

# Intermediate Survey Techniques (and in-cave blunder prevention)

*by Bob Hoke*

The following is an assortment of suggested in-cave techniques that will help a survey team do a fast, accurate survey. The tips only cover the setting of stations, reading the data, and recording it in the survey book. The art of sketching is beyond the scope of this paper (and of the author).

We assume that the reader has been on at least one survey trip and has a general idea of how a survey operates and how to use a Suunto compass and clinometer. Bruntons appear to be a dying breed and are not covered here.

This paper was originally written as a handout for a cave surveying class to be offered in West Virginia in 1996, but the class never materialized. The paper was presented at the 1997 NSS Convention in Sullivan, Missouri, and some minor revisions were made following the presentation. It is intended only as a guide and is not a tutorial in cave surveying.

ny reader interested in more detail should read *On Station*, by George Dasher. If any of the hints presented here are contrary to the conventions used on your project or in your part of the country, then feel free to choose whichever technique works best for you.

## 1. SETTING STATIONS:

- The sketcher determines the length and general placement of stations.
- Properly placed stations have major impact on survey team efficiency.
- Try to put stations on prominent features whenever possible.
- A sure way to get a feature on the map is to put a station on it.
- Avoid stations on flat walls. They are usually hard to shoot from.
- If you want a station on the floor, build a cairn to get it up at least 8 inches.
- Make sure the station is at a reasonable height for instrument person.
- Avoid very long shots. They reduce accuracy and make sketching difficult.
- Make sure the station is easily usable for both fore and back shots.

## 2. MARKING STATIONS:

- Be discreet in marking unimportant stations. Carbide is distinctive and lasts for years. Lumber crayon is good for rock (not mud) and lasts 2-3 years (something seems to eat it).

- Rock cairns may be appropriate in some cases (but are subject to disturbance).
- Formations are usable as stations, but don't touch or mark them in any way.
- Flood prone passage may require a small hole in a rock or other trick.
- Leave obvious, bomb-proof stations where tie-ins are likely later (side leads, etc.)

### 3. READING THE NUMBERS:

- It is more important to avoid blunders than to get super-precise instrument readings. (This is an opinion that may not be widely shared).
- Calibrate your instruments before (and after) each survey trip. Set up a couple of known shots near the cave for references.
- Always do backsights!! The exception would be in short dead-end leads or fly (or splay) shots.
- Backsights should usually agree within 2 degrees (although some projects go for 1 degree).
- Take readings in a consistent order - usually distance, azimuth, inclination, LRCF. This helps reduce the human error in data recording and makes it easier for the sketcher to stay focused on the sketch.
- Use only one eye to read the compass (some folks use two eyes, but this may introduce errors).
- Verify that your glasses, lamp, flashlight, helmet, etc. are not magnetic. Warning: most alkaline batteries contain steel and cause compass errors.
- Be sure the compass is level. If the reading does not change when you rotate the compass it means you are not level.
- Read the correct compass scale. If your party is recording corrected backsights be sure to read the upper scale if you are shooting a backsight. Read the correct clinometer scale (the one closest to the window). If in doubt, point the inclinometer straight down. The side of the scale which reads -90 is the one you want to read.
- Read the correct direction to get fractional part of tape reading.
- Know where the correct zero point is on the tape.
- Avoid tapes with 1/10 foot and inches on opposite sides of the tape. You will usually read the wrong side of the tape.

### 4. RECORDING THE NUMBERS

- Keep the book clean (in your coveralls, in your mouth, whatever).
- Record "+" or "-" for every inclination shot.
- Repeat readings after you write them in the book (not before).
- Put a decimal point in every recorded number. Include a 0 if there is room (25. or

25.0 instead of 25 because a speck of sand could make 25 look like 2.5).

- The book person should do a sanity check on the readings as they come in.
- Keep the instrument readers honest. (The sketcher should do this too).
- Tell the book person what type of instrument reading you are giving them (corrected/uncorrected foresight/back sight azimuth/inclination).

#### 5. PASSAGE DIMENSIONS:

- Whoever records passage dimensions (LRCF) can use a "body length" to estimate distances.
- When estimating passage dimensions, record what the map should show (not a tiny crack that is impassable).
- Passage dimensions should be taken perpendicular to the next shot. At the end of a passage they should be perpendicular to the last shot, but looking in the direction of the shot. (This may vary in your area, but be consistent).

#### 6. MISCELLANEOUS HINTS:

- Keep the instruments dry. They are not waterproof despite whatever their owner does to try to seal them.
- High angle compass shots are very difficult. Try to use a vertical shot instead. If you must do a high angle compass shot try to use the tape as a plumb line to shoot at, or stretch the tape between the stations and shoot along it.
- Some people let the tape tail along behind them, others spool it up after each shot. Use which ever method you feel most comfortable.
- Fly stations (or spaly) should have "F" (or "P") appended to them -such as a fly (or spaly) shot from XY25 to XY25F.
- Keep station names short and avoid names containing I, O, and special characters.
- When lighting a station, don't shine your light directly at the instrument reader.
- Try to have only one person talking at a time. It is very easy to miss or garble numbers when there is lots of background talking.
- Make use of geometry to make shots easier: You can always get far behind a station. Just line up the instrument, your station, and the distant station in You can take a compass reading from as far above or below the station as you wish. Be sure to stay directly above or below your station. You can go as far as you wish to the side of the station for a clinometer reading. Be sure to stay at the same height as your station. You can move away from your station if the person at the distant station moves the light the same distance and direction from that station. Make sure you communicate an exact distance.

#### 7. COMMON BLUNDERS

- Reading the wrong direction on the tape (up to 1 foot or meter error).

- Not holding compass level (random error).
- Reading wrong compass scale (book or sketch person should catch 180 degree error).
- Reading the wrong clinometer scale (typically 10-15 degree error).
- "Decade inversion" on compass - reading wrong direction (up to 10 degree error).
- "Decade inversion" on clinometer - reading wrong direction (up to 10 degree error).
- Dyslexia in writing the numbers in book (random, potentially nasty error).
- Failure to record inclination sign in book (random, potentially nasty error).
- Battery, glasses, or helmet has steel (5-10 degree error usually caught by backsight).
- Notes person records fore/back sights backwards (sketch should catch compass error).
- Illegible book - mud, erasures, lousy handwriting, etc. (random errors).