International Commission for Alpine Rescue

# Presentations Commission for Terrestrial Rescue

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| Place: | Toblach, South Tyrol / Italy |
| Date: | 19. Oktober 2023 |
| Time: | 09.00 |
| Present: | Delegates of the Commission for Terrestrial Rescue |
| | Delegates of the Dog Handler Subcommission (from 09.00 to 09.30, 14.30 to 15.00 , 16.30 to 17.00) |
| | Delegates from the Avalanche Rescue Commission and the Alpine Emergency Medicine Commission (From 14.30 to 15.00) |
| Chair: | Gebhard Barbisch, Kirk Mauthner |
| Minutes: | Fabienne Jelk |

## Search for Missing children – Humberto Hinestrosa / Colombia

The case of aircraft HK 2803, which crashed in rough terrain in Colombia, is presented. On May 1, a community leader and a mother with her four children were traveling with a Cessna U206G from Araracuara to San Jose del Guaviare. The plane took off at 06:42, was missing from 07:44 and was found on May 16, 2023.

From 12.44.44 (UTC) the aircraft was missing, the ELT (Emergency Locator Transmitter) was activated. The last radar position transmitted became the LKP (last known place). The first searches were carried out within a radius of 4 km around the LKP, after 10 days the search was extended to a radius of 30 nautical miles from the LKP. The LKP and the ELT signals were flown without success.

Subsequently, on May 13, 2023, the search was continued with the help of 3 analytical products. All arguments were scientifically based, not personal opinions and intuition. The three analytical products are then shown. Product #1 combined theoretical, statistical and deductive search methods. The analysis of information from different sources was brought together. The 2nd analytical product used theorems and mathematics to calculate the maximum distance and the most probable location. The third product worked with radar signals.



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When searching from the air, it is important to fly low and slowly and to search when the sun is at its zenith. Also look out for broken branches and conspicuous colors in the forest. The HK2803 was finally found by terrestrial based search groups.

The four children, aged 13, 9, 4 and 11 months, were still missing. It was unclear why they left the plane and in which direction they went. The main question was what decisions the 13-year-old child was making. The main part of the search was conducted in grid lines. Various items belonging to the children, such as a diaper, were found. The children allegedly followed their mother's advice to leave the plane. They had to find water. It was also possible that the eldest son was afraid of being punished for leaving the crash site and that the children were afraid of the helicopter noise. The search strategy had to be changed to a more dynamic search, which took a while. The children were found alive 3.7 km from the crash site of the plane. They were malnourished and dehydrated, but not critically injured.

Dogs were also involved in the search. One dog (Wilson) was never found after the search. He spent a few days with the children and then left them. He did not indicate that he had found the children.

Conclusions:

- Know your own abilities, ask for help.
- The same information can lead to different results, think critically.
- Like ELT, PLB's (Personal Locator Beacon) can encounter the same difficulties as case studies.
- What is the ability to locate a transmitting device or other RF (radio frequency) signals?
- Trust the technology.
- Trust the system.
- Use certifications. Only these will make the K9 teams a better search team.
- Vary the training. Would the dog have claimed to have found the target?



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Questions/comments:

*Why couldn't the dog be found?*

The dogs are not wearing a Garmin. The problem is the attachment to the collar.

*File: 20231019-02-Rescue International-Columbia-Presentation v1.pdf*

**Fast Rescue System 2.0 – Thomas Mair / BRD within AVS**

In the past, carabiners were more likely to break. There was no special equipment and you needed carabiners, ropes and slings. Then they used plates (Kong Full-Plate), carabiners, ropes and slings. The plates broke. Now we have the Fast Rescue System, which is shown in pictures.

It needs a solid anchor point.

The first rescuer is lowered down with an Alpine Tube and a Micro-Traxion. The Micro-Traxion is blocked as soon as the first rescuer is down. The first rescuer is blocked and the Alpine Tube is removed. The next rescuers abseil down with a Prusik. The stretcher is then lowered. The manual force is 40 to 50 kg, the maximum load 640 to 780 kilos, depending on the rope. The first rescuer is blocked by turning the Alpine Tube around. The sling can be removed. The stretcher is prepared for hauling up. The ropes are brought together and the stretcher is hooked in. The stretcher is pulled up. A 3:1 system (pulley) is installed for this purpose.

Questions/comments:

*Can the system be used for steep terrain?*

In steep terrain you need a different system, one that was used in the past.

*File: 20231019-03-Schnelle Rettung TERCOM.pdf*



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**4 Parallel Workgroups**

**WG1 – Rescue Vehicles**

**WG 2- Bolts and Pitons**

**WG 3 – Anchor Systems**

**WG 4 – Equal Load on Ropes – TERCOM REC0005**

The delegates can form themselves into four groups and discuss the relevant topic.

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**Prospective Study of Avalanche Deaths – a complete overview of the Rescue Chain - F. Albasii, L. Krebs, Drouhot, L. Richard, F. Jarry, F. Huot / French Group**

The medical database on avalanche accidents was created to provide an overview of the entire rescue chain.

The database has been maintained since 2014. Every avalanche victim who requires medical care on site is recorded. The data is obtained from hospitals, forensics and the state regarding environmental factors.

The mortality rate for avalanche victims is 27 percent. Various data is collected from the victims, such as their injuries/medical problems, severe trauma, non-severe trauma, hypothermia, lack of oxygen, no injury. The type of trauma, such as thorax, face, etc., is also recorded. Is the severity of the trauma caused in an avalanche accident comparable to a high velocity accident? This is not always the case. To answer this, the data is compared with other accidents, e.g. car accidents.

What else do you need to know? Cause of death (hypothermia, trauma, suffocation) and the influence of the environment (snow density, terrain, weather). In order to obtain better data, forensic medicine (CT scan of the body, autopsy, toxicology, biochemistry, pathology) is included in the deaths. Data on the snow, the position of the victim, the height of the fall and obstacles are also included.

The data collected will be used for prevention purposes. The collection of data is intended to improve quality indicators, gain knowledge and improve prevention and decision-making. The data collected can be used for training purposes.

*File: 20231019-04-Prospective-Study-Avalanche-Death*

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**Presentation – Workgroup Results**

**WG1 – Rescue Vehicles – Martin Gurdet**

A result can be presented, but no conclusion.

The vehicles are needed until the patient can be loaded into an ambulance and taken to hospital. In some cases, the patient is transported directly to hospital in an ambulance (60 percent in Bavaria).

In some countries, there are specifications for ambulances that are difficult or impossible to meet.

Transport of stretchers: Different opinions.

In some countries, the government is pushing the use of electric cars. The models currently available are not suitable for use in the emergency services. The problem is the range. E-bikes, on the other hand, are already in use. At the moment, technical development is progressing rapidly. The next steps are likely to be electric ATVs (quads) or snowmobiles.

Regarding the size of the rescue vehicles: on average, a rescue team consists of four people, with the other rescuers following in private vehicles. "The bigger the better" is not the case in the rescue sector when it comes to vehicles. Weight, legal requirements and the required driving licenses all play a role. Furthermore, the costs must not be ignored.

The industry does not support the limited possibilities in rescue services.

Positives:

Pick ups - allow the transportation of a variety of equipment

An ATV (quad bike) can be transported on a trailer over long distances and is very useful on site. It is suitable for all ground conditions (snow, mud and roads).

Car and trailer solutions make it possible to be flexible.

The use of Argo cats with 8 wheels and Defender (Landrover) is useful.

The technical solutions continue to improve - an example of a movable roof rack that allows easy access was on display at the exhibition.



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There are different vehicles for different situations.

The open exchange in the group was perceived as very positive.

*File: 20231019-05a-Workshop-Vehicles.pdf*

**WG 2- Bolts and Pitons – Chris Blakeley, Petzl**

Following the practical sessions on Wednesday a small discussion group with members from Scotland, Greece, Italy, Slovenia and the Faroe Isles met to share their views and identify any learning points or areas for further work.

The group outlined four key areas for thought. Each related in this event to anchor selection and placement, yet equally valid in many areas of urban and mountain rescue.

1) How does a technician gain expertise and become competent ? Technical notices, practical sessions and dedicated time.

2) How does a technician gain confidence with;

*Assessing substrate or natural anchors ?

*Anchor placement - drilling, cleaning, installation of the various types of anchor devices available - fixed and removable.

This can only come from effective training, use and understanding of the various anchors, and can be only assessed by the technician themselves - a great subject for some self guided learning.

3) How can we ensure the succession of proper information from more experienced team members regarding anchor selection and placement, to others who wish to learn. Avoidance of the « we've done it like this for 20 years, and we've never had a problem » and rather include an understanding of why we do it like this.

With relevant internal training or 'sharing' protocols, informal yet facilitated workshops can be very effective within established teams.

4) A really nice sentence from Miha from Slovenia; « Complete confidence in the anchors is a cornerstone of the entire rope rescue system » I appreciate very much this statement, as too often the anchors are quickly selected, placed, and often not reviewed as part of the



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'system check' as we concentrate our efforts on the system in front of the anchors.

We had discussions around removable anchors, ground anchors placed in soil or other ground types, strength of trees, other options such as vehicles, improvised anchors from tools, ice axes or similar.

Certainly there is scope for further work in conjunction with the « anchor systems » group, as the system chosen may depend on, or dictate, a particular anchor choice. These topics are inextricably linked.

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**WG 3 – Anchor Systems - Bernd Adler**

There is no favorite among the types of anchoring.

Redundancy:

- If an anchor point breaks, there should be redundancy.

- Triple anchors (three anchor points) should be used in rescue operations. An exception is made for fixed, solid anchor points such as large trees or rocks.

Distribution of forces:

- Anchor points should be placed in a triangle with angles of 60 to 90 degrees maximum.

- When using a triangle of forces, the additional force effect should be kept as low as possible in case an anchor point breaks.

- If you need a bound force triangle, it would be good if the connections to the anchor points can be adjusted in length.

Material for an anchorage:

- A minimum of 22 kN is required.
- Use locking carabiners.



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- Bolts:
    - At least 30 cm distance between the bolts.
    - Diameter expansion bolts: greater than or equal to 10 mm
    - Diameter of remobable bolts: greater than or equal to 12 mm
- For extending slings and ropes: Only use lockable, metallic connections.
- For shortening slings and ropes: use double or triple connections, do not use knots.

*File: 20231019-05b-TER-COM WS results anchor systems.pdf*

**WG 4 – Equal Load on Ropes – TERCOM REC0005**

South Tyrol Kong panels:

- Lightweight construction systems: It would be good to know the possibilities and limits with corresponding data (tests). You would need to know the compatibility with the other material.
- It is good to see lightweight systems.
- Belunese Hitch can slip if a rope fails; some management is needed.
- There is interest in setting up a working group on lightweight systems.

Harken winch with clutch:

- Weight can be an issue.
- Easy if you know the equipment and have good redundancy; redundancy means that there is no critical point where failure would have a catastrophic effect on the load.
- Sticks/stones can affect the pulleys.
- Questions whether the winch needs to be certified for life load? EU standards?
- There is interest in a working group for winches.



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Lightweight Dyneema system (also applies to other ropes):

- Emerging technology; numerous changes in rope selection in relatively short time due to limitations (knots, interlocking devices, cumulative damage).
- Falls into the category of lightweight systems.
- GOPR considers it as a system philosophy.

Austrian Mountain Rescue Organization:

- It is heavier if the winch and several components are used with a 3rd rope.
- Problem of anchor point separation if the anchors are too far apart. Concerns if the anchor points are too far apart.
- Equal pulling force on both ropes.

Dual-purpose rope system with two tensioned ropes (demonstrated with a Spanned Anchor technique):

- Can be used with purpose-built devices that have a proven force limiting capability or with component-based systems that also have a proven force limit.
- Ask for one operator for each device or one operator for two devices (Clutch, Maestro), each with rope tailing (backing up the operator) ( systems must be tested to prove that they can be 'rope tailed'; some cannot be). Both systems in use.
- Smoother with one operator, only one person for DCD command; possibly smaller space required for operation.
- Caution: Do not use one operator to opern the handle of the the devices a separate person to lower the ropes through the devices; One operator does both actions.



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Working group for lightweight construction systems.

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- Working group for winches.
- Working Group for Bolts/Pitons and Anchor Systems
- Good organization of practical day and working groups.

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*File: 20231019-05c-Workgroup-Equal Loading2023.pdf*

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**Alpine Rescue in Disaster Operations – Allesandro Alberioli / GDF**

The Guardia di Finanza has 21 bases in the Alps, 5 bases in the Italian midlands and 3 bases in the south. The S.A.G.F. is also responsible for mountain rescue. The division has been involved in various events and disasters such as earthquakes (in l'Aquila 2009, Emilia 2012, Central Italy 2016), avalanches (Abruzzo 2017), the collapse of the Morandi Bridge in Genoa 2018, the Marmolada glacier collapse 2022, the flood in Marche 2022 and the landslide in Ischia 2022. The skills that the rescuers have acquired in the mountains can also be used in these events and disasters.

A mountain rescue team was deployed together with dog teams and firefighters in the earthquake of February 6, 2023 in Turkey/Syria. The earthquake had a magnitude of 7.8. 55,000 people died and 100,000 people were injured. The operation was dangerous and difficult. Airports and roads were blocked and bridges collapsed. Practically all buildings, 70 to 80 %, had collapsed and it was very cold, down to -10 degrees at night. The population lived in tents. There were numerous aftershocks, which made work more difficult and endangered the safety of the emergency services. No food or other material could be provided for the rescue workers. The Turkish army only provided water and diesel. Cholera was rampant in the camp where the Syrian refugees were housed.

The search included a 7-storey building, which was completely destroyed. Eight people were missing, including two children. All those trapped were found, but were dead.

The teams were each made up of a team leader, two S.A.G.F. rescuers, including a dog handler, 2 firefighters and a paramedic.



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A search was also conducted at the Hotel Safron in Kahramanmaras. Five people were missing there. The search was very difficult due to the instability of the rubble. Five bodies were found.

Lessons learned:

The teams' strengths were:

- Task force was fast and light.
- Short chain of command.
- The team leader was free to take initiative.
- Use of K9 in the search for debris/corpses.
- Perfect integration of the fire department and P.C.
- Use of USAR/INSARAG procedures.
- Use of fixed-wing aircraft of the Guardia di Finanza.

What were the problems:

- Logistical problems due to weight restrictions on the aircraft.
- Lack of cooking facilities and lack of hygiene. There was a risk of an epidemic.
- Lack of supplies, only water and diesel were available.
- There were no vehicles or helicopters available to reduce the time needed to move within the area.
- Lack of mechanical means for excavation.
- There were communication problems due to different languages and cultures.
- Lack of veterinarians.

2023: Emilia Romangna flood

In Emilia-Romangna, 4.5 billion cubic meters of water flooded an area of 16,000 km2 from 1 to 17 May. This was an enormous amount, unprecedented and completely unusual for Italy.

There were numerous landslides, around 1000, in this area. The mountain rescuers were deployed in the landslides. The training is done in the



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mountains, but is standard for all rescuers who are also deployed in other regions and in civil protection.

Questions/comments:

Gebhard Barbisch reports on the mission in Kahramanmaras and in Turkey. They were able to bring people out alive.

*File: 20231019-06-SAGF-Turkey.pdf*

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**Design of Rescue Anchorages through the 10:1 Static System Safety Factor – Miha Kenda / GRZS**

First, the terms are defined:

SRL = Standard rescue load):

- Single Rescuer (Person und and Equipment) 100 kg, 1 kN
- Standard Rescue Load: 200 kg, 2 kN (Victim + Rescuer + Equipment)

SSSF = Static System Safety Factor

SSF = Element failure load ----------

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Estimated static load

Example of the calculation of the SSF for EN 1892 A rope loaded with SRL

$$SSF = \frac{22\ kN}{SRL} = \frac{22\ kN}{2} = 11 = 10{:}1$$

The breaking load of fixed points (anchor points), consisting of pitons and bolts, varies depending on the material and design. Semi-static ropes, nylon slings etc. are used as elements to connect the anchor points. The load-bearing capacity of the connecting element increases with the number of loops. Knots are also used as connecting elements. The breaking load of a figure-of-eight knot when using an EN 566 sling: 22 kN x 40% = 8.8 kN.



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Conclusions:

- Transverse loading of the bolts: Use anchor points
- Axial loading of the bolts: Use three anchor points
- When using pitons: Use a minimum of three anchor points
- En 1891 A semi-static ropes and EN 566 webbing slings: minimum two anchor points
- Anchorages in the rescue: can be built with Ø 7mm and Ø 8mm cord. As a minimum, build a triple anchorage.
- EN 892 Dynamic single ropes: build a minimum of three anchor points.

*File: 20231019-07-Kenda-Design of Rescue Anchorages.pdf*

**Strategies of Limiting Force in Rope Rescue Systems – Kirk Mauthner / Park Canada**

Shows the principles of how to minimize/limit forces in rescue systems.

The relationships between working load, maximum load and breaking strength must be understood.

Working load: Typical Forces acting on the rope systems when lifting, lowering or suspending rescue loads.

Maximum force: The worst-case event forces, such as an edge transition gone wrong.

Breaking strength: Force at which the components fail.

Working load: The tension on the rope is usually 2-3 kN. Various factors, such as swaying/jumping of the load, can increase the force acting on the rope (4 - 6 kN).

From a design point of view, the descender device should be able to withstand the force of a bounce of the load, which can double the static force (i.e. 6 kN) without slipping.



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From a design point of view, the descender should be able to withstand the force of an impact. Various component-based systems can be used to reduce the force working on the rope. It also depends on what kind of ropes are used. It is very important that the combination of the rope and the DCD (descender device) has a minimum grip. Other gripping ability, which should be equal to or greater than double the static load of the rescue load..

What is the worst thing that can happen during a rope rescue? A rope breaks and the load is only carried by another rope? This is not the worst case scenario. The breaking of a rope can only double the static force that was working on the broken rope and is now also working on the other rope.

The worst case scenario is a fall during a transition over an edge. The additional energy generated during a free fall can generate a multiple of the force required to arrest the fall.

The maximum arresting force is highly dependent on the type of rope used (static ropes, ropes with minimal stretch (low stretch), hyperstatic ropes) and the DCD (descender device). What is the preferred combination?

At international level, there are strict regulations for the maximum permissible force that may be exerted on a person. This is a maximum of 6 kN. The maximum force for rescue loads consisting of two people must not exceed 12 kN in order to comply with the limit of 6 kN per person. The combination of rope and descender device (DCD) must not hold more than 12 kN, but must not start to slip before 6 kN.

From a designer's point of view, the required breaking strength of a rope rescue system depends, among other things, on the maximum force to which it can be subjected and on how reliably this maximum force can be controlled.

The breaking force is calculated as follows: Max. Force (12 kN) x 1.7 Design Factor ~ 20 kN.



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Preferred force limit range for descender devices of rope rescue systems:

Load to be supported: 0 - 3 kN

Slipping force range: 6 - 12 kN

Breaking force: 20 kN

Questions/comments:

*What strategies are there to avoid the worst-case scenario of a fall factor of 1/3 (edge transition)?*

Just like in climbing, we do a lot to avoid a fall factor of 2. In mountain rescue, you should do everything you can to get into a fall factor Ø position, e.g. by placing your anchors above the edge transition. If this is not possible, you should use more rope and try to get below FF 1/5 as the forces decrease logarithmically. This is an important and crucial risk management strategy.

*File: 20231019-08-Kirk-Managing-Forces-Rescue-systems.pdf*

End of our Meeting: 18.00



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