A Pines Survey Method

Most normal methods of surveying will still be used in some capacity. This brief is not intended to get too bogged down. It is an overview of another method.

Alternative Method
By Fred & Tom the cave divers
Fred who is blind in one eye, lost a leg in a car accident and has Alzheimer s, has put his hand up to help out in the Pines survey. He is the better half of the buddy pair. Tom for the most part lives on another planet.

After a simple introduction or brief on what they need to do they are off to give it a go.

In-Water
Tom & Fred swim to point A , they both write down the words; point A (this could be done for them)

At A they write down their dive computer depths, in this case is 3.8mtrs to the 100mm (This is a datum point marked by a square and will have a tag for correction. In this case Fred & Tom s depths are all reduced by 0.3 to match the datum. It is normal for diver computers to have a variation between any 2 computers and water levels can change from day to day. The datum creates a standard for depth over the full time of the survey)

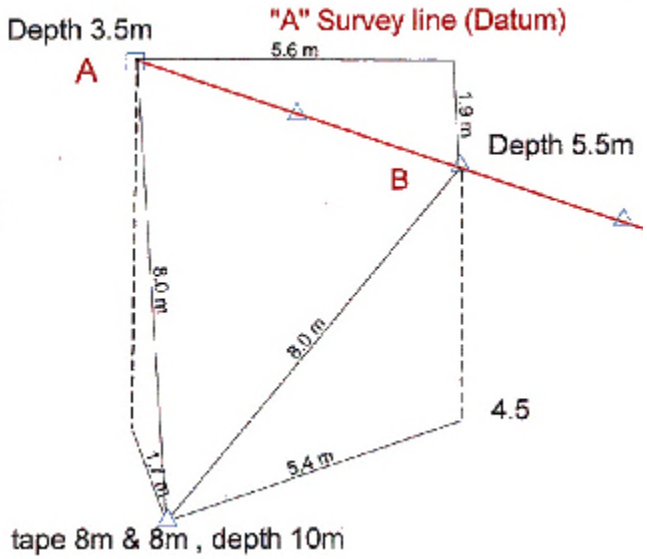


Fig 1

Next Tom clips a tape onto A and swims to C . Meanwhile, Fred swims to B and writes down the depth 5.8mtrs, clips his tape off and swims to C .
At C which is also a primary survey point they both read and write down the distance and depth Dis8 X Dis8 D10.3 to the 100mm

The guys have done well. They have just completed a survey to a grade 5. They can swim round the room and collect as many other secondary points as they wish. It makes life easier if they swim in one direction and write down what each point is; wall, floor, rock etc

No compass is required; they have just completed a mathematical triangulation to find and make a known point in 3 dimensional space. Sounds scary but even Fred & Tom could do it.

The error related to 100mm left or right, up or down over 8mtrs is less than 1 degree. To take a compass bearing would be pointless given the norm is between 2 & 5 degrees of error.

The Catch

The catch for this method: a tape measure cannot be less than 3 metres.
Otherwise the 100mm error factor has to be reduced to stay in a grade 4.
The survey is based on straight lines or line of sight, the longer the distance the better. Added, a dive computer also works with a 100mm variations in its read-outs.

So you must be religious about collecting dive computer depths and how you use it.
If Fred or Tom missed even one depth at a primary, then it s stuffed and that has to be accepted.
The crosscheck here is they both collected depths and distance to the same point.
There are many variations for this method on how you actually collect the data for solo divers to good buddy pairs to triples. Fred & Tom may like space therefore one leaves markers while the other picks them up for secondary points. It is the end result that counts.

How it Works

The key factor to this method of survey is the survey station points. Their location is based on skilled knowledge of how it all works. You may notice in figure 3 the B line is across the long axis of the cave.
The term Datum line in this case is a line between two points in which the compass bearing is taken in both directions. It is important to be somewhat fussy about this. After which the line can be removed between 010 & 012 known survey station points.
If the need arises Fred & Tom can re-add a line between 010 & 012 and make other survey points.

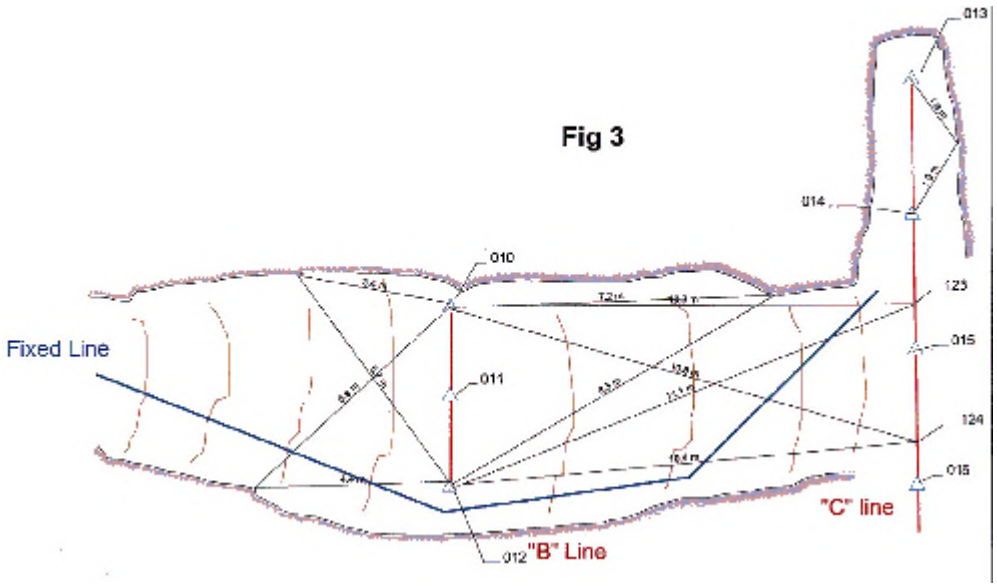
The C line requires no compass bearings. Fred & Tom have used triangulations to make it a known location and direction to within 100mm, but from line to line you would reduce the error factor. The C line was added to get round a corner or extend the survey.

The fixed line for the most part is meaningless the survey in this sample but you could into or plot the line, if needed.

Their is no limitation on survey direction. You go vertically above and below the line.

This method is suited to large chambers, long wide passages, vertical sections - the bigger, the better.

Fig 3



to

tap

can

For small caves, passages or sections (in reality anything under 5 mtrs in width & distance) other methods are better suited. It is not a be-all and end-all; no survey technique is.

In the Pines survey this method suits ideally for the main chamber and the CCR.
The link between the two sections will only in part incorporate some aspects of this method which is a point to point survey.
Meaning the actual survey stations go in before the lines, based on a 3 dimensional line of sight.
The skill requirement is more precise about where you put the survey points. It is not intended for Fred or Tom to do this.

Fred & Tom have done the dives; swum from point to point; collected the data as their part in the survey; that s all they had to do as part of the team effort. Really it is that simple.

The computer program does all the maths:
***Fig 1**; A, B, C are the known point in 3 dimensional space*
***Fig 2** gives the required line length changes for 2 dimensional drawing of point C*
From point A & B
***Fig 3** a sample survey map of a cave, (it only shows a few points)*