IP field logistics for Jungle areas

ExploreGeo Technical Note 2

ExploreGeo

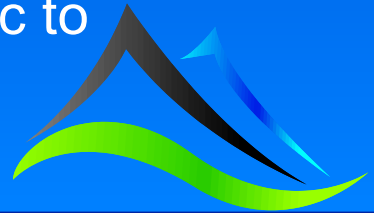
IP Field logistics

This note aims to prepare project staff for the arrival of the IP crew and for those that have not seen IP in action, explain what should happen and what is required.

Firstly IP stands for Induced Polarisation. The crew injects current into the ground through electrodes and measures the voltage a distance away through special electrodes called pots.

There are thousands of different IP arrays (almost as many as there are geophysicists) however in jungle areas it is likely that Double Offset Pole-Dipole (DOPD) or Double Offset Dipole-Dipole (DODD) will be selected because of their good depth of penetration and cost efficiency over 2D co-linear arrays.

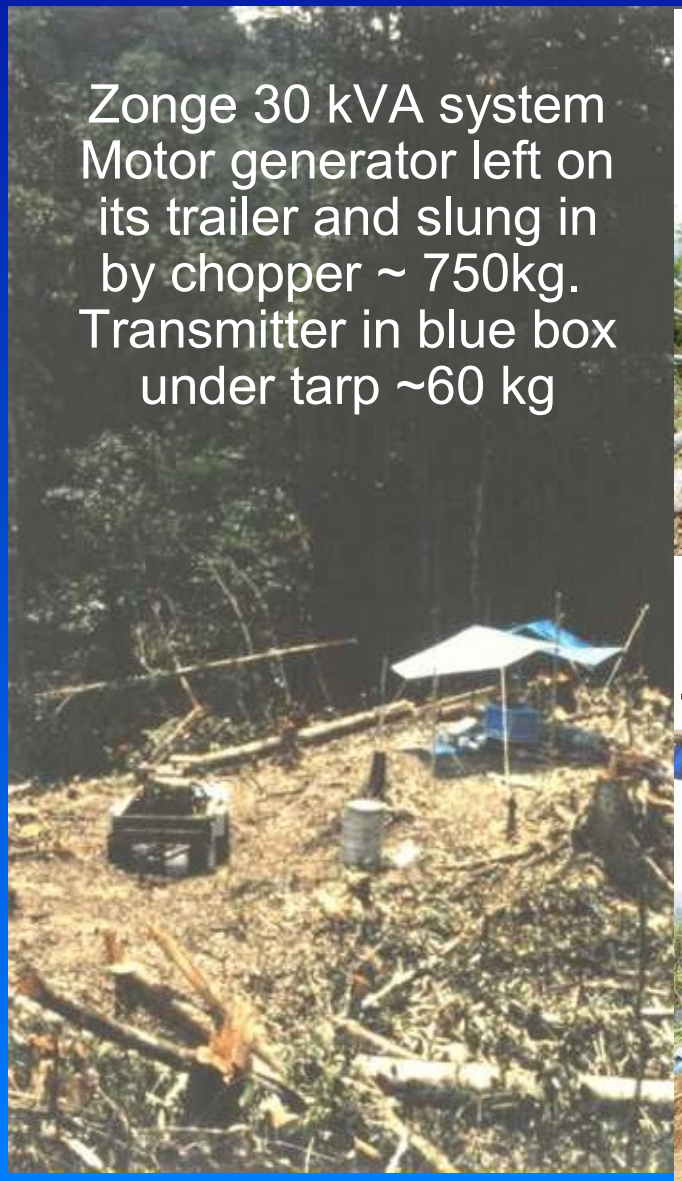
Separate notes have been prepared explaining the layout of these arrays so this will not be repeated. Only the field logistics generic to IP surveys will be covered here.



IP Field Logistics

What does the gear look like? - Transmitters and Motor Generators

Zonge 30 kVA system
Motor generator left on its trailer and slung in by chopper ~ 750kg.
Transmitter in blue box under tarp ~60 kg



Scintrex 10 kVA transmitter ~ 60 kg

Zonge 10 kVA
Motor generator on poles ~ 150kg.

Scintrex 10-30 kVA motor generator to power the transmitter above ~600 kg Slung in by chopper

Search 10 kVA
Motor generator and transmitter on poles ~ 150kg & 60kg.

IP Field Logistics

What does the gear look like? - Receivers

Receivers are relatively light < 30 kg and can be put in a back pack for transport

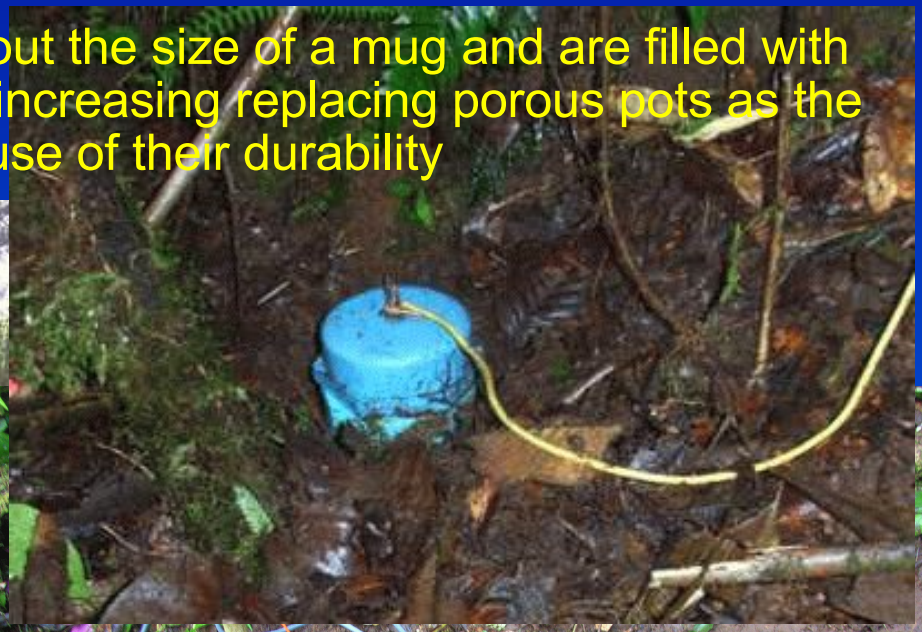
IP Field Logistics

What does the gear look like? - Current Electrodes

IP Field Logistics

What does the gear look like? - Potential Electrodes

Porous pots come in all shapes and sizes but are about the size of a mug and are filled with Copper Sulphate ($CuSO_4$) Stainless Steel stakes are increasing replacing porous pots as the preferred potential electrode because of their durability

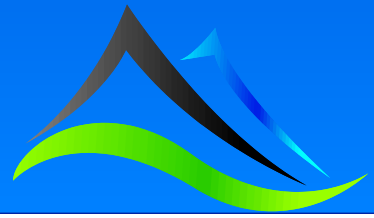


Stainless steel stake

IP Field logistics

Main points

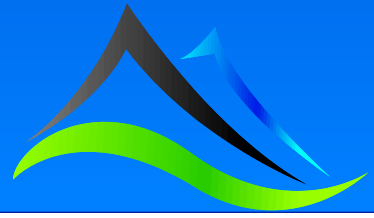
- Design the grid
- Cut grid lines and any required base lines
- IP labour support
- Survey actual electrode locations with GPS



IP Field Logistics

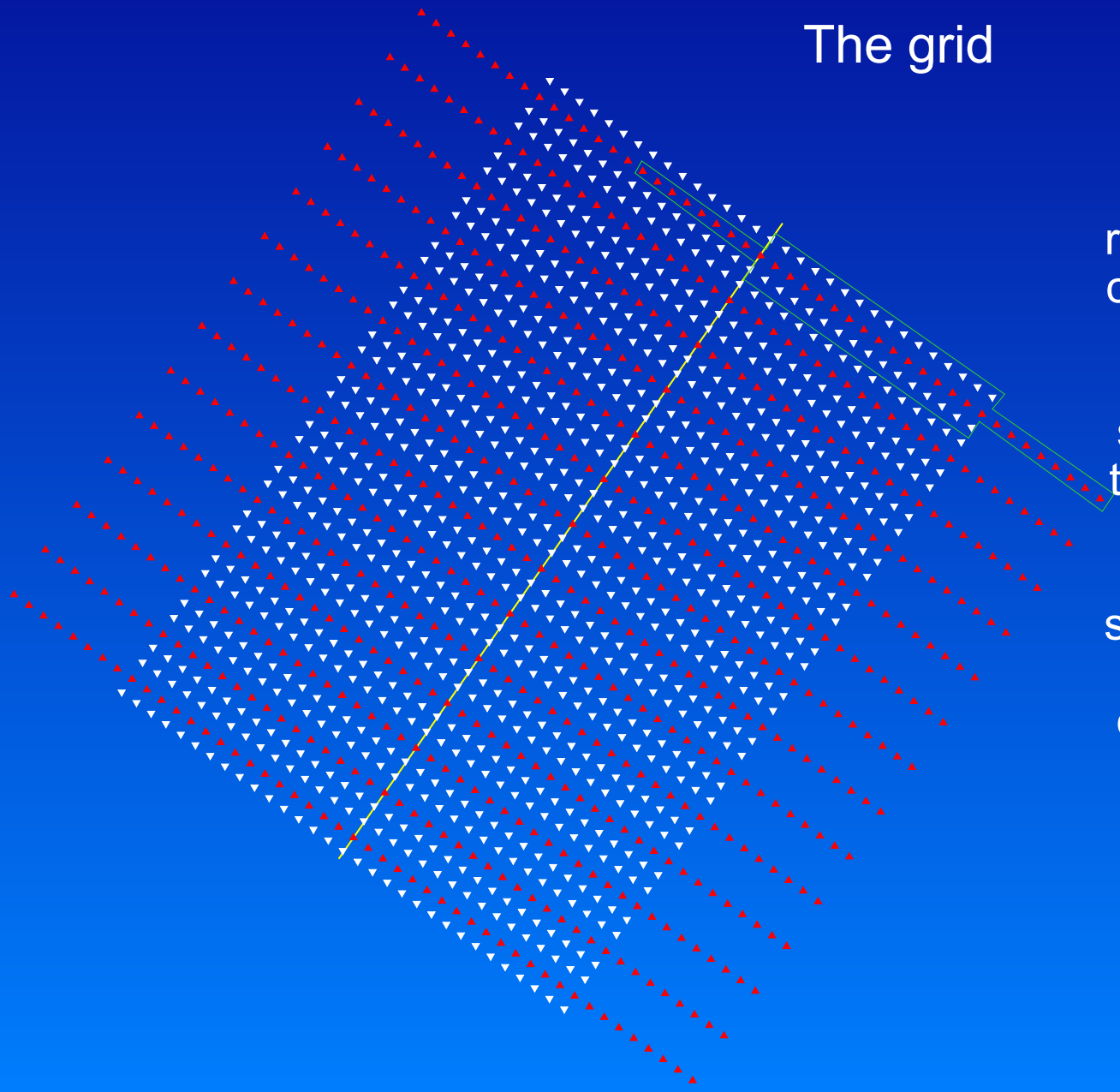
Design the grid

Unless a grid already exists it will usually be designed from scratch by the geophysicist in consultation with the geologist running the project. If the grid is to serve a purpose other than collection of IP data this should be made clear to the geophysicist as it may change the design. If the programme is using 3D arrays such as DODD or DOPD there are efficiency restrictions on the shape of the grid. This is because unless all the input channels of the IP receiver are being used, the survey will not be as cost effective as possible. Modern IP receivers come in multiples of 16, 30 or 32 input channels, depending on the instrument, so arrays should be sensible multiples of these numbers of dipoles.



IP Field Logistics

The grid



This grid is set up for 28 DODD arrays. The white triangles are receiver pots the red triangles are current electrodes. The base line is shown in yellow and a single array is outlined in green. In some areas cutting base lines at the ends of the receiver block will help in moving equipment from one line to the next. The line spacing used here is the same as the dipole spacing. This is the optimal arrangement but the line spacing can be expanded out to twice the dipole size with a resulting loss in near surface resolution between survey lines.

IP Field Logistics

The Base Line

If a helicopter is available larger motor generators can be used and the base line will only be needed to move people and light equipment between lines and between camp and the work lines. Heli-pads can be cut along ridge lines close to the array ends or centre points on each transmitter line.

If a helicopter is not available, man portable gear will be required in which case the base line will have to carry heavy equipment and thus may need to be cut a little wider to allow for this.

IP Field Logistics

The Base Line

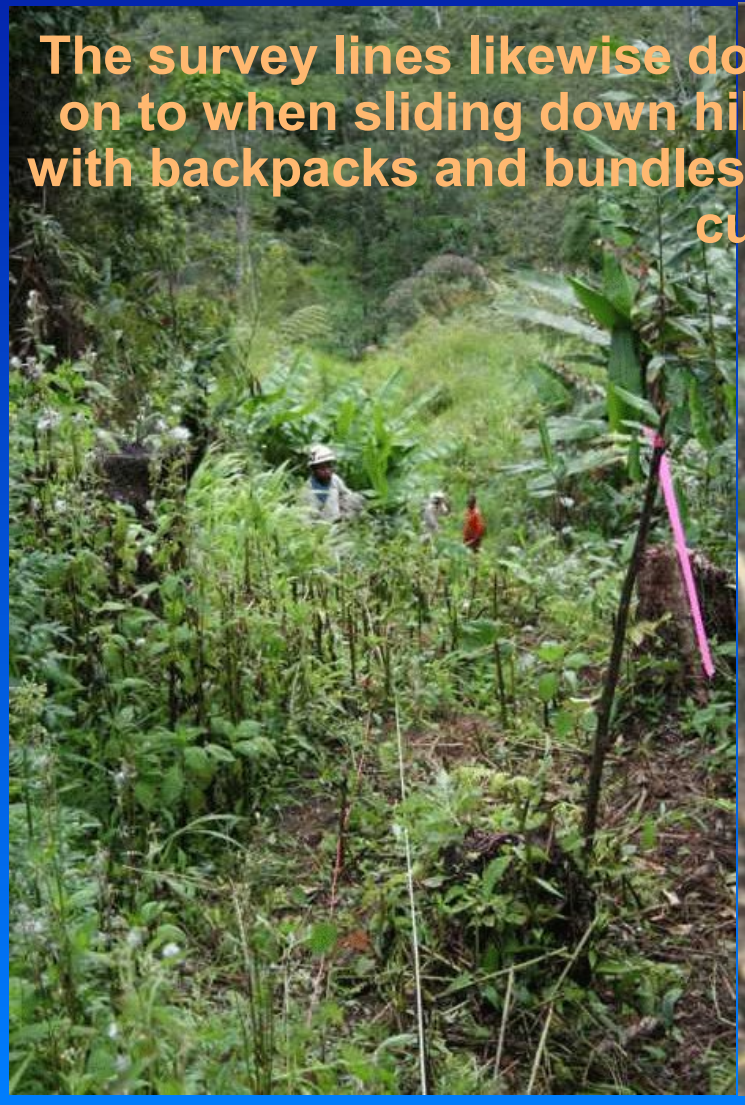
A super highway is not needed - just enough room to move people and equipment safely. This might mean that it pays to leave some vegetation on steep slopes to grab on to or to break a fall.

This example is wider and more clear than needed. The steep sections will be hard to climb because of a lack of vegetation to grab hold of.

IP Field Logistics

Survey lines

The survey lines likewise do not have to be highways, having something to hold on to when sliding down hills is a bonus! They need to be suitable for walking with backpacks and bundles of wire. Preferably without groin piercing stakes left cut at just the wrong height.

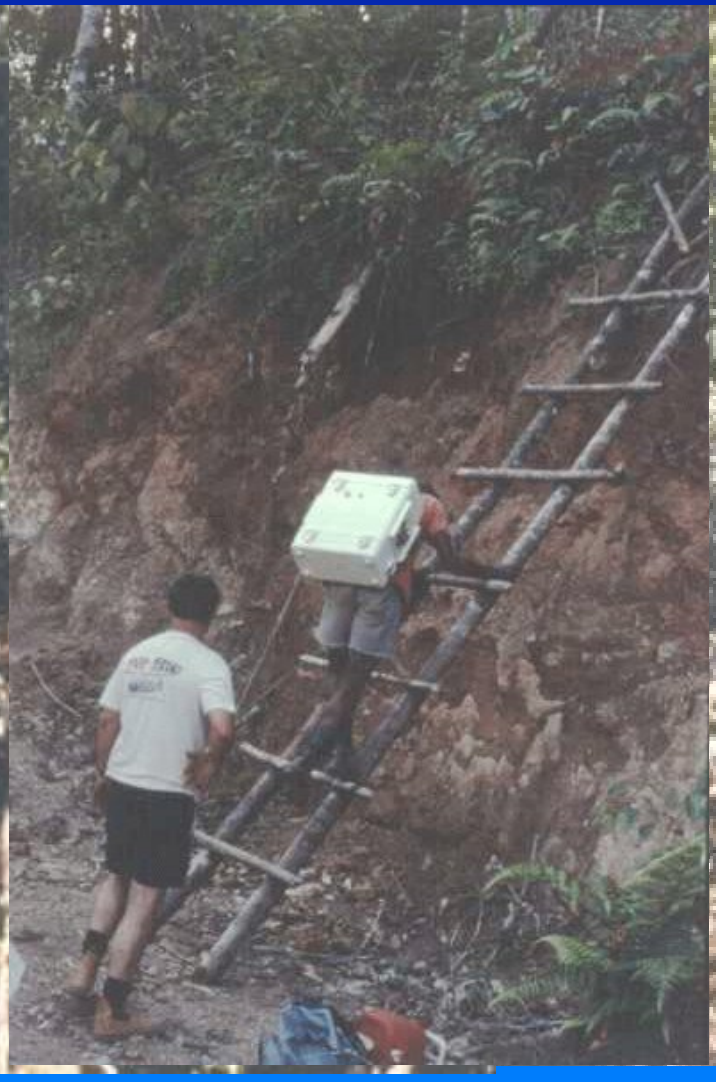


ExploreGeo

IP Field Logistics

Survey lines

Were the lines are steep, ladders or steps cut into the hill can speed things up and help avoid equipment damage



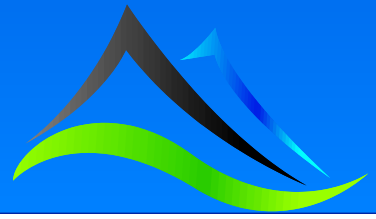
IP Field Logistics

Line cutting

Once the crew get going they should record one DODD or DOPD array every 1.5 - 3 days, depending on the dipole spacing. For 100m dipoles this means that every 3 days at most the crew will need another 6400m of line cut and ready for work. The line cutting needs to start well in advance of the crews arrival and continue at pace while the crew are working. An IP crew sitting on standby waiting for more lines to be cut is a waste of money and demoralising for the crew who usually want to get in, do the job and get out.

If the base line is surveyed properly with short right angle take offs marked for the survey lines then the survey lines should be able to be cut with tape and compass. However if GPS coverage is generally available then use it. While desireable, the accuracy of the survey lines relative to the plan is not critical (50% of line spacing) however knowing where they actually went is, so the lines will need to be picked up at as many points as possible with GPS or optical surveying if the canopy is too thick.

The lines should be pegged and flagged with the co-ords written on the tape or flagging. It does not matter if the the peg spacing is measured horizontally or slope corrected so long as it is consistant. If slope corrected the IP crew will need to know in advance the likely maximum distance between electrodes as they use pre-made cables.

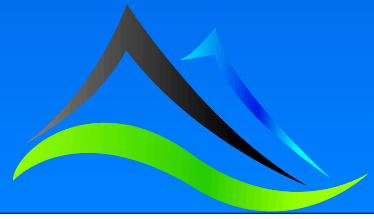


IP Field Logistics

The IP crew arrive

Once there is a comfortable buffer of line cutting completed the IP crew should arrive. Each crew chief will have their own methods but in general their needs are the same: lay receiver wires, plant pots, set up the transmitter and motor generator, run current wires and dig, line and water the current electrode pits. Each of these operations will require a small crew of labourers. Depending on the local conditions and any language issues, each of these crews may need a geologist or other senior person to act as foreman and interpreter. Well managed field support for the IP crew will result in better production and a cheaper survey in the long run.

For this presentation we'll split the teams into receiver teams and transmitter teams



IP Field Logistics

The crew - only two of these are the contract IP crew the rest are your problem!

IP Field Logistics

Receiver Team

The receiver team need to run multicore cable between the pots and the receiver unit(s) and plant the pots. The multicore cable will generally be cut to about the right length for the dipole spacing to be used on the job, allowing for slope corrections.

Pots need to be planted into a shallow muddy hole so the crew may need to carry water in areas that do not get daily rain. In dry areas each pot may need 2-3 litres initially and another 5-10 litres over the next two days as the array is recorded

Bundles of multicore receiver cable heading to the line

IP Field Logistics

Transmitter Crew

The transmitter crew need to dig electrode pits. These are generally 2m x 2m x 10-20 cm deep holes lined with aluminium foil, covered and watered, generally with salt water to improve their electrical contact. In dry areas a single electrode can require up to 100 litres of water.

A corner of the alfoil is left exposed to roll a bared back piece of current wire in to make electrical contact.

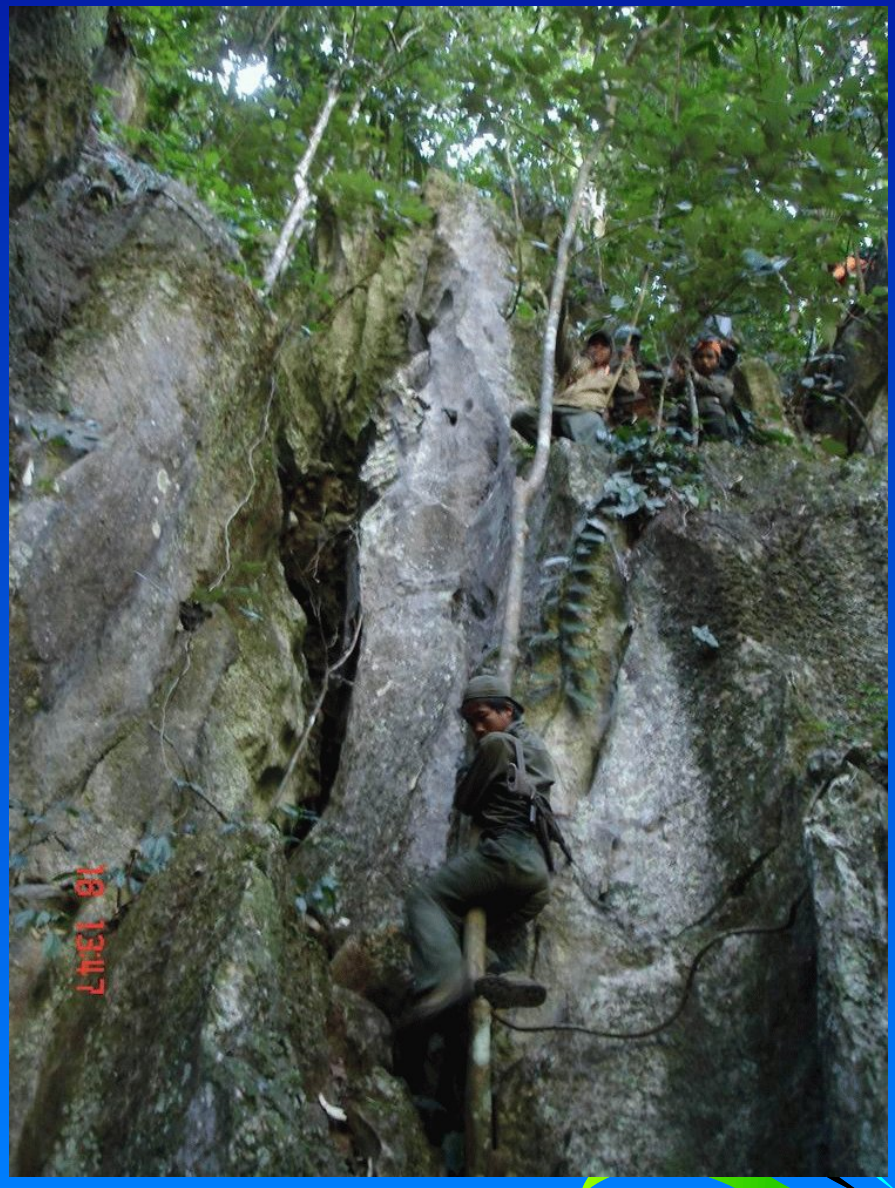
Covering the alfoil lining the pit.

Wiring in the current wire

IP Field Logistics

Transmitter Crew

In rocky areas it may be difficult or even impossible to dig pits. In these areas other types of electrodes will be required, e.g. tree roots or steel spikes driven into joints in the rock.



IP Field Logistics

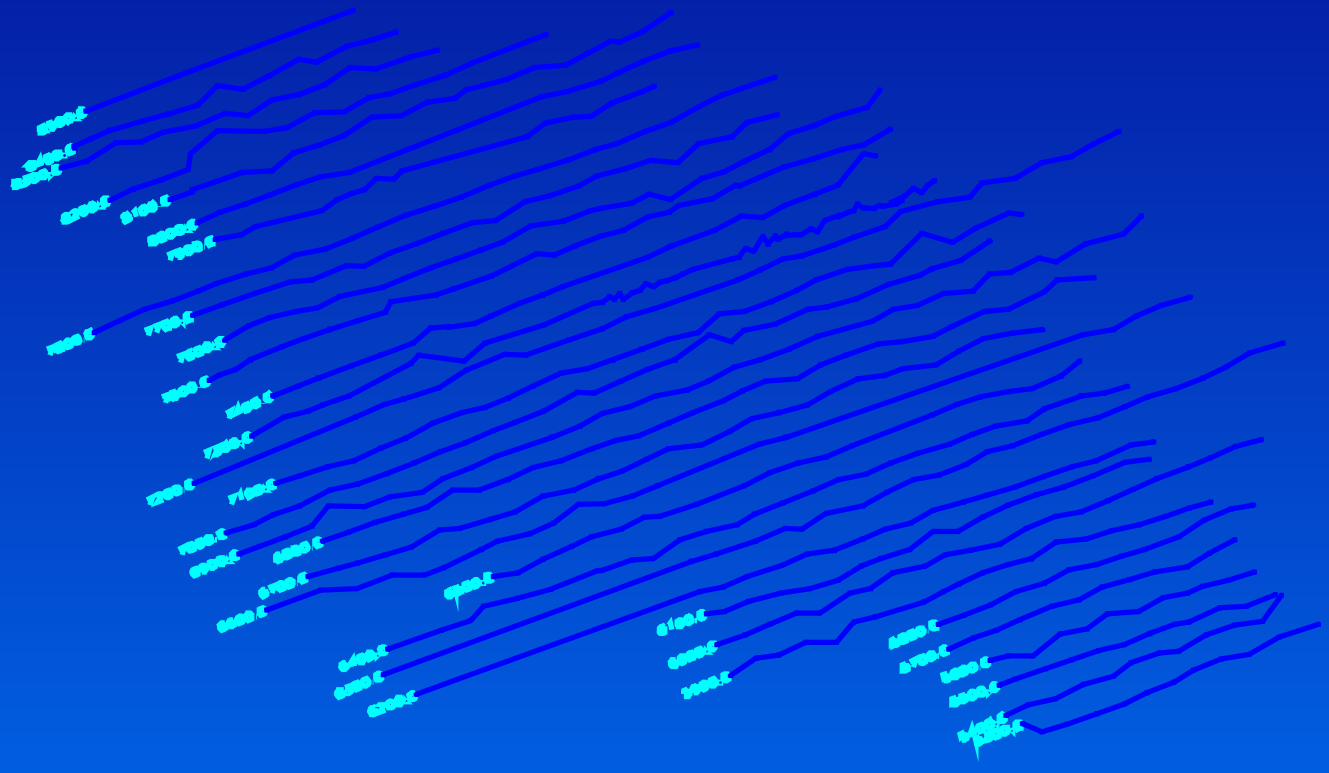
Recording data

Once the wires are all laid out and electrodes connected the crew should be ready to start recording. Depending on the time it takes to get to the survey area and the size of the survey it may be necessary to set up fly camps which move with the crew through the survey.

6-10 day transmitter fly camp

IP Field Logistics

Pick up electrode locations



Remember that although it is nice to have the grid where you planned it, this is not as important as knowing where it actually is. While the crew are surveying and before the location of the pot holes are obscured, the actual electrode locations should be surveyed in, preferably with GPS but if cover does not permit this then by using optical means. It may not be possible to pick up every electrode but that should be the aim.

IP Field Logistics

Consumables the crew will require

- Alfoil - caterers packs are longer and stronger
- Copper Sulphate powder is using porous pots rather than stainless steel
- Salt - pool salt is fine
- Water and suitable containers to move it around
- Fuel and oil for the motor generators
- Bentonite if working in dry areas and electrode drying is a problem
- Batteries - for GPS, possibly also for walkie talkies and genset starter batteries
- Clean 240V power for chargeing equipment and running computers at night time