GEAR REVIEW - PULLEYS.
Chris Curtis.

I have been playing around with various types of pulleys in rescue and at home for many years, but never had the chance to try out a carabiner-pulley. These are a carabiner with a pulley built in. Like most pulleys, there are a lots of designs and brands to choose from (Photo 1).

Photo 1: Some of pulleys that are available. **Photo:** *Chris Curtis.*

I have some homemade nylon pulleys similar to the Petzl Ultralegere pulley wheel, which I made purely for emergencies as they weigh next to nothing at around 10 grams. The biggest problem with them is their efficiency is quite poor and they don't sit very well on an oval carabiner until loaded (Photo 2).

Photo 2: One of my homemade pulleys. **Photo:** *Chris Curtis.*

So, I decided to bite the bullet and purchase three Petzl Rollclip "Z" Screw-Lock pulleys. These aren't cheap compared to a carabiner, but they are still cheaper than a separate carabiner and pulley, and they are much more compact and lighter (Photo 3). Best of all they are barely any bigger than a standard carabiner (Photo 4).

I bought three of these Petzl pulleys because this enables a big range of uses for most situations. If I need more than three pulleys then things are getting rather complicated. The main reason for purchasing these pulleys is for emergencies/rescue situations. If I am planning on using pulleys then I can always take my normal pulleys as well.

Photo 3: The Petzl Rollclip "Z" Screw-Lock pulley. **Photo:** *Chris Curtis.*

Photo 4: A Petzl Rollclip "Z" Screw-Lock pulley compared to a standard carabiner. **Photo:** *Chris Curtis.*

Now that I have these pulleys I will also take them on canyoning trips, not just caving. They are very useful, and not just for emergency situations.

Some typical uses for them are:
- When hauling gear.
- On angled abseils/ascents.
- Tyroleans (Photo 5).
- Redirects.
- In a Rapid Ascent Descent (RAD) system (for use under the hand ascender) (Photo 6).

Photo 5: SSS member on a tyrolean traverse.
Photo: *Chris Curtis.*

Photo 6: The RAD system set up.
Photo: *Chris Curtis.*

Most people from my experience don't have pulleys. Pulleys seem like a luxury item or rather that they are not generally needed.

The other problems with some pulleys are their size and weight. Most people won't take them because they just add more bulk. Everyone likes to travel as light as possible. So it's not typically worth it, that is until things go wrong...

Once you need pulleys for any kind of emergency, their value becomes priceless.

Try to use a haul system without pulleys and you will quickly realise just how much friction there is and that heat can build up quickly in a carabiner.

You can't always rely on a large team of people for hauling either. Adding more people to haul, just to overcome friction, isn't smart.

Carabiners typically don't add much mechanical advantage (MA) due to friction, amounting to about a loss of 50%.
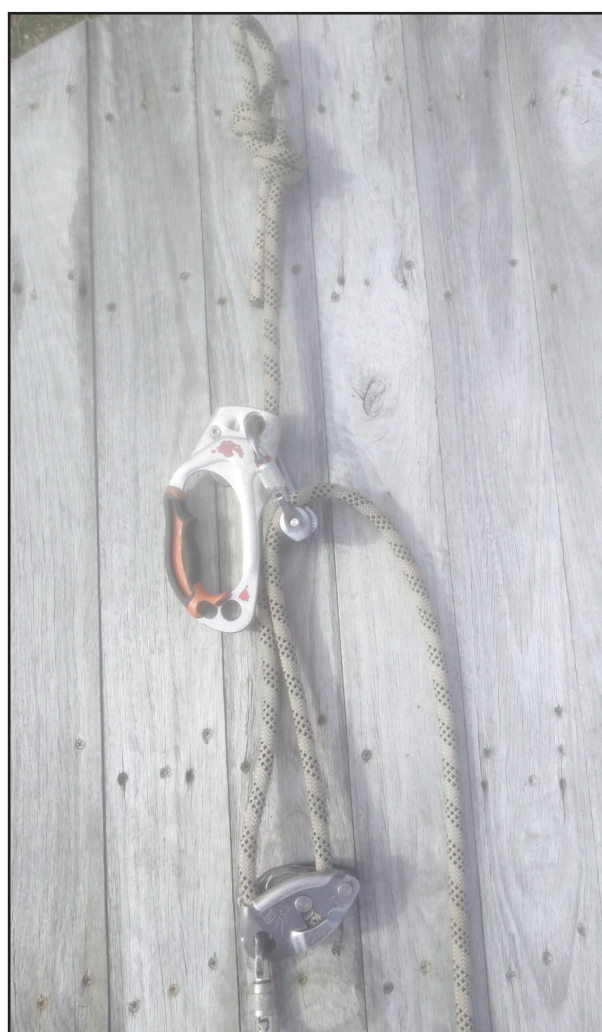
You can rig a three to one MA Z rig using only carabiners and the friction will put you back closer to a one to one MA. Add pulleys into the system and you are hauling with very little loss, only about 5% to 10% for efficient pulleys.

Some typical uses for pulleys in rescue are:
- Human, fixed & dynamic redirects.
- Haul systems.
- Counterbalance lifts.
- Stretchers on tyroleans (Photo 7).
- Pick offs.

Basically, if the rope rubs on a carabiner, rock or another rope, a pulley can be used to eliminate the friction point, in most cases. The more points of contact, the bigger the advantage becomes to use pulleys.

Other advantages of pulley carabiners are:
- They reduce gain. Gain is the distance from the top carabiner attachment point to the pulley wheel. This can be very useful when trying to get the rope or object being hauled off a friction point. (Photo 8).

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Photo 7: Pulleys in use on a stretcher movement. **Photo:** *Chris Curtis.*

Photo 8: Pulley type comparison.
Photo: *Chris Curtis.*

- They keep things simpler/less gear.
- There is less chance of errors.
- The rope running over the pulley wheel can be added while the carabiner is attached to its anchor. Most pulleys have side plates that require the pulley to be removed from the carabiner to attach the rope, which can make use more difficult. (Photos 9, 10).
- Less chance of dropping pulleys or rolling away on a tyrolean during setup.
- They prevent unnecessary wear on alluminium carabiners.

Photo 9: Standard carabiner. **Photo:** *Chris Curtis.*

In my opinion, every vertical trip, whether canyoning or caving, should have a small amount of gear for emergencies, just like taking a first aid kit or a spare light and batteries.

The gear can be spread out amongst the party so each person would only have to carry one item. Considering the weight of a full SRT kit plus ropes and carabiners for a day of vertical caving for a group of four people, a couple of extra items won't be noticeable. If you end up needing it, you will be thankful you have it. If you have it, you will find ways to use it.

What you would need for an emergency kit would vary, but a couple of pulleys, carabiners and slings would be sufficient to start with. With a little knowledge or imagination, it's surprising what can be done with a little bit of extra gear!

If you are looking to purchase pulleys of any kind and not sure what to buy, feel free to give me a call to discuss things in greater detail.

Specifics of Pulleys and Carabiners

Petzl Rollclip Z Screw-Lock pulley
- weight 105g.
- Efficiency 85%.
- Breaking strain 20kN.

Typical single pulley weight
- weight 100g to 300g.
- Efficiency 95% (approx).
- Breaking strain varies up to around 35kN.

Typical aluminium screw gate carabiner
- weight 50g (approx).
- Efficiency 50% (approx).
- Breaking strain 23kN.

JSSS

Photo 10: Pulley type comparison.
Photo: *Chris Curtis.*

SPELEO SCENE SECTION.

Photo 1: The Whaletail, Descender. **Photo:** *Ross Ellis.*