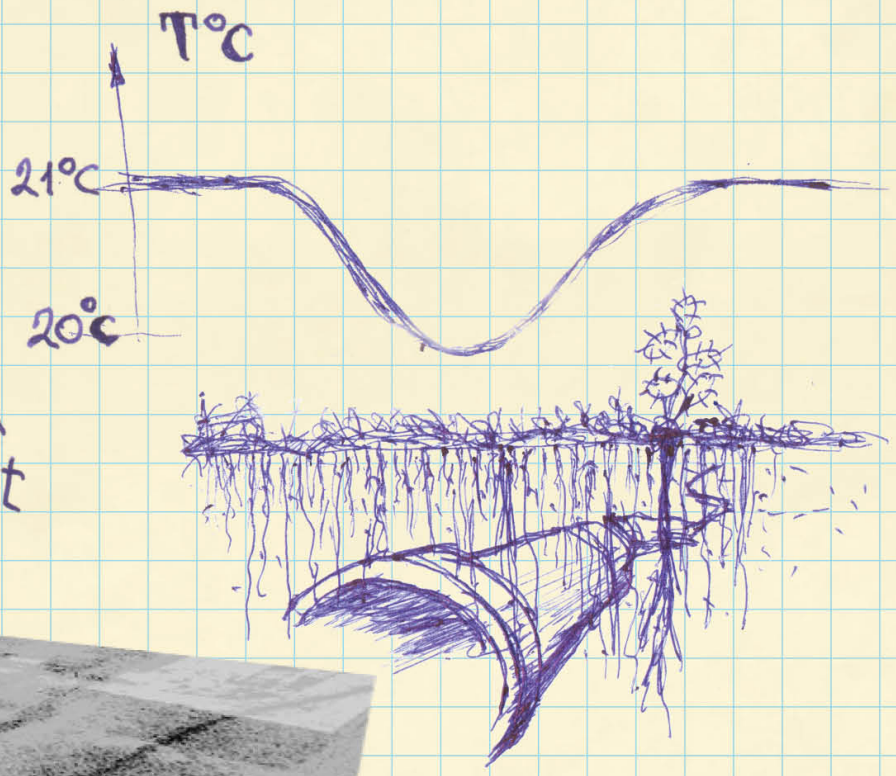
SCAN-T can be installed in light aircraft inside or outside fuselage with ease.

We provide full software support including automatic georeferencing

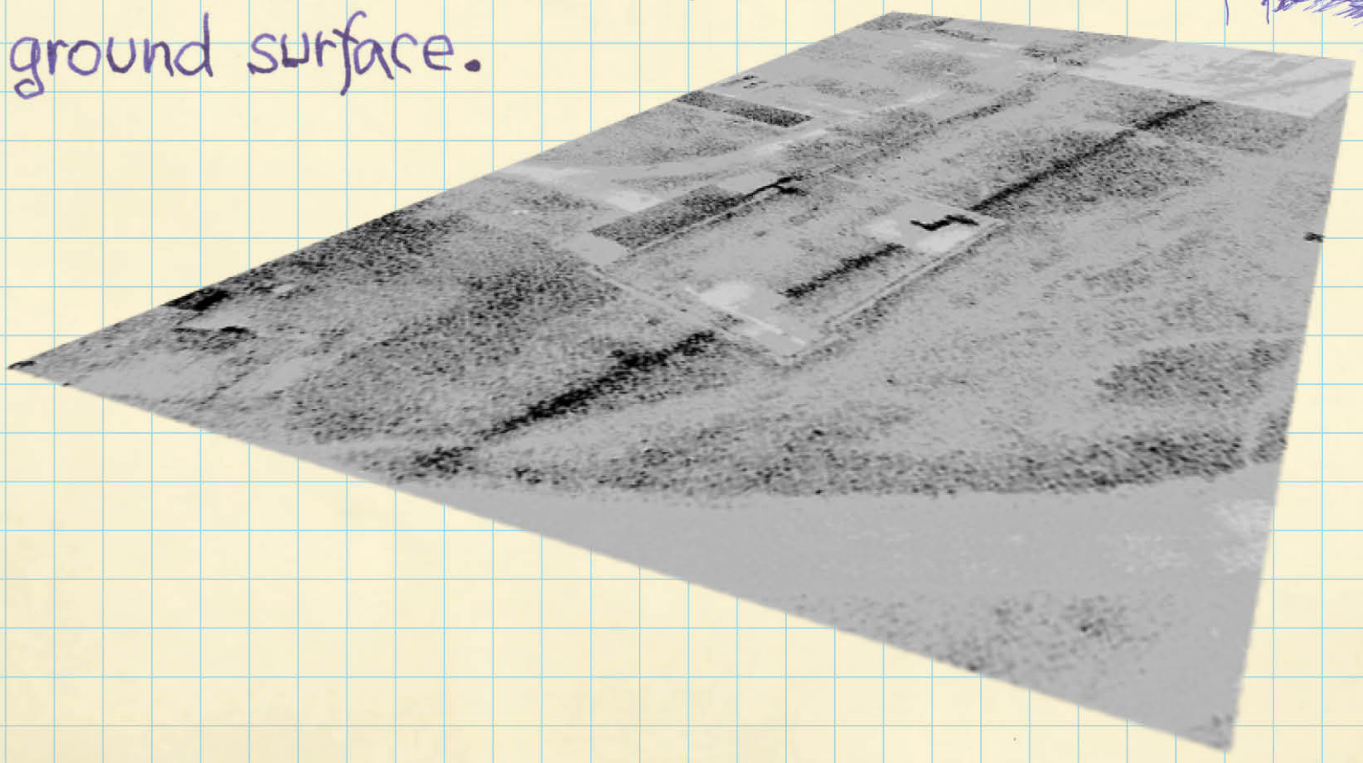
AIRBORNE INFRARED IMAGING

The method works with cold objects as well

During the Infrared survey in **Mexican** outback (January 2011) we found a long cold underground object among swamps, cactus and wild animals.

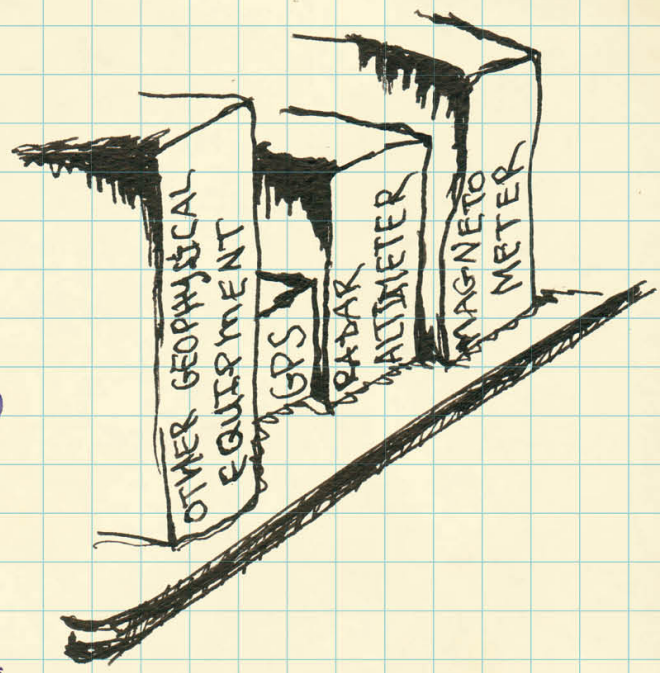


It turned out to be an ammonia pipeline. Its temperature was just **5°C** colder than that of the ground surface.



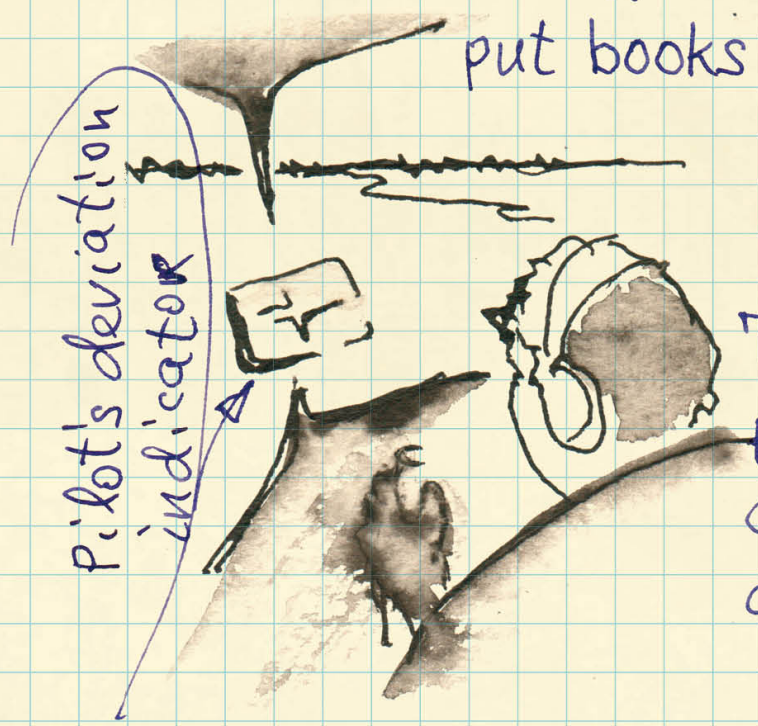
Navigation and Data Acquisition Software

Airborne surveys employ one or more geophysical devices and requires very accurate navigation. That's why we developed system **NAVDAT**
It's main functions are:



Geophysical equipment integration

is almost as simple as to put books on a shelf



Navigation:

To approach and follow a route a pilot should keep the needle of the deviation indicator in zero position during all flight

Survey process monitoring:

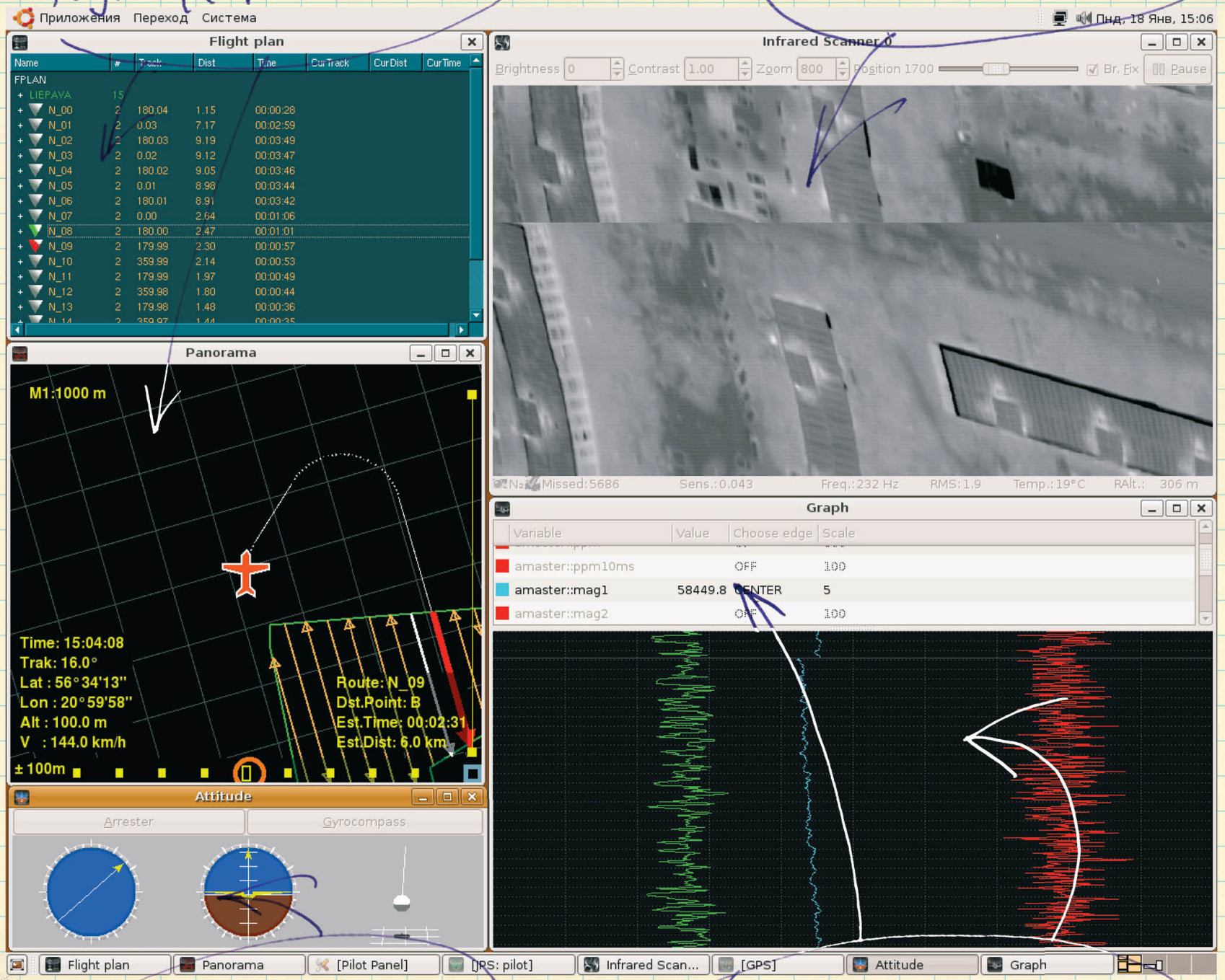
operator observes all measured signals and inspects navigation accuracy

Navigation and Data Acquisition Software

There's an example of **NAVDAT** screen. It consists of several windows, which displays following information.

Navigation map and flight plan

Infraved image in real-time



Gyro system parameters

Measured parameters list and charts

—Geotehnologies — gp.gtcomp.ru —

Navigation and Data Acquisition Software

Sometimes operator's workspace looks like that

In this situation it would be better if operator looked like this one

So we tried to ease operator's work while developing NAVDAT. Here is the result

TO BE CONTINUED

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