



Gebhard Barbisch, ICAR Terrestrial Rescue Commission President

Kirk Mauthner, ICAR Terrestrial Rescue Commission Vice President



Workgroup: Incident Command System by Asgeir Kristinson (ICESAR)

Asgeir Kristinson from ICE-SAR presented a case study of searching for and rescuing two avalanche victims from the Vatnajökull Glacier, and used this example to discuss several aspects of their incident command system.

They have a software program which is used to share information about missions in progress in real time across the 16 regions. In many cases, such as this one, teams from multiple regions respond to a single incident. This program easily allows the incident command to track responding and available resources across the entire country.

They also have implemented a formal quality improvement method modeled on Deming's process improvement cycle. This includes the planning before a mission, executing the mission, and the after-action review. Then, changes are made to the plan based on that review, and the process repeats.

TER-COM 0007 Rope Differentiation: Static/Low Stretch/Dynamic Ropes by Kirk Mauthner

As with all ICAR Terrestrial Rescue Commission Recommendations, periodic review and updates are necessary. TER-COM 0007, first accepted in 1999, attempted to clarify the difference between dynamic and low stretch ropes used for rescue. Back then in Europe, low stretch ropes were predominantly white or black, making rope identification in the field much simpler. But now, with multi-colored, varied pattern ropes for dynamic, low stretch and static ropes being the norm, this recommendation attempts to assist mountain rescuers with easier field identification. UIAA 107 marked ropes have defined patterns assigned to dynamic and low stretch ropes, but this standard is not applicable to static ropes, which are more widely used in North America.

In the explanatory notes of the recommendation, it states that "Using a low stretch/static rope instead of a dynamic rope can increase the risk in technical rescue when it is necessary to absorb energy in a dynamic way (e.g. lead climbing).

The use of dynamic ropes in rope based rescues may introduce excessive stretch issues which can negatively affect control and increase impact risks when working with longer lengths.

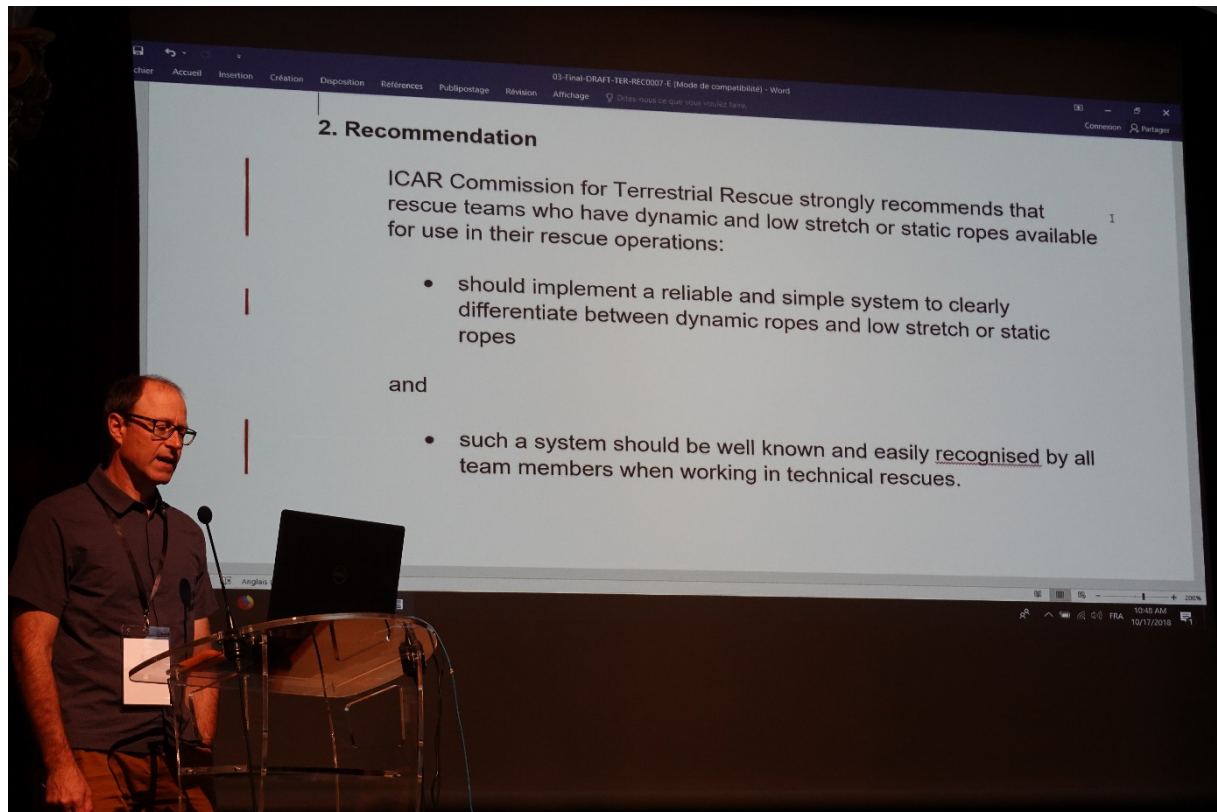
If the use of low stretch ropes certified to the UIAA Safety Label Standard 107 is possible, then this is a possible solution for differentiation and helps reduce errors in rope selection and inappropriate use."



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The final adopted language for TER-COM 0007, as presented by Terrestrial Commission Vice President Kirk Mauthner, is below.



Lightweight, Back-country Rope Rescue Systems by Richard Delaney (New South Wales State Emergency Service and Rope Lab)

Australian rope rescue and rope access expert Richard Delaney discussed some lightweight options for backcountry rope rescue, citing many of his test results and field observations as being the basis for his recommendations. This is something he often does for companies looking to develop fit for task justifications, and he then works with different manufacturers to create lightweight access and rescue options.

Stating that searches often become rescues or recoveries, which begs for searchers to carry lightweight gear, he presented prototype versions of some lightweight harnesses and edge kits. Many of these lightweight systems rely on dual tensioned, 8mm Technora-sheathed canyoneering rope systems.



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Using a titanium Conterra Scarab backed up by a Petzl Shunt, he played a video demonstrating that two young boys can safely and efficiently lower and then raise a subject using a dual tensioned rope system.

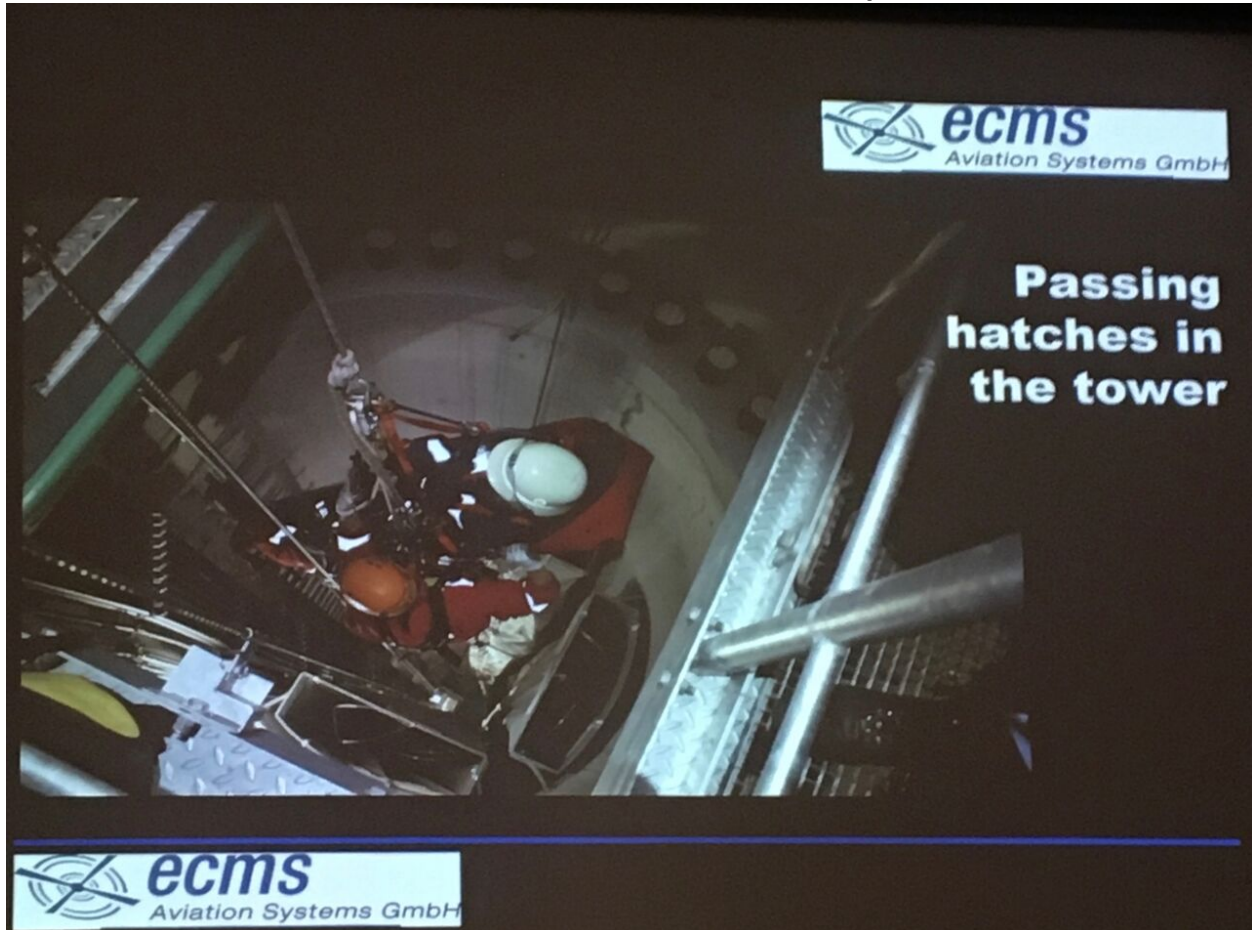
Delaney (seen below testing out a new descender on the Practical Day) also stressed that though lightweight options are not for use in every scenario, their use should be considered when appropriate, provided that all components are compatible.



Rescue from Wind Turbines by Charley Shimanski and Axel Manz

Rescue from wind turbines is a specialized field in rescue, with specific and unique problems. The industry is growing rapidly, resulting in an increasing number of these structures, which are often more than 150m in height, located in over 90 countries.

Several practical problems specific to wind turbine rescue were discussed. If lowering a patient inside the structure, there are hatches as narrow as 60cm in diameter that have to be negotiated every 25m. For efficient evacuation, this requires a system that allows the litter to be easily pivoted to a vertical orientation to pass through each hatch. The presenter's preferred solution is to use a sked rigged with either an Aztek haul system on the foot, or a pre-rigged rescuer counterbalance technique. This team actually routinely practices the technique using a simulated hatch in their training facility.



Helicopter hoisting is frequently used to evacuate injured patients from the top of a wind turbine, though that also has a specific set of risks. The turbine blades can cause air turbulence and radar signal disruption, which can affect the ability of the aircraft to safely perform the task. Because of the safety railing surrounding the platform, litter tag lines are avoided if at all possible. A short haul technique or using a rescue hoist bag with an integrated anti-rotation air brake is preferred.

Resero Whistle Rescue by Dmitry Gavva Resero

The Resero Whistle is an app based cell phone system that helps aid in backcountry searches and avalanche rescue when GPS is unavailable. The system notifies nearby rescue teams who have the app. Also pre-established emergency contacts are notified when an emergency occurs. The waterproof unit is simple to operate, and the battery lasts for one week. Production models available next winter. The search units can be deployed with helicopters or drones, with a 15-30m range. Though the retail cost of each unit is similar to that of InReach and SPOT units, the monthly subscription fees will be less (around 30 Euros).



Glacier Cave Rescue by Eddy Cartaya (NCRC)

The National Cave Rescue Commission (NCRC) was founded in 1979, and joined ICAR this year as a B2 member. The NCRC organizes and provides rescue training and individual certification, maintains equipment caches around the country, and develops pre-plans for cave rescues of all types in the United States. This presentation focused on the issues specific to rescue in high altitude glacier caves in the Pacific northwest.



Climate warming has resulted in glacial changes which affect rescue in various ways. The entrances are often unstable, often with associated significant rockfall hazard as boulders melt out of the ice. The caves themselves are changing quickly, mandating that pre-plans are updated constantly as the underground maps from only a few years ago may already be out of date.

Problems specific to this type of rescue include running water, reduced visibility from steam and fog, and dangerous underground gases which require use of special monitors for hazardous air conditions. Missions are often prolonged, lasting longer than a typical mountain rescue; planning the logistic support for multi-day operations should be initiated early. Radio transmissions are difficult and unreliable, so wired telephone and radio systems are still the standard for reliable communications. The constantly wet conditions favor the use of mechanical devices over prusiks and other soft rope grabs. Glacial ice is under extreme compression, and can behave in different and unpredictable ways compared to the waterfall or surface glacier ice with which most mountain rescue teams are familiar.

A 3:1 haul system with a type of diminishing loop counterbalance system was also presented as a way for a small team to efficiently raise an injured subject out of a confined space such as a glacial cave.



Fatigue Influences the Search Strategy, But Not the Likelihood of Success of Well-Trained Avalanche Military Dogs by Alberioli Alessandro (GDF)

Since Avalanche Dogs and Handlers are represented as a Terrestrial Rescue Sub Commission, this study was presented as a part of the joint session. Citing an influence by the 2017 Rigiopani Hotel disaster as the impetus, this presentation studied the effects of fatigue on military avalanche dogs and their handlers.

A study in 2003 stated that panting dogs are less effective at avalanche search, so this was an effort to devise behavioral strategies to increase effectiveness in fatigued dogs and handlers.

Figuring ways to combine rest with speed to get best results for military avy dogs was the goal for the 13 mixed breed SAGF dogs in this study.

The search area was a 25x25m field, and video was taken to gauge positioning of dogs. All were given heart rate monitors, as they were tasked with finding a scent article buried 1 m deep. The average was 15 minutes to find, then the dogs were vigorously exercised and tested again.

RESULTS: Fatigue rose for both dog and handler, but did not affect likelihood of success, whether rest was used or not (though it did affect how they searched-head down versus head up).

Backcountry SOS by Stephanie Thomas (Teton County SAR)

As part of their Backcountry Zero project, the TCSAR Foundation worked with Teton County SAR to address a common problem with lost parties; an unknown location and a low cell phone signal. It can be downloaded for free, and needs to be pre-installed to work in the field. If in trouble, the screen will prompt you to select one of 3 status buttons: lost, injured, or “life-threatening.” It then pre-fills your coordinates from the phone’s internal GPS, and will send this message out to Teton County 911. The team can then first ascertain if the requesting party is in their response area, and either refer to the appropriate agency or start initiating a SAR response if indicated.

Satellite Apps for Mountain Search and Rescue by Fredrick Bendz Aarrestad (EURISY)

Eurisy is a facilitator, catalyzer, advisor and matchmaker, acting collectively to bridge space and society. Stating that satellites are currently being used for navigation, communication and earth observation, Aarrestad listed the challenges and opportunities that exist for satellite-based app use in the Alps. He strongly recommended that we should make location sharing on phones and GPS units a Euro standard, establish common data standards to allow team coordination, support a community of end users and implement compatible solutions to better serve SAR in Europe.



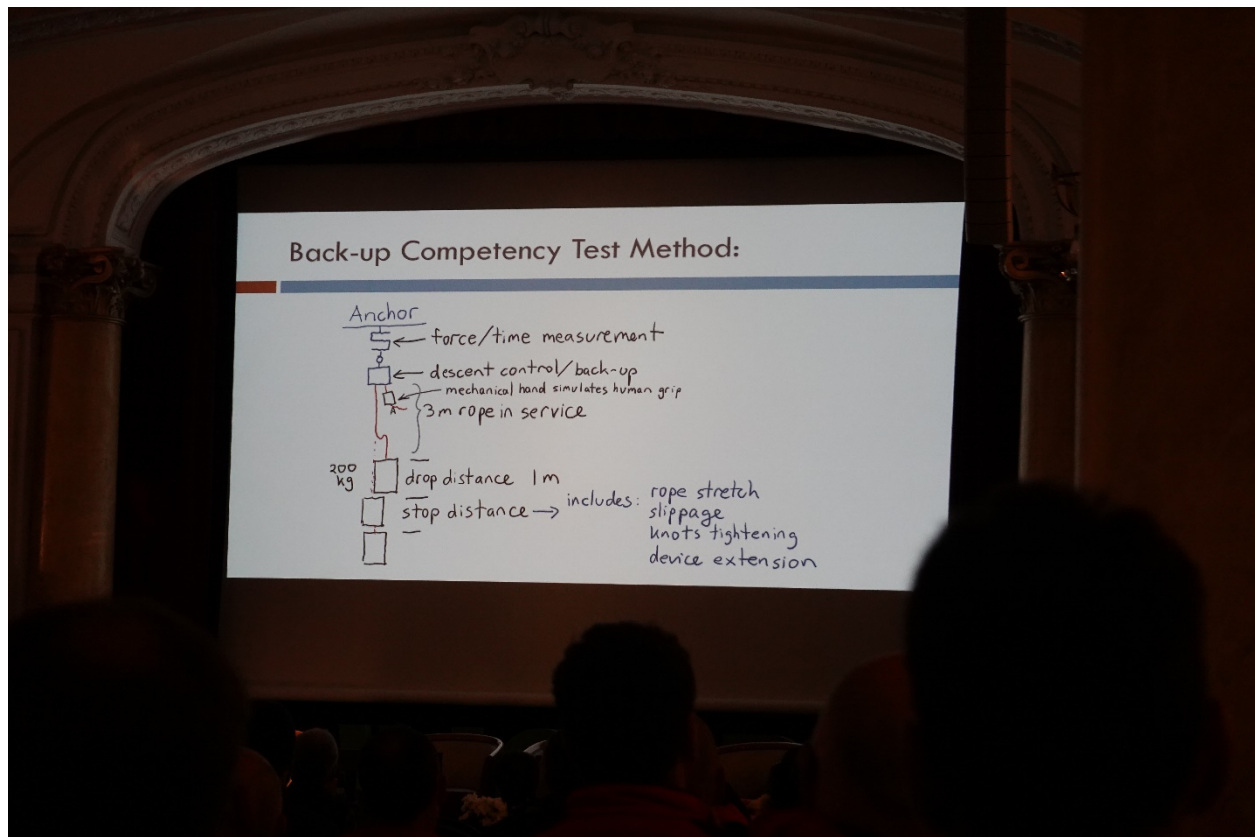
Performance Criteria of Rope Rescue Systems- A Canadian model by Kirk Mauthner

Mauthner discussed a 2016 nationally funded re-evaluation of technical rope rescue techniques and practices in British Columbia that differed from the UIAA dynamic component test method. The BC study focused on the system, not a single component, to best determine performance criteria for rope rescue.

Stressing that all rope rescue be comprised of two-rope systems, Mauthner discussed the performance criteria that should be established for each of the two ropes. Mainline criteria included the overall capacity, self-braking capability and limited rope twist. The backup line criteria focused on maximum peak force, maximum slip forces, post-fall functionality, minimum strength criteria and human factor influence.

Mainline system criteria needed a working load of 4kN and addressed the worst-case scenario of a 1m fall on 3m of rope.

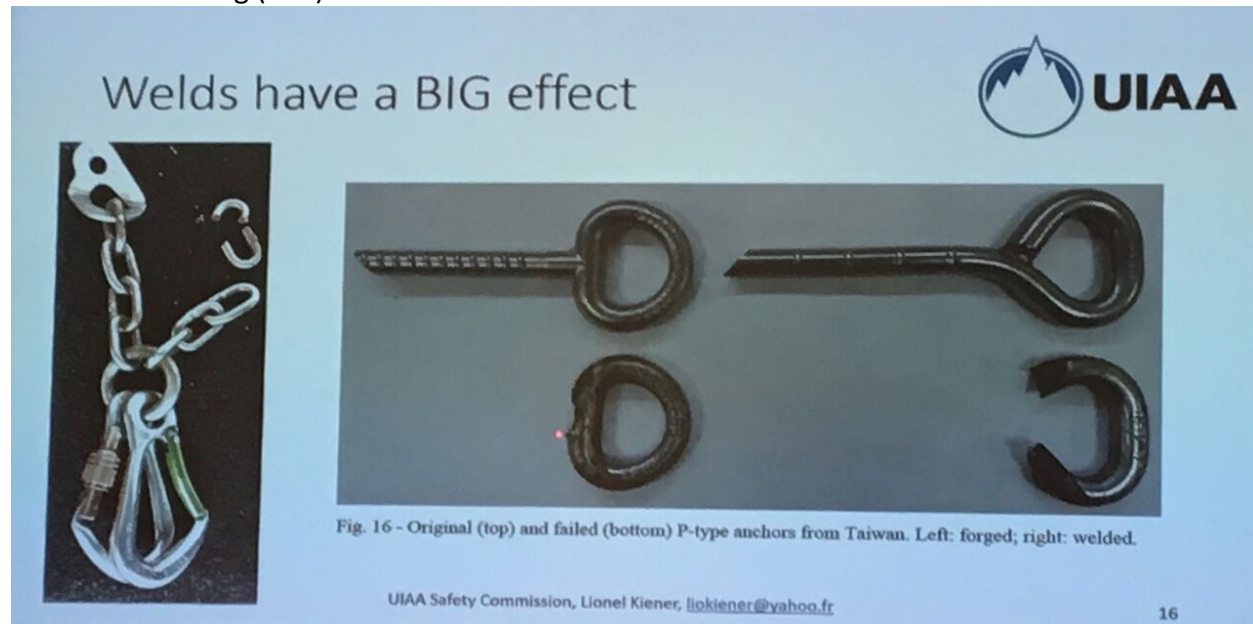
The backup competency test method limited the maximum arrest force of 12kN or less, a 20kN overall system strength, a maximum slip force of 6kN, have post-fall functionality and yet still hold 80% of its original capacity.



In line with ICAR TER-REC 0005, Mauthner recommended the Dual Capability Two-Tensioned Rope System (DCTTRS). The test results for DCTTRS validated data-based comparisons of both static and low stretch rope systems and identified where improvements could be made in both.

UIAA Safecom Bolt Testing by Lionel Kiener (UIAA)

The UIAA issues equipment standards with recommendations for use. This presentation discussed the effects of corrosion on fixed anchors/bolts, summarizing the environmental characteristics that have been found to correlate with a higher incidence of problematic stress corrosion cracking (SCC).



These factors include high temperatures, proximity to the ocean, lack of rain, and limestone as opposed to other types of rock. A long-term SCC study in Thailand showed only that titanium anchors were less susceptible to this problem in that particular environment. The UIAA also discovered multiple instances of incorrect labeling and marketing of anchor materials.

Because of the complex mix of factors involved, the UIAA does not feel that it can issue a strong recommendation on the best materials and design for fixed anchors; inspect carefully, and back yourself up! The most reliable rescue anchor is the one you just installed yourself today.

ICAR Rescuer's Fatality List by John Ellerton and Iztok Tomazin (ICAR MEDCOMM)

This proposal was designed to establish an ICAR register for Line of Duty and training deaths for the dual purpose of analysis and memorialization. This would be done in the hopes that analysis identifies trends that could be corrected to save lives in future.

Though still in the early stages of development, they conceded that information would likely be uploaded via a dedicated website and a webmaster would report back periodically to a group.



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Not all uploaded information would be made public, confidential data would be used to complete analysis.

An ICAR panel would need to be established, and it would include representatives from all ICAR commissions. Both Ellerton and Tomazin stressed that this panel would need to tread lightly to respect those left behind. The MedComm will report back to the ICAR membership with more formal proposals in the near future.

40 Years of Mountain Rescue in Sweden by Marie Nordgren and Stephen Jerrand (SVEFRO)

Nordgren and Jerrand gave an overview of mountain rescue in Sweden, going back as far as 1718 to contrast the differences in clothing, tools and techniques. With long mountain ranges, extreme distances between population centers and a sparse population, Swedish mountain rescuers from both the police and volunteers face many challenges.



By conducting an accident analysis from a 40 year old mass casualty incident that left 8 dead of hypothermia in Jamtland, Sweden, many lessons were learned in regards to how hypothermia affects cognition. Also, the best gear in the world is worthless if inexperienced folks in the backcountry don't know how to use it.

Additionally, the need for psychosocial rescuer support is imperative, especially after mass casualty incidents. As a result, the Mountain Safety Council of Sweden now pushes a

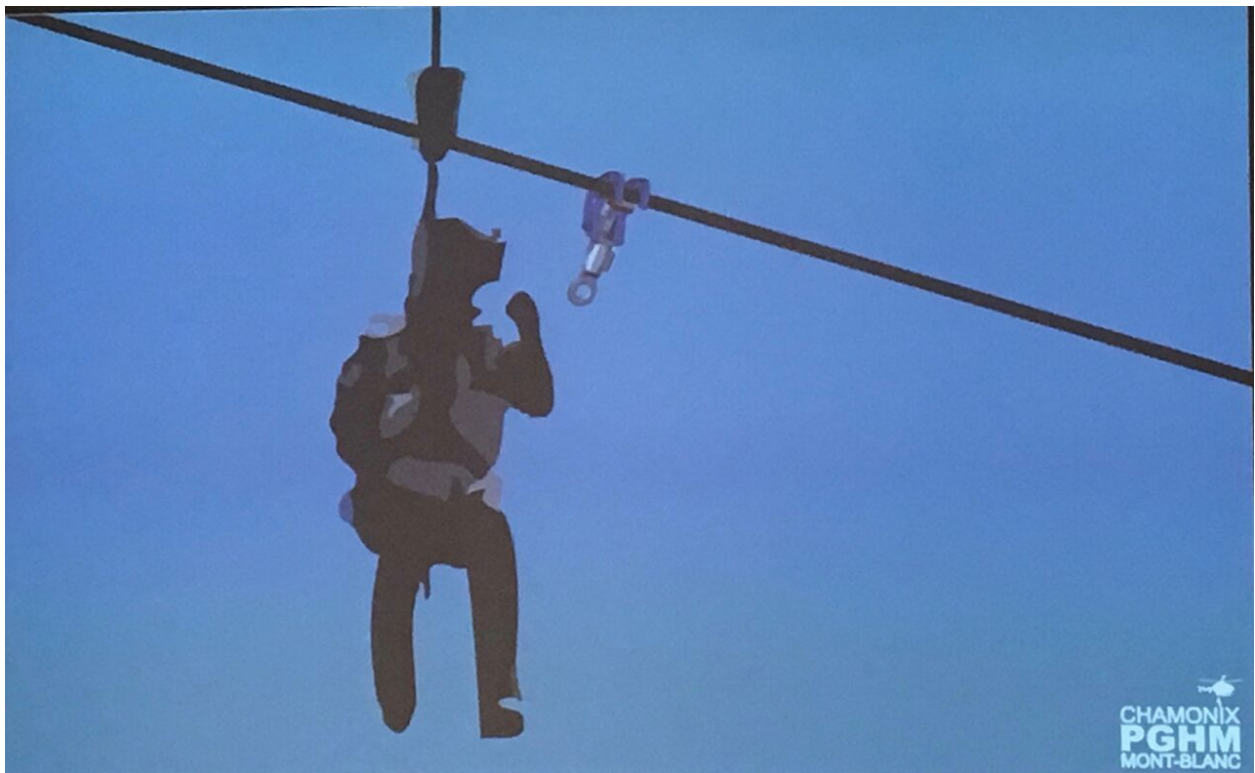


prevention message and has resources to better aid mountain rescuers before, during and after a call.

Cable Clamp Anchors by Remi Pellison (PGHM)

The Gendpac, a prototype cable locking device designed to assist with the rescue of paragliders entangled with cable car cables, will be manufactured by SMOP-Altim, a French company specializing in ski lifts.

Presented by Pellison of PGHM Chamonix (the French mountain rescue police), he noted that about 1,000 mountain rescues per year happen in the Mont Blanc area alone. He cited a 2013 incident with two paragliders entangled in a cable. Shown in a dramatic video, the rescuer had to anchor with dyneema sling attachment to cable from helo hoist to access the entangled subjects. This and other rescues have highlighted the need for a better solution. The prototype cable grab works on steep angled cables, and with weights under 2 kG. It only needs one hand for use, on 28mm cables up to 48 degrees. It provides a quick and secure anchor point mid-cable to allow for the rescue anchor needed to access the paraglider. Testing is still in the prototype phase at present.





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Work Safety Regulations and Consequences for Mountain Rescue by Herbert Streibel (Bergwacht Bayern)

Occupational safety regulations differ by country, and this was a discussion specific to the rescue team in Bavaria, Germany. Teams need to use rescue components that have been individually certified and can be tracked, and they use RFID chips to facilitate compliance with this regulation. Rope systems also need to be certified, and to get their specific dyneema rope system independently certified cost this team 7000 euros. These certification and tracking procedures are largely driven by insurance company requirements.

Because of these requirements, they strongly encourage their team to restrict improvisational solutions to emergency situations only.

Effect of Handheld Radios on Avalanche Transceivers by Illari Dammert (Mammut)

Although many US mountain rescue teams still primarily use analog VHF radios, there is an increasing shift to digital radio use. This study tested continuous transmission radios versus the newer TDMA (time division multiple access) radios, which are mostly the TETRA standard in Europe. In the US the TDMA standard is often referred to as “phase 2.”

The bottom line is that TDMA digital radios such as the TETRA standard in Europe cause significantly more interference at longer distances than conventional VHF or radios with FDMA signals.

User Stein Moller from Norway noted that they found last winter that headlamps caused a lot of interference problems. Interestingly the issue was seen less at high power settings, likely because more energy is going into light production and less into creating an electromagnetic signal that could interfere.

Hut Based Remote Controlled Systems for SAR by Oceane Vibert (La Chamoniarde and PGHM)

Like a lighthouse for climbers trying to find a hut in bad weather, this newly implemented system in the French Alps’ hut system was a joint effort between the volunteer SAR unit La Chamoniarde and their PGHM counterparts.



Utilizing a radio system dedicated to mountain rescue near Mont Blanc, this system, is installed in huts like the Vallot Shelter. Built in 1938 at 4,362m, this unmanned hut is on the route up Mont Blanc and is a likely spot to go when visibility is poor (4362m). In the past, fatalities occurred within dozens of meters of the hut because climbers couldn't find the shelter in severe weather. The radio network is both analog and digital capable and is controlled from PGHM HQ. This system has operated in 17 huts and shelters since 2016, is solar powered, has a snooze mode in winter and can both listen and transmit.

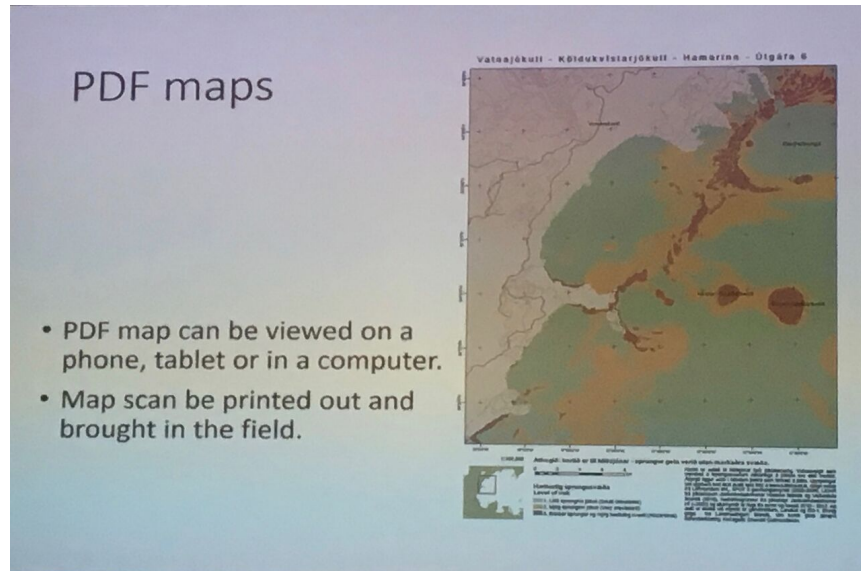
The red blinking light and LED siren can be triggered remotely by PGHM and is visible from 80m. Each unit in the hut has USB ports for phone charges.

Though not highly advertised for fear of making the public too reliant on the system as a primary means of navigation in poor weather, the system has been used 10-20 times per season and saved two people lost in storms last August.

Iceland Glacier Crevasse Mapping Project by Agust Por Gunnlaugsson (ICESAR)

This glacier mapping project was initiated after a jeep tour incident in 2010 which killed one person. Driving tours are popular on the Icelandic glaciers, and climate change and volcano eruptions are resulting in more open crevasses. Most travelers have little or no knowledge about the crevasse hazard, and do not possess the skills or equipment to rescue themselves if an incident occurs.

Using aerial and satellite mapping techniques, more than 97% of the 11,000 square km of glaciers in Iceland were mapped. The most important tool was a digital elevation model created by using an aircraft mounted laser scanner to accurately document size and location of crevasses. Safe travel routes were then overlaid in an ARC-GIS system, and hazard areas classified into regions of lesser (green), moderate (yellow), and high (red) danger.



These glacier hazard maps are now available to anyone for free. Multiple formats are available, which was presented as being the key to reaching as many user groups as possible. Formats include printable PDF as well as downloadable version for handheld GPS and smart phones. Contact agust@vedur.is for more info.

Accident Prevention in Outdoor and Indoor Rock Climbing by Sylvie Viens (FFME)

Presented by the French mountaineering and rock climbing association, this presentation studied the accidents and fatalities of their members and explored potential ways to reduce accidents and fatalities of climbers through better education.

Though rock climbing (in both rock gyms and outdoors) had more accidents than skiing, canyoning or hiking, it had fewer fatalities than mountaineering, according to their statistics. Interesting to note was that on average, at least one fatality per year occurs in French rock climbing gyms. Additionally, they discovered that experts were more prone to accidents or fatalities than new climbers and bouldering accidents are on the rise.

Typically, human error and poor anchor selection were to blame for the majority of the accidents that were studied.

To help curb future accidents and fatalities, FFME has developed some illustrated safety rules which are disseminated in flyers. Not just for climbers, their public education efforts also targeted those who train new climbers, those who build indoor climbing walls. Created with the help of other safety specialists, their publications include famous author Christian Morel's book, "Les Decisions Absurdes II".



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Their work with behavioral science experts helped to determine the most effective ways to address common mistakes climbers make and reduce human error factors.

Visit www.ffme.fr for more info.

Accident at Wildgerloskees, Martin Gurdet, OBRD

This report described an accident on Mount Gabler in the Zillertal Alps near Salzburg, in which a roped team fell on an icy section resulting in 6 deaths. With global warming the standard route now has increased rock fall danger, and often has less snow than in past years. The section of the normal route where the accident occurred was very icy, resulting in the team's inability to arrest the fall of one member, which then pulled the rest of the team off. It was mentioned that the climactic temperature increases are affecting Austria more than the worldwide or even the European average.



It is also important to point out that using a different risk management technique may have been able to reduce the likelihood of such a tragic outcome. For example, if travelling roped together, using ice screws for a running belay may have been able to prevent such a long fall.

Avalanche Situation in 2018 by Bruno Jelk (KWRO)

In describing 2018 as an unusually heavy snow season near the Matterhorn in Zermatt, Jelk highlighted many of the strengths and weaknesses of municipalities that were put to the test when avalanche danger made travel in and out of cities impossible for days on end.

In early 2018, two massive snowfalls loaded up the 34 chutes above the main road in and out of Zermatt. Up to 10 of these channels meet at a single intersection above public transportation lanes, forcing city officials to close all roads for days.

Each canton in Switzerland has a municipal avalanche plan, with infrastructure in place to deal with the drastic weather changes initiated by global climate change. Avalanches were not the only danger to



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residents; mudslides, roof avalanches and power failures also happened as a result of the heavy snows and rains.

When orders to shelter in place limited resources in and out of each village, medical evacs took highest priority when air resources were able to fly. Businesses in avalanche paths had to close for as long as a month, and municipalities used heavy equipment to build snow dams to protect some businesses.

Adding to the frustration of disaster planners and rescuers, many people chose to ignore avalanche warnings, sparking the debate of unnecessary risks to rescuers.

Bondo and Guttanen, A Challenge For Rescue Teams by Theo Maurer

Following along with the theme of Climate Change, Maurer presented information on Bondo and Guttanen, two Swiss towns that were struck by massive mudslides and rockslides in 2017.

Guttanen is surrounded by 3,000m peaks. On 22 Aug 2005, mudslide triggered by heavy rain created a 25m ditch from the mountain and into town, displacing 500,000 cubic meters of debris in the flooded valley. Twenty-five construction workers were stranded by rains and mountain rescue was activated. The evacuation was terrestrial, with no casualties but the river path through town changed and massive structural damage to homes and streets in town occurred.



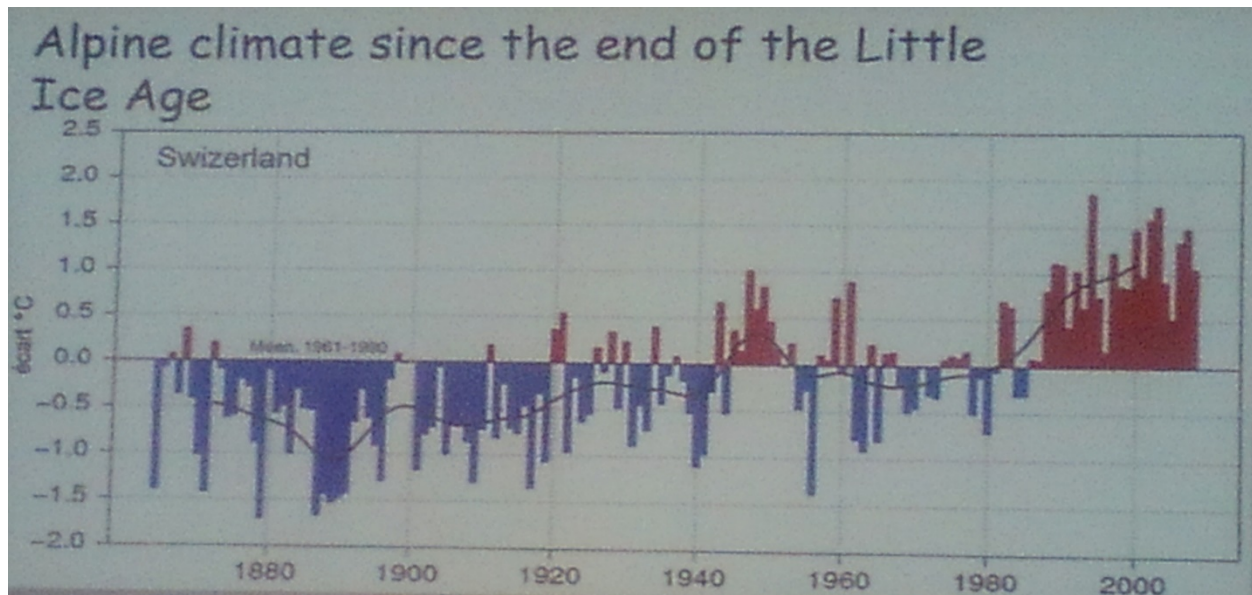
In 2017, a catastrophic rockfall event took place at Bondo, slamming into the town at 250 km per hour, surprising everyone since the rain had actually stopped days earlier. Twelve huts were destroyed, all in spite of the alarms that had been installed after a similar slide in 2011.

Eight hikers were reported missing after the rockslide and were never found.

The lesson learned from Bondo was that in large scale natural disasters, mountain rescuers must work together with other municipal agencies.

High Alpine Mountain Facing Climate Change by Dr. Ludovic Ravenal

In what was the most relatable presentation in regards to the Climate Change theme, Dr. Ravenal presented data and photos that graphically illustrated the effects of global climate change on the Alps (see temperature graph below).



Since 1936, there has been an increase of 2.1 degrees Celsius in the Alps, and the Mer de Glace in Chamonix has retreated 25% since 1985. As a consequence, the glacier must now be accessed through a series of sketchy ladders, and many philosophical questions about human interventions on the Mer de Glace and other glaciers have been raised.

Climbing routes are rapidly changing since the 1980s, with more rock and less snow have increased the exposure and difficulty of nearly all alpine climbs. For instance, the Aguile de Midi has lost 35m of ice from its climb, making it a longer climb on steep rock instead of snow.

Huts in the Alps were originally built on permafrost that is now gone, destabilizing them significantly.

Glaciers have less snowpack but more ice now, making them more dangerous to climb. Crevasses are bigger, snow bridges more fragile. And with no permafrost on summit, more unstable rock comes tumbling down each year.

Ravenal noted that the ice that is melting now is 2,650 years old, and had photographic proof of the changes on the mountains.

Though we can't turn the tide of climate change at this point, Dr. Ravenal noted that we do have it within our power to change the way we work, play and rescue in the mountains.



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