Introduction to Guideline Procedures Part 1: Equipment

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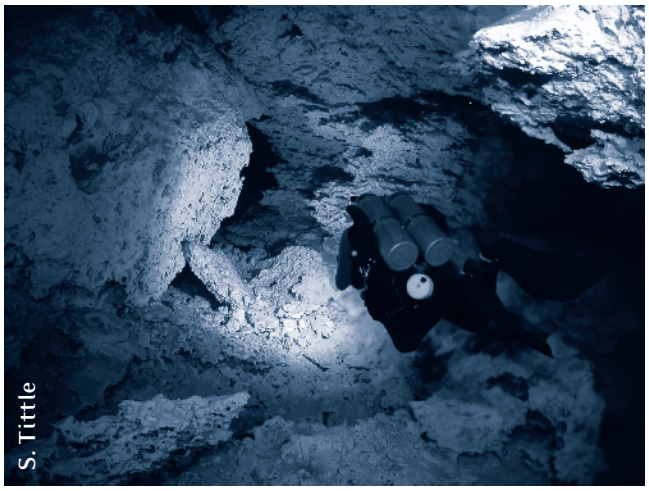
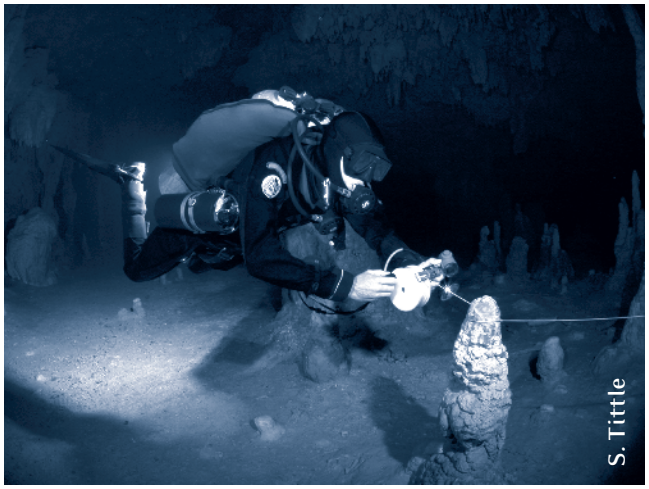
Accident Analysis is a central component of cave training and all students learn how it applies to both trained and untrained cave divers. Sheck Exley, in his 1979 booklet "Blue Print for Survival," first recounts and then assesses errors made by divers penetrating overhead environments. In one of these accounts, he discusses a group of divers who ventured only a short distance into a cave without a guideline, and never found the exit again.

Several months ago, three trained cave divers entered Cenote Mayan Blue, an opening into the Naranjal Cave System, in Quintana Roo, Mexico. Their dive plan consisted of entering tunnel "B," jumping to tunnel "E" and exiting tunnel "A." Though this dive requires the installation of two jump spools and two primary or penetration reels, this particular team decided they would not use any reels or spools. They consciously chose not to maintain a continuous guideline to the open water. Although these divers successfully completed their dive, if an emergency would have occurred, the outcome might have been different.

Many would find it hard to believe that "trained" cave divers would venture into an overhead environment violating one of the most basic rules in cave diving. Individuals who train for diving in overhead environments are all taught the value of maintaining



Cave divers should always maintain a continuous guideline to the open water



Diver reeling out

a continuous guideline to the open water; yet surprisingly enough some choose to ignore this vital safeguard. Why?

In most cases, continuous guidelines are not installed because of diver *overconfidence* and/or *lack of skill*. As cave instructors and guides, we often see divers struggling with guideline related skills. Such a lack of skill is often tied to diver training that is not only cursory, but also lax. A clear pattern exists between the Mayan Blue divers and divers who choose a fast, and sometimes neglectful, education.

To improve guideline use, nothing can replace proper training, practice and the right choice of equipment. It is only through education and then repetition that divers will be able to cultivate a skill-set that will become second nature to them, and one that will help them become both confident and proficient.

A properly installed, continuous guideline to the open water is crucial in assuring efficient navigation in a cave and to the open water, especially when teams are confronted with limited visibility created by light failures, restrictions, percolation, tannic acid, hydrogen sulfide, surge or generally poor water conditions.

What follows is the first of several articles focusing on the equipment, methods, and simple navigation of guidelines. We hope to provide divers with a broader view and clearer perspective of this insufficiently emphasized aspect of diving.

EQUIPMENT

To understand guidelines, one must first become familiar with the equipment involved.

THE GUIDELINE

Material

Nylon is the material of choice for guidelines. If it were to come loose, a nylon line will sink in the water. A line lying on the floor of the cave is much easier to follow than a line floating on the ceiling. For this reason, polypropylene is not an acceptable choice for a guideline. Nylon also resists the natural elements well and can be left in a cave for many years before any deterioration is seen. Cotton line, on the other hand, will quickly rot and break apart.

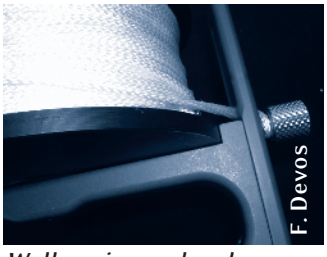
Weave

There are two general types of nylon line weave: *twisted* and *braided*. Although twisted line has a higher tensile strength, braided line is more abrasion resistant. It is therefore imperative that penetration reels or spools, with lines that are repeatedly being installed and removed from the cave, use braided line. For exploration in no-flow caves, twisted line has been used successfully. *Kermantle* line is a combination of the two weaves with a core of twisted line and a sheath of braided nylon. This has traditionally been used in mainline passages seeing heavy diver traffic, or training areas where lines could be put through a lot of use or abuse.

Thickness

Line thickness is generally measured in gauge. The number of threads a line has represents its gauge, therefore the thicker the line, the bigger the number it will have. For most applications, a 24-gauge, braided line will offer sufficient tensile strength and abrasion resistance. However, if abrasion is of great concern, some divers may prefer to use a number 36-gauge. At times, when abrasion resistance is less of a concern, explorers will install a high-tensile, thinner, 18-gauge, twisted line. However, beware of thinner lines, as they may not offer sufficient strength, and of thicker lines, which require needlessly large reels or spools. An additional concern with thick guidelines is that they can present a false sense of security and can coax divers farther from the line. This can lead to losing the line as

Types of guidelines



Well engineered reel

well as increasing the swath of damage caused by cave divers as they stray from the line.

Color

White is the most reflective color and is the leading choice for guidelines. At times, mainline passages, or commonly dived routes, can be distinguished by the use of other reflective colors. Some divers will also use a peculiar color for the line on their safety spool, so that during an emergency search for a missing diver or lost line, they know if they accidentally loop back to their own line. Keep in mind though, that color is only effective with good visibility and should never be used as the sole reference.

Knots

Explorers will often pre-tie knots on their line so they have a means to roughly measure and survey the passage they are exploring. These knots are usually at 10-ft intervals. The same procedure can be employed with safety spools, but with knots tied at shorter intervals. During an emergency search, this can allow a diver to know the distance they have traveled and to distinguish their own line even during zero visibility.

REELS AND SPOOLS

Proper training that allows plenty of time for practice is essential in the understanding and handling of vital equipment such as a reel… REEL… did we say REEL? For many, the word *reel* conjures nightmarish memories of training. A reel in hand is essential when otherwise good trim and perfect buoyancy control goes out the window.

Reel Components

Again, understanding the equipment is the first step in becoming proficient in its use. A reel consists of several parts.

- **Frame**

All reels have a frame, with an axle where the spool is secured, and a line guide. On the frame you can find the handle, which is ideally mounted on the side rather than the top of the frame. This provides for better streamlining and conforms to the use of a Goodman handle.

- **Spool**

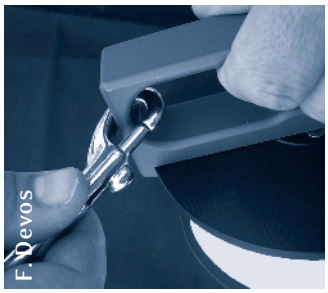
A spool is the hub where the guideline is wound. The size of the spool defines the amount of line able to be stored. Plexiglass spools are fragile and can easily break, while metal spools can be bent and hinder rotation on the axle. Metal spools will also sink faster if accidentally dropped. Delrin, on the other hand, is lighter and remains rigid, yet is virtually unbreakable.

- **Winding Knob**

The knob to reel in the line is found on the outside part of the spool.

- **Lock Down Screw**

This screw can be located on the side, front, or rear of the frame. This screw is used to hold the spool in place when the reel is not in use, thereby preventing line from uncoiling. It should not be used to adjust line tension. A screw mounted on the opposite side of the line guide is preferred, as it prevents line entanglement. The lockdown screw should not be made of nylon with threads that can easily be stripped.



Right way to clip reel

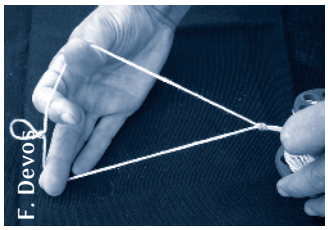
Wrong way to clip reel

- **Attachment**

Attachment of the reel can either be in the form of a bolt snap or a double-ended bolt snap. The use of a double-ender is preferred as it allows a diver to remove it while the reel is in use, thus limiting the places where the line can get trapped. If a double-ended bolt snap is used, make sure it is properly secured to the frame to avoid it being accidentally opened. A single clip, using a metal-to-metal attachment to the reel should be avoided as it offers no alternative if the action of the clip fails to open. Line catchers such as suicide clips or boat snaps, carabineers and other "gate action" attachments are not appropriate.

- **End Loop**

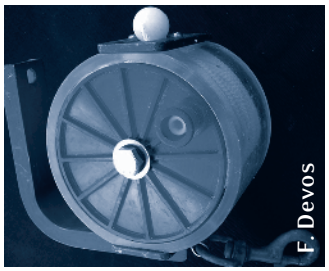
At the start of the line there should be a loop large enough to allow the entire reel or finger spool to pass through. A small loop should be added at the end of the main loop to make it easier to retrieve the line. With reels, a small marble attached to the end can prevent the line from spinning back inside the spool.



End loop

Types of Reels

- **Enclosed Reels**



Enclosed reel

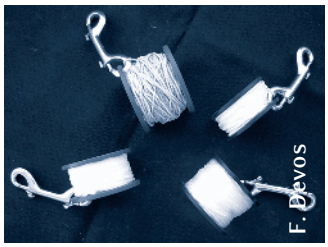
This specific type of reel has a plastic cover over the spool section of the reel, covering the line. The assumption here is that if the line is enclosed it will not get tangled. To some degree this is true, however unfortunately, if the line does become jammed, there is no way to fix it, since the line is inaccessible.

- **Open Reel**

This type of reel is preferred, as it allows for easy access to the line on the spool. Ideally, a reel will have the spool engineered close to the frame in order to prevent the guideline from spilling out and ultimately jamming it.

- **Finger Spool**

A spool has no moving parts, and is without a frame; as a result, there is no way to jam a spool. There are no knobs or other parts to break off or get entangled and it is low volume for easy stowing.

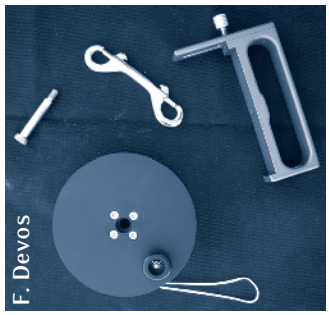


Finger spools

SELECTION OF REELS

It is always best to evaluate the amount of line needed when choosing what size reel or spool to use. Avoid using oversized reels, which are cumbersome and difficult both to manipulate and stow. Spools have the advantage of being simple, easy to deploy, and easy to both manipulate and stow. However, over long distances, winding the line back onto a spool can be tedious work. This is when a reel is more appropriate.

Reels and spools should be personalized with the diver's name or initials. Engraving the frame of a reel or the faceplate of a spool can ensure the reel is recognizable by touch during a blind exit.



Reel components

Reels and Spools can be defined by their purpose.

- **Exploration Reels**

An Exploration reel can accommodate as much as 2,000 feet of line. This is a specialized piece of equipment used only during extended exploration dives, as the bulkiness of the reel is impractical for day-to-day use.

Gate action clips

- **Penetration Reels**

A Penetration, Primary or Lead reel, is used for connecting a point of direct access to the surface with the beginning of a permanent cave line. A permanent cave line may be positioned a few hundred feet into an overhead environment and may require a substantial amount of line to reach it. A typical penetration reel will have anywhere between 300 feet to 500 feet of line. Only one penetration reel is necessary per team.

Metal to metal attachment

- **Jump and Gap Spools**

Jump and Gap spools are spools that are utilized to create a connection between two permanent lines. They commonly have 50 feet to 100 feet of line. This is too little line to use in emergencies and therefore cannot be used as a safety.

- **Safety Spools**

A Safety spool is the one piece of equipment that every diver needs to carry with them. It is used only in the event of emergencies, which could include: lost line, broken line, line entanglement or lost diver. One hundred and fifty feet of line is recommended and it is critical that a spool, and not a reel, be used for this purpose. A reel can jam and be rendered unusable, whereas the simplicity of a spool ensures its readiness at all times. Your safety spool should be secured in your bellows pocket, tucked away yet ready to be deployed in an emergency.