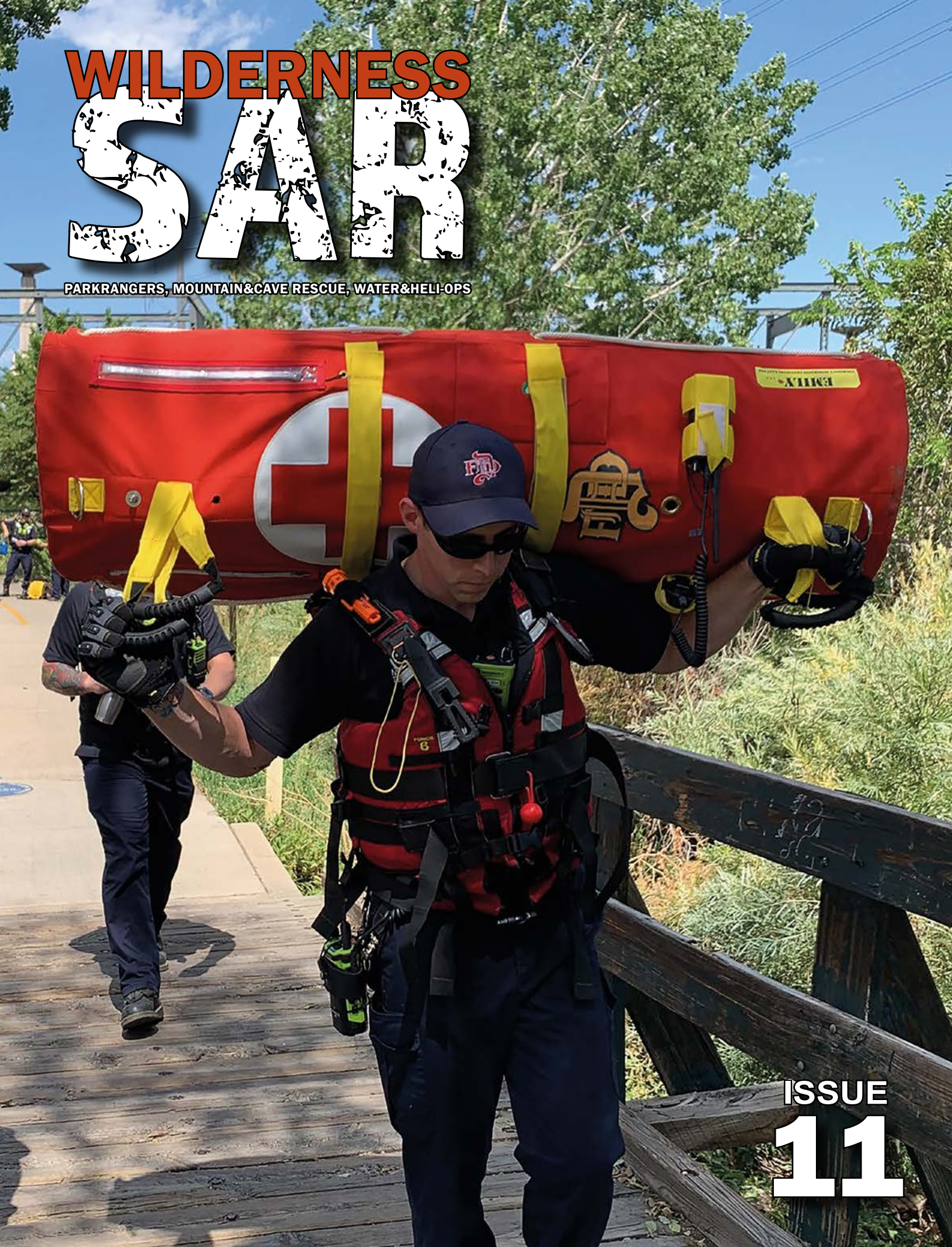
WILDERNESS SAR

PARKRANGERS, MOUNTAIN&CAVE RESCUE, WATER&HELI-OPS



ISSUE 11

www.rescuemagazines.com

WILDERNESS SAR

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RIGHT: Our veteran swiftwater team argue the case for avoiding risky live bait or throwbag-protected water entries by using remotely anchored, self belay systems. **p62**

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Hydronalix EMILY Water Rescue Drone

This issue's front cover features members of Denver Fire Department's Water Rescue Team 'hiking' to the water carrying the *Responder* version of the EMILY water rescue drone. This together with a colleague carrying a Pelican case with the command module is all that you need to perform a remote rescue without the need to commit any personnel to the water – something that would please our Water Rescue guru Dr Mike Croslin who is now on a mission to minimise rescuer exposure due to the number of water deaths in recent years.

The Beach version of EMILY shown in the main picture, is capable of breaking out through surf. It weighs only 11.8kg/26lb, has a speed of 23mph and can run for 14 minutes non-stop at full power – a lot more if you power down – that amounts to 5 or 6 miles in distance. It is robust enough to be hauled around all manner of obstructions before being unceremoniously thrown into the water. It is then controlled by shore or boat-based operators using this hand-held unit with a wheel on the side to finitely alter direction as it powers out to an in-water casualty to offer a series of handles and/or an 8ft rope all around its circumference which the casualty can hold onto while transported back to safety (pic top). EMILY has a line of sight radio-range so it can work several hundred yards/metres from the operator. It uses a jet-pump drive with what we're told is 'aerospace components' and ceramic bearings. There may well be occasions when an unobstructed but long-range route to an in-water casualty would benefit from a long tether, a thin floating line attached to one of the heavy duty D-Rings. Below is Beach EMILY's optional 800ft/244m line and reel. This might increase drag and decrease operational range but it does give you the option of using all available power and range to reach the casualty and then resort to manual hauling retrieval.

Equally if there are concerns of EMILY moving out of radio-range this also offers a means of recovery. Careful choice of cord and expert line management can make this an asset in expanding EMILY's capabilities. There are several different versions and complete kits including tactical/law enforcement and swiftwater EMILY which is shown below with PFD and helmet for the casualty to put on and a radio mount so that you can establish direct communications with the casualty.

BEACH RESCUE EMILY SPECIFICATIONS

Weight	11.8kg/26 lb
Height	35.5cm/14 in
Width	35.5cm/14 in
Length	127cm/50 in
Positive Buoyancy	68kg/150 lb
Orange Flag	122cm/4 ft
Speed	23 + mph or 20 + kts
Duration	12 – 14 min full power (approx 70 – 100 rescues at 91m/100 yrds)
Battery Operational Range	>8km/5miles at full power, >9.6km/6miles at slower speeds
Perimeter Grab Rope	240cm/8 ft

- Custom Labels
- Waterproof Internal Modular Components
- Three D-Ring Tow Line Attachments
- Jet Pump Drive made of Aerospace Composites and Ceramic Bearings
- Quick Change 240 WH Battery
- Four Ergonomic Grab Handles
- High-Grade Industrial Marine Fabric Float Cover
- Self-righting
- 1.2 KW Motor
- Fast Smart Battery Chargers
- Frequency hopping 2.4 GHz Transmitter Controller with 3 watt Amplifier

Website: **www.hydronalix.com**

CRIC integrated Ascender-Pulley

[ED: Bit of a pulley-cam-fest this issue with three hardware items from three of the five European hardware powerhouses – the smallest and lightest is Petzl's Nano-Traxion, the latest and tiniest of their superb Traxion series. CAMP seem to have taken inspiration from Kong's Duck and CT's RollnIock to come up with the TurboLock with its simple to use sprung gate opening and CT has the largest but versatile Cric offering what is virtually a conventional hand ascender with the benefits of a pulley and PCD. All great stuff.]

CRIC is due out in early 2023 and is a multifunctional rope clamp with integrated pulley for mountaineering, rope access work and rescue. Robust, practical and intuitive, it is a 4-in-1 device offering four different modes of operation: ascender, pulley, rope clamp/ pulley or progress-capture hauling pulley.

- ASCENDING the rope in accordance with EN 567 / EN 12841-B standards (ascender mode)
- a simple PULLEY for lifting or transferring a load in accordance with the EN 12278 standard (pulley mode)
- integrated ball-bearing sheave can be used as a simple REDIRECT to make it easier to ascend a rope or to lift a person without the aid of additional connectors (rope clamp/pulley mode)
- direct lifting of a load, the creation of HAULING SYSTEMS and the rescue or self-rescue of a person, as in the case of a victim fallen into a crevasse (progress-capture hauling pulley mode)

In PULLEY mode, the rope is free to run in both directions; when the hauling-pulley mode is used, the rope can only run in one direction and it is locked in the opposite direction. In PROGRESS-CAPTURE hauling pulley mode, it is possible to lower the lifted load by acting on the dedicated cord connected to the cam within the device. *CRIC* opens easily via an intuitive release button, making installation onto the rope swift – no matter the mode that is going to be used in – even with gloves on or while operating in difficult conditions. It is equipped with a steel cam featuring teeth that minimize rope wear but are effective in blocking the rope. In addition, the cam is designed with two slots to reduce the build-up of dirt, so maintaining the lock on the rope very efficient in any condition (muddy, frozen rope, etc.).Caution! This equipment is not a fall arrester (EN 353-2 / EN 12841-A) nor can it be used for self-belaying while climbing.

Wt: 140g/4.9oz
Rope: 8-12mm*
WLL: 4kN/900lbf as PCD
2x10kN (20kN/4496lbf) as pulley
100kg/220lb as ascender

COST: approx £86 />$100/€100

EN 567:2013	8 – 12mm
EN 12841:2006-B	10 ÷ 12mm
*EN 12278:2007	≤ 11mm

www. climbingtechnology.com

TEENY TINY...

[*ED: Petzl Nano-Traxion. You thought the Micro-Traxion was small! That is 95g with a 27mm sheave – this Nano is 53g with an18mm sheave suitable for ropes from 7 to 11mm so you could have a veritable swarm of these spread throughout your rope packs, water rescue packs and anything with a pocket including your dinner jacket. It's like a turbocharged Tiblock, maybe smaller than a set of bootlace prusiks?*]

Ultra-light and compact:
- hole allows a Sm'D carabiner to be connected to the pulley with a cord, making the device loss-proof
Designed specifically for rescue.
- sealed ball bearings provide excellent efficiency (91 %)
- locks even on frozen or muddy ropes
- rope installation diagrams engraved inside pulley
Sealed ball bearing sheave

MBL: 2 x 7.5 = 15 kN
4kN as PCD/Progress Capture Pulley
All-Black or Black/Gold
Cost: £60/$100/€76

www.petzl.com

SAR/Tactical Dog Camera

heliguy™ 's design team have created a bespoke dog camera, engineered for SAR, police and security/ surveillance personnel.

The high-definition camera is moulded onto a lightweight impact-resistant helmet which is worn by the dog. Footage, captured from the animal's perspective, is instantly transmitted to a screen worn by the handlers. It allows the handler to work behind the dog from a position of safety but still gain a picture of what is happening ahead in real time. The camera system is especially suited for Search and Rescue, USAR, building searches and firearms operations. Real-time search and post-incident footage can be viewed by the dog handler who can identify changes in the dog's behaviour as well as visualising the dog's line of sight. The dog cam helmet is made of impact-resistant nylon 12, while the nylon protective lenses are interchangeable, meaning they can be swapped with sunglasses to enable mission continuity in all weather situations.

Weighing 1kg, the camera and helmet have been designed to be comfortable for the dog to wear, while providing enough support to keep the camera steady.

The HD camera on the dog's head streams footage back to the handler or other team members, which is viewable on a 1080p screen. The camera has a range of up to 400m and a run time of up to eight hours. The video receiver is placed inside a pouch that can be mounted to a tactical MOLLE vest. The screen is also chest-mounted.

The dog camera was designed and produced in-house by heliguy™'s additive manufacturing, product development and prototyping department, heliguy™ Lab.

www.heliguy.com

PROGRESS CAPTURE PULLEY

Dims: 106x58x27mm
4.2x2.3x1"
Wt: 198g/7oz
Rope: 8-13mm
WLL: 2.5kN/562lbf PCD
2x2.5kN pulley
MBL: 23kN/5620lbf
Sheave: 41mm/1.6"
Eyes: 19 & 21mm
0.75&0.8"
COST: £
$140
€111

EN
EN 567
EN 12841 / B
EAC

The C.A.M.P Turbolock is a progress capture pulley designed to be exceptionally compact, robust and efficient. Specifically contoured for one-handed use. The locking mechanism for opening and closing allows the rope to be inserted without removing the device from the anchor and it cannot be opened when the pulley is loaded preventing accidental openings during use. The toothed cam is designed for an immediate and strong grab on ropes from 8 to 13 mm. The cam is enabled and disabled with a switch that is protected inside the flanges to prevent accidental activations. One movement to open the cam for easier insertion or removal of the rope or to use the device as a non-locking simple pulley. Two movements to enable the cam.

The two attachment points (main attachment point and the becket hole) allow for the rotation of carabiners for maximum ease of use. Large diameter sheave with sealed ball bearings for very high efficiency (95%). Robust construction features hot forged side plates, precision milled aluminum alloy sheave, and stainless steel cam, rivets and pins.

www.camp.it

Short Fall Air Bag in your High Viz

SKYVEST is designed to reduce injuries from falls from low heights. It consists of a reflective vest and an integrated airbag made of tear-resistant material that inflates in the event of a fall and is inflated via a pressure bottle that is equipped with a pyrotechnical trigger. The filling unit (incl.) connected to an electronic sensor unit recognizes fall situations based on parameters such as movement, acceleration and position of the person. It not only protects the chest

and back along with the spine, but also the back of the head and coccyx area. It is put on with three click fasteners and can be reused after the airbag has been deployed. SKYVEST is flexible, independent and universally applicable over a period of 24 hours.

• maximum safety when working at low heights • patented, intelligent airbag system • flexible, independent and universally applicable • long service life (5 years inflator, 10 years Hi-Viz vest)

SIZE: UNISIZE
WEIGHT: 1.73kg/3.8lb
MATERIAL: polyester
COST: €1428
WEB: **skylotec.com**

WIGGY'S SLEEPING BAG

WIGGY'S SLEEPING BAGS

THE BEST SLEEPING BAG FOR "SAR" WORKERS

When SAR workers go into the field on a mission, they carry lots of equipment and one of those items is a sleeping bag. The sleeping bag in my opinion is the most important of those items carried. The sleeping bag should have several characteristics that allow it to perform for the user. They are as follows:

1- The sleeping bag should perform at the temperature rating stated by the manufacturer. Wiggy's manufacturers the most accurately temperature rated sleeping bags in the world.

2- The sleeping bag should be made from durable materials. Wiggy's has been using seventy denier nylon taffeta for 34 years continuously. It has outperformed all other materials used by companies that claim to make sleeping bags. Wiggy's uses #10 molded tooth zippers for 34 years. No other company in the industry uses them, they use coil zippers. When you are out in the field and the zipper breaks you struggle to stay warm. The #10 molded tooth zipper does not break.

3- INSULATION: Wiggy's uses LAMILITE the most efficient insulation in the world for sleeping bags and cold weather clothing. Lamilite makes all other forms of insulation obsolete. Lamilite has shown that it is not affected by water. Even when the Lamilite gets wet, it retains it heat retention capability. This is especially important for SAR workers when they are on a mission if they encounter a rain situation. Sleep comfortably dry in a Wiggy bag.

4- Wiggy's bags are machine washable and dryable. We recommend this be done after any extended outing.

5- Wiggy's bags can be left in their stuff sacks for extended periods of time, [how long is not known].

6- Wiggy's bags can always be used as hypothermia bags if necessary.

See our online catalog for all of the different models and temperature ranges we manufacture and take the time to read our testimonials.

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Wiggy's INC.

VICTIMS / CASUALTY HYPOTHERMIA BAG

VICTIMS / CASUALTY HYPOTHERMIA BAG

The VCH bag is a development by myself and several search and rescue professionals who gave me almost all of the recommendations that have gone into the making of this product. Their advice has made the VCH a user-friendly product. The interior and exterior fabric are waterproof. The bottom is 1000-denier cordora and the lining and top are 200-denier oxford nylon. Color is black on the bottom and lining. The top is international orange. The top half of the bag separates completely from the bottom half to easily place a victim. The zippers can be opened from either end and either side depending where it is necessary to provide service to the victim. There is a zipper in the middle to expose only a portion of either leg, if that is all that is required. All of the zippers are the YKK #10 - possibly the strongest zipper available. It is completely launderable. It weighs approximately eight pounds and fits in a compression stuff sack that is 11" x 23".

- Zippers that open from all four sides
- Opening for Oxygen Mask
- Side Opening for I.V.
- Flap Opening for Catheter
- Central Zipper for Greater Accessibility
- Straps for as many as 10 carriers
- Loops to insert support board

US NSN 6532014989681
Canadian NSN 6530219148698 (Orange)
Canadian NSN 6530219205924 (Green)

UAV SEARCH & WILDFIRE MANAGEMENT

SPECIFICATIONS of CW-007	
Fuselage	1.3m/4.3ft
Wingspan	2.2m/7.2ft
MTOW	7.8kg/17.2lb
Payload	1kg/2.2lb
Endurance	70-90min
Crulsing speed	61.2kmh/38mph
Wind Resistance	10.8-13.8m/s
Take-off Altitude	4500m/14,764ft
Ceiling	6000m/19,685ft

[*ED: another of the larger drones than the average handheld DJI Mavic that we see most in SAR and some interesting alternative firefighting assets including a 'wind-fire extinguisher' – a giant fan maybe for redirecting or halting a fire's progress? Worth a thought]*

Most parts of the country have entered the winter forest and grassland fire prevention period. The fallen leaves in the mountains and plains will ignite once they encounter sparks, bringing many hidden dangers to the forest area. JOUAV participated in the fire drill. This fire drill was hosted in the northwest of China with 1,500 people from 13 fire-fighting echelons participating. The drones, wind fire extinguishers, fire extinguishing water guns, fire-fighting motorcycles, etc were all used in this drill. The fire drill was a complete success through rigorous organization and scientific and flexible tactics. CW-10D JOUAV (now discontinued) and CW-007 JOUAV drones joined the UAV firefighting echelon and played a prominent role in promoting the smooth development of firefighting and rescue work. The local fire department officials commented. “After receiving the command, we quickly dispatched the JOUAV CW-007 image-free control system UAV to undertake the task of collecting, evaluating, and comparing orthophoto impact data before and after the fire. Then, JOUAV CW- 10D mounted a 30x zoom visible light camera and a 3x zoom infrared lens with a dual EO/IR Gimbal camera that responded quickly and went to the scene to investigate the fire situation and provide a factual basis for combat deployment. Due to the unexpectedly rapid spread of the fire, we had to move fast. JOUAV's intelligent high-altitude detection and forest fire video monitoring system was applied to forest fire prevention and wild forest fire detection. It can detect forest fires in time, prevent large-scale forest fires and protect lives and property” the commander of the UAV said. www.jouav.com


Drones-eye view with data-feed panels obscured

RESCUING THE RESCUER?

This won't be new to divers and we've highlighted Spare Air before but this is worth mentioning in a new guise because it can be so vital a rescue tool in emergency situations for flood and swiftwater rescuers and wilderness SAR teams who may encounter water more frequently at certain times of the year. This can be an absolute life saver for rescuers and victims alike. This particular model makes it a more easily worn package – low bulk and low profile, even adding some insulation and buoyancy but readily to hand if needed. The 170 cylinders are about the size of a Coke can and with included adapters are refillable from BA/SCBA or dive shop or with optional adapters via Life jacket cylinders. mini compressor or even a high-pressure hand pump].

The Xtreme is designed for extreme water sports like surfing and kayaking to allow more time to self-rescue from the dangers of submersion. A proven design, the Spare Air has been in production since 1979 with over 350,000 units in use. Package includes:

- 1.7 cu ft of air provides about 32 normal breaths
- Neoprene Vest for hands-free use (uni-size)
- Dial Gauge Pressure Indicator
- Mouthpiece Cover
- 910S and 920 C Refill Adapters
- Cylinder Capacity: 1.7 cu ft / 48 liters
- Water Capacity: 6 cu in / .3 liters
- Service Pressure: 3000 psi / 207 bar
- Length: 8.75" / 22 cm
- Diameter: 2.25" / 5.7 cm
- Weight: 1.5 lb. / .7 kg
- Cylinder Material: Aluminum – Black Anodized
- Regulator Type: Balanced Single Stage
- COST approx $400

*Based on 1.5 liters per breath

Website: **www.spareair.com**

EASY TRANPORT RESCUE BOARD

The Sea Eagle IRB – Inflatable Rescue Board is a 5-foot inflatable rescue board that packs down to a mere 1/6th of its fully inflated size – making it easy to store, transport, and quickly deploy for use for wilderness rescuers working around water.

The inflatable Drop Stitch construction allows this board to be inflated up to 10 psi which makes for an incredibly rigid board while providing just enough flexibility to prevent the injuries caused by traditional rigid/hard shell boards. Great for emergency water, mud and ice rescues.

Constructed of two layers of reinforced 1100 denier drop-stitched fabric stows in half the space of a solid board.

- High-visibility orange color
- Dual bow high-visibility reflective strips
- Durable, portable, packable, storable
- Fits into just about any compartment
- Deflates and stores at 1/6th the size of similar rigid boards
- Twelve large heavy-duty D-ring attachment points
- Four high-strength grab/carry handles
- Dual sides high-strength 1/2" grab lines
- Deluxe recessed Halkey Roberts style air valve
- Skid-resistant, soft, EVA foam traction pad
- Extremely rigid, drop-Stitch inflatable construction
- Up to 10 PSI max air pressure capacity

*Please note that the Sea Eagle Rescue Board is not towable.

Hull Weight	7 kg.
Length x Width x Depth	152x74x13cm
Deflated size	Approx. 81 cm x 36 cm x 15 cm
Load Capacity	1 person, 109 kg
Air Valves	Recessed One Way
Inflation time	Less than 30 seconds
Seam	Quadruple Overlap
Material	1100 Decitex Reinforced Drop Stitch
Inflation Pressure	Up to 10 psi
Regular Price in pump, bag & repair	$762
Website:	**www.seaeagle.com**

How BUXTON MOUNTAIN RESCUE TEAM upgraded their UAV capabilities

[ED: This isn't a new item having blogged about completing a course and restructuring for Buxton Mountain Rescue Team (UK) last year but it's a useful precursor to one or two equipment and techniques articles that we have coming up from the heliguy™ *guys. While we have been in on the ground with UAVs since before drones even existed and a number of our regular contributors have extensive operational experience with UAVs, we thought it would be useful to get a perspective from training experts with a broad cross-platform knowledge. It's a fine line between editorial independence and commercial expedience when you have a commercial entity writing articles and it's something we come up against all the time because so many experts are in the private sector – our US Ropes Editor Reed Thorne for instance is one of many, many rope rescue instructors but there aren't many, if any, with his technical knowledge and abilities. In the case of* heliguy™*, we sought them out to get on-board with WSAR for technical UAV editorial so we can feel nicely untainted by commercial expedience.]*

heliguy™'s Operations Manual renewal service has enhanced the life-saving capabilities of Buxton Mountain Rescue Team – helping to upgrade the document to enable night-time drone flights.

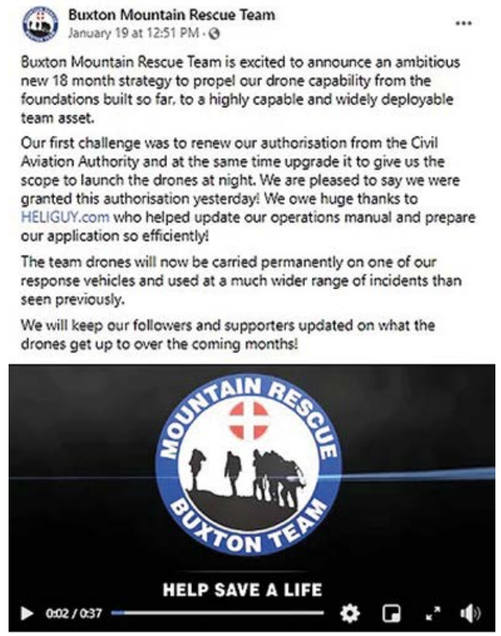
- heliguy™'s Operations Manual renewal service expands Buxton Mountain Rescue Team's life-saving capabilities;
- Our instructors helped build a CAA-complaint document while expanding the scope of the permissions to enable night flights;
- The Buxton team can now deploy drones at a wider range of incidents;
- The team uses DJI drones, saying they can make a critical difference to search and rescue missions.
- heliguy™'s Operations Manual renewal service has enhanced the life-saving capabilities of Buxton Mountain Rescue Team – helping to upgrade the document to enable night-time drone flights.

Derbyshire's Buxton Mountain Rescue Team used HeliGuy's drone training team to help update their Operations Manual, keeping it CAA-compliant but expanding the scope of the permissions. Within a day, the heliguy™ instructors reviewed the document and made key recommendations to bring it up to date with the new drone regulations and include the all-important night-time authorisation as an added extra.

The Operations Manual was subsequently approved by the CAA, meaning the Buxton team now permanently carry their DJI drones on response vehicles and deploy them at a wider range of incidents than previously.
Rob Stordy, Deputy Team Leader at Buxton Mountain Rescue Team, said: "Our team are experts in search and rescue and the outdoor environment in general, however we are definitely not experts in paperwork! Thankfully, when we turned to heliguy™ for support with updating our Operations Manual, they were only too happy to help.

"Inside a day they read, checked and made suggested edits to the manual, and helped us include night authorisation for flights outside of daylight hours; and thanks to the help of heliguy™ – whose responses were prompt, thorough and well-informed – we quickly received our renewed Operational Authorisation from the CAA.

"Our drones will now be used at a much wider range of incidents than before, expanding our provision to conduct search and rescue missions and save lives."



Streamlined Drone Operations Manual Process

heliguy™'s annual Operations Manual renewal is an essential service to enable drone teams to fly safely and legally – providing crucial advice and support during the preparation of the document. In cases like Buxton, our expertise can help pilots scale and grow their operational permissions and capabilities.

We also provide streamlined Operations Manual generation to help pilots build a CAA-compliant document – shaving hours off the usually time-consuming process.

Ben Shirley, Head of heliguy™ Training, said: "We were all too happy to help Buxton Mountain Rescue Team update their Operations Manual to renew their operating permission. With the introduction of the new UAS regulations, it's vitally important that UAS Operators not only maintain compliance, but also their understanding of the changes to their permissions.

"Night operating permissions are something which the vast majority of UAS Operators have enjoyed since their standardisation sometime ago, however, when we identified that Buxton had not previously incorporated such procedures into their Operations Manual, we sought to increase their deploy-ability by recommending a series of specific operating procedures; leading to their subsequent successful renewal application.

"Had we not expedited their review, they may not have been eligible to renew their permission with their existing NQE qualifications. Responding in a timely manner ensured they achieved their permission before the deadline and in the most cost-effective manner.

"Here at heliguy™, we are advocates of the use of UAS by our emergency services and voluntary rescue organisations; working extensively with both to ensure safe and effective operations. One can think of fewer more benevolent reasons for drones to be used than that of saving lives."

Using DJI Drones To Save Lives

The updated and upgraded CAA permission is part of an ambitious new 18-month strategy by Buxton Mountain Rescue Team to take its drone provision to the next level, expanding to a highly capable and widely deployable team asset.

The team is embarking on this mission after experiencing first-hand the benefits that drones bring to search and rescue.

In fact, in 2019, Buxton was the first Mountain Rescue Team in the UK to be granted a PfCO by the CAA, having started to look at the advantages of deploying UAS to improve incident response in 2017.

Rob said: "We know from our first couple of years operating drones that they are great at quickly searching open or steep areas of land and water. This can make a critical difference to a search and rescue operation.

"Locating casualties or missing people quickly maximises their chances of a positive outcome, while also reducing the need to commit team members to rough ground or bodies of water which could risk their safety.

"Not only have we found the drones great for searching, but they obviously also record great footage, which is useful not only for us as a training aid but also to provide the police or coroner with a clear image of incident scenes when required."

Scaling Search And Rescue Drone Programme

The team currently uses two DJI Mavic Pro drones, purchased on the back of a fund-raising campaign which was well-supported by local grants and community generosity.

These platforms have provided a good entry level to drones and enabled the team to develop their skills and demonstrate the use case, but the aim is to move towards a higher-spec aircraft in the future.

A drive to grow the drone-pilot team runs in parallel, with the ultimate aim of having 10 fully-trained operators. Buxton Mountain Rescue Team currently has two pilots, and four aspiring pilots.

Rob said: "It's clear to us that, at the moment, we are just scratching the surface of how drones can be used in search and rescue operations.

"Over the next six months or so, we will deploy the drones at almost all incidents we attend and monitor the operations to see how they can help us in less obvious ways and what capabilities we may want a new drone to have in the future. When the time is right, we will likely turn to the public once again to help with funding.

"Our ultimate goal is to have a good number of highly-competent trained pilots and a state-of-the-art drone. Together they will be capable of assisting with all manner of incidents – contributing to saving many lives and keeping our team members safe."

About Buxton Mountain Rescue Team

Buxton Mountain Rescue Team has been operating since 1964. Over the years, the team's role and the number of incidents that members attend have grown significantly.
The team now attends more than 100 incidents a year, ranging from sprained ankles to searching for missing vulnerable people and rope rescues at major incidents. In 2019, the team was deployed to the partial dam-wall collapse at Whaley Bridge.

SARSAFETY

PART 5
GEO-LOCATION

Enhancing the overall safety of rescuers and those requiring rescue in mountainous and austere environments

By Greg Toman

Greg was awarded a Churchill Fellowship for this research in 2019. Two years on, some of the personnel mentioned may have changed post but most things remain unchanged. Greg is currently leading the development of the remote rescue capability for the Queensland Fire & Emergency Service in Australia. Outside of the Fire Service, Greg's background includes a Diploma in Outdoor Education, outdoor pursuits instructor (rock climbing and whitewater kayaking), rafting guide, and instruction in advanced swiftwater rescue and high angle rescue internationally.

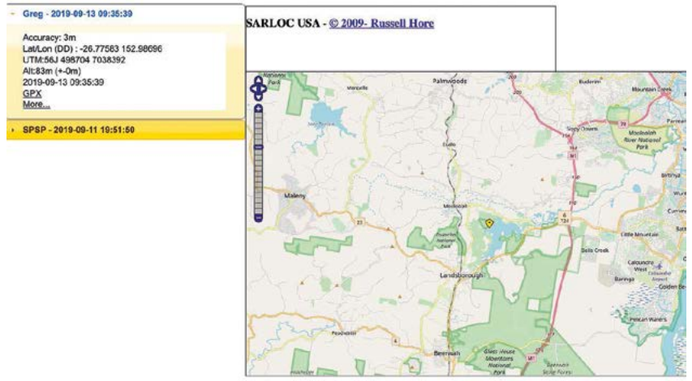
Tyromont Stretcher with ski-module - Photo courtesy of TYROMONT Alpin Technik GmbH

GEO-LOCATION

The ability of emergency services or mountain rescue teams to identify or estimate the location of a caller (via their mobile phone) was consistently described as the biggest 'game changer' of recent years. This vital piece of information had a significant impact on a rescue team's ability to safely and efficiently locate and access a lost, stranded or injured person.
Having the caller's location displayed in latitude / longitude, universal transverse mercator (UTM), GPX file or directly onto a base map assists the rescue organisation to make an informed decision with respect to the type and quantity of resources deployed.
Many of the rescue organisations visited had a system, program or app that was designed to obtain a caller's geolocation, with minimal intervention from the caller. The caller's location was then displayed on a web-based topographic map which could be accessed via computer, tablet or mobile phone.

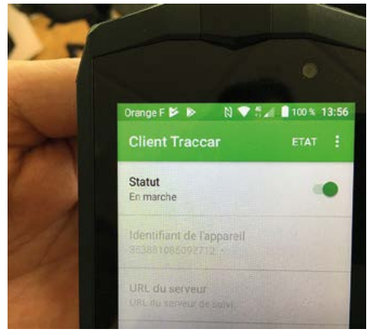
Some examples of these are:

SARLOC
https://www.facebook.com/SarlocRescue Developed by an Ogwen Valley Mountain Rescue team member (Russ Hore), it is utilised throughout the UK. The caller is sent an SMS to their mobile phone which contains a URL link. If they click on this link, details of their



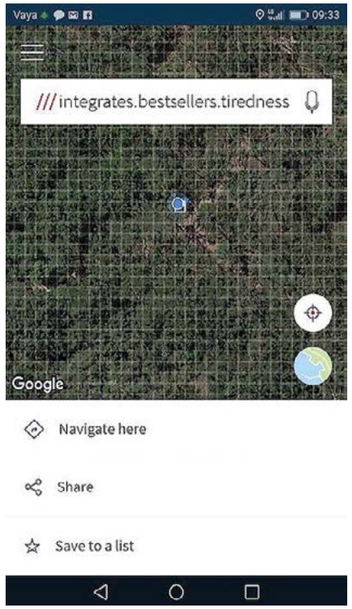
location are displayed on their phone and the details are automatically sent to a URL which can be accessed by the rescue organisation or rescuers. The caller's location is displayed in latitude / longitude, UTM and on a base map, with the degree of accuracy given in metres.
A link is also provided to a GPS File (GPX) which can be downloaded into a mapping app (e.g. GAIA Map).

TRACCAR is an open source GPS tracking system which the French Military Police Mountain Rescue Team have utilised and integrated into their dispatch



System. The Traccar app was also used by rescuers to navigate to the caller's last known location, and to also provide their own location details back to the command centre.
https://www.traccar.org

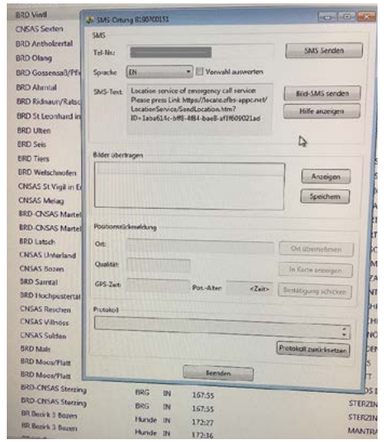
What3words
https://what3words.com/
What3words has broken down the world geographically into 3m x 3m squares. Each square has been allocated a 3-Word identifier / address. Instead of a caller having to read out a long series of numbers and symbols (latitude / longitude) they only need to read out or repeat three short words. The operator receiving the message only needs to record three words, reducing the chance of making an error.
What3words has also developed software for use by emergency services communication centres that can be integrated into their existing Computer



Aided Dispatch (CAD) system.
Some emergency services call centres are currently in discussion with Google (developer of the Android mobile operating system). It was indicated that Google are able to develop coding in their Android firmware that can automatically send (within 20 seconds) the caller's phone location when a specific number is dialled. For example: if the Ambulance Call Centre's number (e.g. 118) is dialled with an Android phone, the caller's location and phone details are sent to the 118-call centre within 20 seconds of that number being dialled. It was also indicated that Apple were looking to develop the same feature for their iphone.
On two occasions, while meeting with emergency rescue personnel, geolocation systems were used to locate a caller who was lost or injured in the mountains.

1. **French Military Police** – Mountain Rescue Team (PGHM) communicated by mobile phone to a hiker who was lost while on a hike in the mountains with two young children. The caller was an international tourist which posed some challenges with obtaining a geolocation, as access to the internet was required to activate the weblink sent to them by text message from the PGHM. Not all overseas tourists have a data pack or data roam.

2. Peter Pixner, helicopter pilot and volunteer **BRD mountain rescue team** member also worked in the emergency call centre in Bolzano, Italy. Peter took a call from a hiker who believed they had broken their leg while hiking in the mountains. Utilising the geolocation program integrated within their CAD system, he was able to identify their location and determine the resource requirements including specialist rescuer capability, number of rescuers and best method of access (air and land) to perform the rescue.



MULTI-AGENCY SEARCH AND RESCUE INCIDENT MANAGEMENT PLATFORM

The timely sharing of information among rescue teams and emergency service organisations can at times be a challenge. Generally, this process relies on individual resources (e.g. rescue teams, air services, police, ambulance, fire) advising their respective call or communication centre of any actions taken or changes in their situation. If deemed to be warranted, this information may be shared with other agency communication centres and if interpreted by the communication centre staff as important, it may be passed onto their teams or crews in the field. This often disjointed communication process does not always provide an accurate and timely 'picture' of the incident that includes all agencies involved. An example of one system that has been developed to overcome some of these challenges is SARCALL.

SARCALL is used by mountain rescue teams and cave rescue teams in England and Wales for callouts, messaging, and incident management using the shared situational awareness logger. The majority of Scottish and Irish mountain rescue teams are also now using SARCALL for incident management.

SARCALL was developed by volunteer mountain rescuer, John Hulse (https://sarcall.com). Operating through a secure web interface it enables users (rescue organisations and rescuers) to interact with a range of client devices such as smartphones, tablets, PC's and terminals. An important part of the secure SARCALL platform is the Incident Logger that enabled the relevant SAR Teams, Police, Helimed, Fire, SAR Helicopters and Ambulance to interact securely for the operation, which greatly improves shared situational awareness and offers a full audit trail of messages, decisions and actions.

A strong geolocation tool called phoneFind is embedded in SARCALL and enables a coded web-link to be sent to a target mobile phone by SMS. When the recipient clicks the link, the smartphone sends the current location coordinates to SARCALL and the location was recorded in the incident log, viewable by all authorised rescue agencies, and also displayed on the SARCALL mapping.

8	08/09/2019	13:52:28	PhoneFind SMS Sent	PhoneFind SMS To Specific Number With Finder Ref. ID = 3656	Message Sent = 'This is Search and Rescue - click the link 'NOW' to help us locate you and please enable the phone GPS location services:- https://sarcall.mountain.rescue.org.uk/phonefind /n.php?token=5d74f9******** sent to phone number '4477[redacted]	-	L[redacted] Base
9	08/09/2019	13:52:38	Status - SMS	SMS Report - Delivered Successfully To The Specific Number With Finder Ref. ID = 3656	Message = 'This is Search and Rescue - click the link 'NOW' to help us locate you and please enable the phone GPS location services:- https://sarcall.mountain.rescue.org.uk/phonefind /n.php?token=5d74f9******** sent to phone number '4477[redacted]: by L[redacted] Base >" was delivered successfully at 13:52hrs 08/09/2019	-	SARCALL
10	08/09/2019	13:53:13	PhoneFind - Clicked	PhoneFind Clicked - ID Ref. 3656	'44771[redacted] clicked the PhoneFind message. They are using Safari browser on iPhone running iOS 12_4_1 from a mobile client.	-	SARCALL
11	08/09/2019	13:53:24	PhoneFind - Location	PhoneFind Position - ID Ref. 3656	The position of '4477[redacted] was NY27400367 (+/- 24 m.)	-	SARCALL

The above example from a rescue shows that the target mobile of the injured person was geolocated within 56 seconds of the message being sent. Importantly the location information was visible to all the rescue agencies logged into the secure SARCALL site as soon as it was displayed in the relevant log. For the above case, the position information from the log was used by the Helimed aircraft, possibly in-flight, to go direct to the casualty's location. *Source: Hore, R. SARCALL Ltd*

For volunteer organisations, a core feature of SARCALL was group and individual messaging using SMS, email and landline routes. Team members could respond using an SMS with a short code message to a dedicated number that was used by SARCALL to authenticate and group the inbound responses.

Coming next Risk Management/ Mitigation and First Aid in Austere Environments

NON-STOP DOGWEAR PROTECTOR Life Jacket (PFD)

Non-stop dogwear's other flotation harness, the *Safe* PFD

In the last issue of WSAR we had a Market Guide to Dog Flotation Harnesses or PFDs- Pet Flotation Devices as we could usefully call them. Among these was a harness from Norwegian dog harness specialist *Non-stop dogwear*. This is a company renown for its pulling harnesses – effectively dog athlete harnesses that attach to their running master/mistress's own waist belt or harness for hands free running. At the time of the last GUIDE their new model the *Protector* life jacket (not to be confused with their other '*Protector*' products) on the cards but it wasn't out in time to be included. So, we not only have this and a couple of their land-harnesses in for review, we've also put a mini version of the GUIDE at the end of this article to give a comparison against some leading models, including their own. This also gives us the rather scary chance to show how some prices have increased in just a few months. The *Safe* PFD shown opposite was listed as US$98-118 but is now $120-140 and the *Alp Design Delphinus* was £220 now £300! The *Non-stop dogwear Safe* PFD was already a good looking, well-featured jacket, so why did they feel the need for a second model? The key obvious differences, which you can see at a glance (beefier panel foam and a tied cord main attachment rather than metal D-Ring) wouldn't immediately make you feel better about parting with an extra $30-40/£20-30/€30-40. What might though, is the fact that this is an incredibly well researched and tested upgrade for improved in-water body position and a higher degree of buoyancy while maintaining a lighter and more open top and jacket surround. This PFD may even set new standards for the testing of dog flotation which is currently entirely lacking because *Non-stop dogwear* have taken the SOLAS human PFD testing regulations and applied them as far as possible to the *Protector.* I could duct/Duck-tape a small mattress to a string vest and call it a dog flotation harness without any fear of prosecution although that might depend on how I subsequently described its dubious performance capabilities.

Before we look at the specific features and bits and pieces on this harness we'll discuss two key design elements: buoyancy and overheating. If you look at the *Safe* PFD (far left) and most of the other models, they tend to wrap the dog entirely in sheet foam with a relatively impervious cover – usually some form of ballistic nylon like *Cordura*. The result is an even distribution of flotation along the length of the dog and a macintosh style degree of water and heat retention out of the water. This raises two problems; first, overheating. Most rescue dogs would be wearing the *Safe* style of harness as a precaution against falling into water rather than as an active swimmer vest. In fact we only had two true rescue swimmer vests in the whole of last issue's GUIDE, the Italian *ALP Designs* models. So for most of the time the dog is likely to be out of water and for well over two thirds of the year, in most climates, this means they can overheat. That's a problem we'll be seeing more and more.

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You don't see many mountaineers grunting through the foothills in a full length macintosh or Sou'Wester and your active rescue dog, tracking beside fast flowing water will similarly not need the added heat stress. Pet owners tend to use such harnesses either as a direct swimming aid, probably from the car park straight into the sea/lake/river or boat owners may use them as preventative but be in a position to easily use water to cool the dog.

In contrast, the *Protector* uses strategically located panels of foam flotation that enable the entire top panel to be an open breathable mesh surrounding their equally open breathable '*Hexi-Vent'* foam. The bottom wrap helps secure the harness and pad the two retaining straps and is much lighter than the full-body-wrap models, Consequently, in combination with the mesh upper, this helps to keep the dog cooler out of water. Of course, many handlers use the full-wrap models specifically as a warm coat in cold weather so that does make the *Protector* a more targeted swimming harness than the *Safe* and others which serve both purposes – you can't win them all!

The second issue is buoyancy or to be more precise, its positioning on the body. There is no doubt that having a sheet of foam surrounding the dog with cut-outs for the legs will keep them afloat and make swimming easier unless the foam's cut is too restrictive. But a dog's weight is not uniformly distributed so having the same flotation at the chest as you have at the haunches does not give an even 'ride' position or plane to steal a boat analogy. If you look at the images on the right, you can see our test subject, Wilson, a 46kg Lab/Goldie, who swims non-stop (so to speak) for 30 or 40 minutes before we have to force him to give it a rest. In the first image he is wearing a *Non-stop* dogwear *Grip* line harness which is certainly light and free-draining along its narrow padded webbing which has a tactile covering to better stay in position during line-work. If you look at his rear half you can see how larger dogs swim with their rear end much lower in the water and this becomes more pronounced as they tire. The second picture shows the *Non-stop dogwear Safe* PFD (which is typical of most dog PFD designs) and you can see that, even with flotation, the rear still sits below the water line giving a less efficient swimming position. In contrast the *Protector* PFD below that, shows Wilson's back to be level, with the rear given much greater support to create a better swim position. The difference between the first two harnesses, the *Grip* and the *Safe* PFD, is that, as the dog tires and the rear sinks lower it is supported by the *Safe* PFD and hopefully saved from drowning by the front-end buoyancy which ensures the dog's head stays above water (not so lucky with the *Grip* harness!) But even that is not guaranteed if the dog becomes so exhausted it lacks the strength to keep the head up and the muzzle sags below the water. We saw some models, admittedly the more peripheral brands, in last issue's GUIDE with a foam flap beneath the chin to presumably provide support for the muzzle in exhausted dogs. That would seem to be a reasonable idea but we don't see it on any of the leading brands' models. The *Protector* however, does have a little more padding in the adjustable front section and this does seem to provide more flotation to the head because it sits higher out of the water though it won't directly support the muzzle. This increased buoyancy of around 33Newtons in human PFD terms, comes at the cost of restricting the dog's comfort out of water when trying to lay down. Out of water and trying to get a well earned rest, Wilson found this collar section too large and stiff to comfortably rest his head down on his paws or the floor as he would normally do and was consequently unable to settle unless we changed his harness back to the excellent *Grip* or *Rock* land harnesses. The neck section doesn't look any 'fatter' than some other models so this increased stiffness may be due to the length of 40mm webbing that provides length adjustment or it may simply be that the harness needs to be broken in like a comfortable pair of hiking boots.

This entire issue of flotation and swim position is not so obvious in smaller and medium sized dogs that weigh much less so peripheral manufacturers churning out standard template PFDs for *Amazon* may simply take their standard PFD for smaller dogs and give it longer straps to fit a larger dog. More astute dog-specialist manufacturers like *Non-stop dogwear*, *Ruffwear*, and *Julius K9*, even though not specialists in flotation, have had the sense to adjust their sizing so that it actually suits the dynamics of the larger dogs. Presumably the true flotation specialists like *Crewsaver* and *Baltic* which aren't necessarily as in-tune with dogs, do have extensive knowledge of the buoyancy differentials for different body shapes and body masses.

FEATURES

MAIN ATTACHMENT: Unusually *Non-stop dogwear* opted to use a 5mm tied cord main attachment. (blue cord in the pictures). They argue, quite rightly, that metal D-rings add weight, are prone to corrosion and can't be replaced while the cord allows any sized, or indeed number of, connectors to be used – carabiner, carbine hook or sprung clip. We can't disagree but a reasonable sized alloy D-ring is much neater and easy to clip in a hurry because it usually presents well. It also it forces us to maintain the harness by cleaning in fresh water and drying because steel rusts and alloy gets that white powdery reaction coating. We could easily replace the cord by sliding in a delta *Maillon Rapide* or even a small carabiner if we were to insist on a hard-fixing so all bases are covered making this a more versatile feature than a fixed metal d-ring. There is no frontal attachment as there is on the *Rock* and *Grip* terrestrial harnesses because these are normally used for pull-control – this can be useful with larger dogs on land that might otherwise have the power to pull you over but in water you could probably control a rogue elephant with a sharp tug on the dorsal attachment. Aside from the main cord-eye there are two web-eyes for lateral control or steering that can also assist in countering currents or flow in much the same way as we would control a mid-stream boat in swiftwater rescue.

VISIBILITY & HANDLE: Aside from being bright orange, the *Non-Stop Dogwear* logos (a D & W) are reflective and the handle too has reflective beading. This handle is large enough to accept the very largest of gloved hands and is bar-tacked to a section of webbing running along the spine and down to the two transverse belly straps so it easily supports the full weight of dog in it if you have to haul aboard a rescue boat or dockside. And bear in mind that Wilson is 46kg *dry* – that's considerably more when his long hair and undercoat are wet but the handle and support comfort of the belly flap are well up to the task.

FASTENING: These belly straps are made from 40mm webbing and terminate with *Duraflex* side-squeeze buckles. They secure over the top of the belly-flap which has three longitudinal strips of *Velcro* hook securing to three transverse strips of loop *Velcro*. In Wilson's case, we're not saying he's overweight (to his face) but he only just made it onto the last strip of Velcro though the webbing straps are what provides the strength and security to close the jacket and hold it in place. The padded belly flap is more for comfort.

POUCH: There is a non-sealable pocket on the top of the harness behind the cord attachment and it is a good idea to keep a section of 15-20mm webbing connected to the eye and stuffed into this pocket because it provides a makeshift lead or control measure should your dog disappear across the horizon towards the dog-walking beach. The pocket contains what looks like a giant laundry label which is chocked full of safety warnings and care instructions.

NECK/CHEST ADJUSTMENT: There is an adjustment buckle on one side of the neck/chest section that enables you to tighten the loop around smaller dog necks (but not too tight!) but Wilson and his XXL harness for dogs over 41kg needed this on the maximum setting. This chest loop is padded and fixed so the front part of the harness goes over the dog's head first when donning.

MOBILITY: If you look at the *Protector* and *Safe* images on the title page you'll notice that the *Protector*'s belly flap is cut further back at a shallow angle whereas the *Safe* has more of a quadrant cut and is positioned further forward. The result in the *Protector* is greater freedom of movement for the legs. This isn't unique to *Non-stop dogwear*'s *Protector* since *Ruffwear* and *Crewsaver* have excellent space for leg movements but it does show an enhancement within their own range and when compared to many other PFDs.

Aside from the lack of designated vertical lift points, this new *Protector* PFD is a supremely well made and well featured harness for in-water/around-water use by professional dogs in warmer climates. It doesn't have the metal D-rings of the *Safe* to which you can more obviously attach a web loop handle for makeshift in-water rescue but it does have the two sewn control eyes that can serve the same function because we loaded them to well over 30 kg each with no problems and in-water that's a lot of force. Even without using optional side handles on the sewn eyes, with its enhanced buoyancy the *Protector* can easily function as a swim-rescue vest using the top handle. Wilson was able to tolerate towing a dead-weight human for 40-50m. While his swim position was lower in the water it remained no worse than the *Safe* and other XL buoyancy PFDs. At 46kg Wilson is at the upper limit of the *Protector*'s 50kg and size adjustment range. Exceptions are the *Alp Design* models as the out and out pro rescue PFDs and the largest *Julius K9 3in1* models which fit larger dogs and have correspondingly greater buoyancy and some excellent attachment options.

What *Non-stop dogwear* have done with the *Protector* is combine their knowledge of dogs with a water-safety industry perspective. The idea was to give freedom of movement, restrict overheating when not in the water and provide extra, targeted buoyancy in a relatively simple design and this does appear to have been well achieved because this is simple to size and don with excellent targeted buoyancy. On the negative side, if indeed it counts as a negative, this is a dedicated, enhanced buoyancy harness only so it doesn't have any vertical lift capability for helicopter or abseil work and the heat-reducing design may actually be counterproductive for winter use. Maybe use a different model if you're working in very cold conditions?

The degree of R&D that's gone into this is inspiring and the cost is wholly acceptable for a more specialist design especially since it's from Norway which is not renown as being a cheap country. On the next spread we have added the *Protector* into a selection of 4 other leading brands from our previous GUIDE to give a comparison of sizing, cost and features.

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images NOT to scale		MODEL	COMPANY	ORIGIN	COST inc tax/ VAT	USES: SUSPENSION	USES: GROUND	USES: SWIM RESCUE	MATERIALS: 'JACKET' / WEBBING / INTEGRAL 'HARDWARE'	SIZE	WEIGHT of PFD	WEIGHT of DOG	GIRTH of DOG (&/or LENGTH of VEST)	SECURE: GIRTH / BELLY	SECURE: NECK / LENGTH	TOP EYE(S) TOP HANDLE(S)	POUCH. VELCRO LIGHT ATTACH	HI-VIZ MOLLE REFLECTIVE	COLOURS	NOTES	WWW.
		Delphinus	ALP DESIGN		£300 $330 €290	■	■	■ ■	Cordura 2x Velcro straps Polyester 7x double-D buckles 1xRing +4xSml Rings	S M L	800g/16oz 1kg/35oz 1.3kg/46oz	20-25kg/44-55lb 25-40kg/55-88lb >40kg/>88lb	- -	■ ■	■	1 6*	■ ■	■ ■	■ ■	Full flotation swim harness with zipped pouch. *2 handles on flanks. 2x rings on each side are options.	alpdesign.it
		Petfloat	CREWSAVER		£58 $76 €65	-	■	■	3x plastic fast clips 1x plastic D-ring	XS S M L XL	300g/10.6oz 375g/13.2oz 450g/15.6oz 525g/18.5oz 600g/21.1oz	-	24-30cm/9-12" 28-35cm/12-14" 35-45cm/14-18" 45-55cm/18-22" 55-65cm/22-26"	■ ■	■	1 1	■	■ ■	■ ■		crewsaver.com
		Multifunc-tion/ IDC 3in1 Dog Vest	JULIUS-K9		£82-120 $120-164 €110-150	●	■	■	Neoprene Nylon 2x plastic fast clips 3x metal D-rings	S M L XL	305g/11oz 385g/14oz 580g/21oz 740g/26oz	15-25kg/33-55lb 24-40kg/53-88lb 40-60kg/88-132lb n/a	40 44-64cm/16 17-25" 46 55-72cm/18 22-28" 51 65-82cm/20 26-32" 57 75-92cm/22 29-36"	■	■	2 1	■	■*	■ ■	Flotation panels can be removed *reflective seams	julius-k9.com
		Safe Life Jack-et 2.0	NON-STOP DOGWEAR		£87-100 $120-140 €88-107	●	■	● ■	PU-coated 210D Polyester Oxford/ 8mm TPE C/S1800 padding, Nylon 2x plastic fast clips* 3x metal D-rings	XS S M L XL XXL	169g/6oz 192g/6.8oz 312g/11oz 473g/17oz 619g/22oz 688g/24oz	1.5-7kg/3.3-15.4lb 2.5-10kg/5.5-22lb 5-20kg/11-44.1lb 10-30kg/22-66lb 15-40kg/33-88.2lb 20-50kg/44-110lb	20cm/8" 25cm/10" 30cm/12" 36cm/14" 42cm/17" 51cm/20"	■ ■	■	1* 1*	■	■ ■	■	*+2 side-control metal D-rings can take side clip-on handholds * Duraflex	nonstopdogwear.com
		Protector	NON-STOP DOGWEAR		£100-115 $135-155 €115-130	-	♦	● ■	PU-coated 210D Polyester Oxford/ 8mm TPE C/S1800 padding, Nylon 2x plastic fast clips* 3x sewn eye loops	XS S M L XL XXL	169g/6oz 192g/6.8oz 312g/11oz 473g/17oz 619g/22oz 688g/24oz	1.5-7kg/3.3-15.4lb 2.5-10kg/5.5-22lb 5-20kg/11-44.1lb 10-30kg/22-66lb 15-40kg/33-88.2lb 20-50kg/44-110lb	20cm/8" 25cm/10" 30cm/12" 36cm/14" 42cm/17" 51cm/20"	■ ■	■	1* 1	■	■ ■	■	* Duraflex introduced in 2022 buoyancy panels providing up to 50kg of buoyancy. *+ 2 sewn webbing side control eyes	nonstopdogwear.com
		FloatCoat	RUFFWEAR		£105 $130 €125	-	●	■	1000D Cordura PE 'Nylike' 4x 3-bar buckles 1x double-D buckle 4x length adjusters	XXS XS S M L XL	.2kg/0.4lb .25kg/0.55lb .34kg/0.75lb .43kg/0.95lb .5kg/1.1lb .6kg/1.35lb	-	33-43cm/13-17" 43-56cm/17-22" 56-69cm/22-27" 69-81cm/27-32" 81-91cm/32-36" 91-107cm/36-42"	■ ■	■	2* 1	■	■ ■	■ ■	*1 eye is a webbing eye	ruffwear.com

NOTES: N/A = info Not Available/not given COST: Approx & includes local tax/VAT $ in orange = currency conversion only-NOT imported price USES: ○● = OK BUT NOT IDEAL USES & FEATURES: □■ = Option

IN THE FOLLOWING TABLES.....

A circle (a diamond in the previous Guide) ●● in the 'USE' columns indicates that the feature is OK for that purpose but not ideal.

COST: a rough guide only – includes local taxes. Varies with exchange rates, extra taxes etc. We usually round up to the nearest Pound£/US Dollar$/Euro€. Larger sizes often cost more.

US$ in orange is a currency conversion figure NOT an accurate import price with taxes etc which is shown in black **$.**

SIZES: Given as generic sizing **S**, **M** **L** etc. which varies wildly between models. Colour-coded to the weight/girth to read more easily but some are universally adjustable. We have tried to include the weight of dog to give an accurate idea for the flotation required but many only provide measurements.

USES: All of these harnesses can be used to provide a degree of floatation in water but one or two may only provide this as a consequence of using foam padding for comfort or thermal protection in which case they will have a diamond in the **BUOYANCY** column. **SWIM-RESCUE** refers to the ability of the harness to assist not only the dog in staying afloat but also in assisting either a rescuer or a casualty while in the water. Usually this will be via extra handles on the body of the harness for a person to grab onto and is only present in the two ALP Design models. **SUSPENSION** means the harness is capable of being hoisted or lowered vertically. This is usually via a bridle to spread the dog's weight evenly front-to back for hoisting into a helicopter, on or off a ship or up/down a cliff or wall. A single robust top eye does NOT constitute hoist-capable even if it will easily take the dog's weight because it is not even close to being safe – the dog may slip out and/or suffer compression of the thorax or neck. In our previous GUIDE **GROUND** referred to long-duration search, patrol and/or tracking and manoeuvring over boulders etc. requiring freedom of movement and no heavy panels that might rub against legs. In this GUIDE it refers only to the ability to add a lead or tether and use the harness on dry land for a period of time. The ALP Design specialist water rescue harnesses for instance, is shown with a diamond rather than full square because they can have a lead attached but the dog would not be comfortable for long distances on land.

MATERIALS: The main fabric of the body panel containing the foam is shown in **black**. Webbing type is shown in **green** and the hard fittings (buckles & D rings) are shown in **burnt orange**.

WEIGHT/GIRTH of DOG: is the weight of dog that is intended to use the harness. Body mass is a more accurate indication for floatation requirements but girth measurement provides more accurate fitting. **BUOYANCY** provided by the harness is only given by a few manufacturers. It is NOT the same as the weight of dog it will support – a 27kg dog would only need 3 or 4kg of buoyancy to support its weight because the water is supporting much of the load. There is a huge difference between the quality of components in a pet-shop dog harness and a professional dog's lift harness. Unusually for us, this GUIDE contains non-rescue professional designs that are mostly NOT intended for hoisting so the Minimum Breaking Strength/Load – MBS (in burnt orange) is only provided by one or two. We list the precise weights and sizes in metric with the imperial figures rounded up or down because it's a less precise measurement anyway! We dispensed with the **COMFORT /PADDING** column used in the previous GUIDE to *Hoist-Capable Harnesses* because ALL of these are padded to some degree.

INTEGRAL/ADD-ON FLOTATION: most of these harnesses have integrated flotation indicated by a black square but some can have extra flotation pads added to a neoprene jacket like the JuliusK9 3in1 or to a webbing frame like the Ray Allen Modular LLC. This allows quite a bit of flexibility and is indicated by an orange square ■. Those with minimal buoyancy are indicated by a black circle●

SECURE: The straps and attachment points which secure the dog in the PFD and you to the dog!

GIRTH/BELLY: a strap that can be adjusted for length on the underside of the dog. The **girth** strap is behind the front legs and the **belly** strap is further back towards the rear legs. For most of these float harnesses the buckles are plastic push-fit (Fastex,Nexus or DuraFlex) but some like the NRS use a plastic ladderlock where you simply pull the web tail to tighten and some, like ALP DESIGN ave alloy double D buckles because they are designed for hoisting as well as swimming.

LENGTH: refers to adjustment for length from front to back and is usually a buckle on the top at the shoulders or on the back near the back legs. Only one or two of these harnesses have that capability.

NECK: indicates that the front or breast strap that encircles the neck can be adjusted for size.

We have omitted the Front eye/Handle column that we had in the last GUIDE to Dog Harnesses because none of these PFDs has that feature but it is an option on the K9 Storm harness.

TOP EYE. TOP HANDLE: Mostly a metal ring or D-ring but can be a reinforced sewn eye. Sewn eyes are indicated by an asterisk and details in the NOTES column. In professional models the top eye(s) may constitute part of a lift/hoist capability indicated in the **SUSPENSION** column. Otherwise assume that all of these are simply lead/tether eyes. The handle, will always be capable of lifting the full weight of the dog but this is simply for assisting out of the water or over an obstacle NOT for hoisting off the ground.

ACCESSORIES:

POUCH. VELCRO. LIGHT ATTACH: A pouch or pocket which can be for accessories like lift straps or dog supplies or the harness itself when not in use. **VELCRO** refers to strips of loop velcro onto which you can add badges, reflection, panniers etc. a key feature of 'tactical' harnesses. **LIGHT ATTACH** refers to elastic or Velcro-secured straps intended to hold a chemical light stick,strobe or torch/flashlight.

HI-VIZ REFLECTIVE MOLLE: HI-VIZ is a High visibility colour option like yellow or red. REFLECTIVE refers to smaller panels or badges or piping rather than the entire jacket. Often an optional badge and easily applied to harnesses with Velcro. **MOLLE** or PALS is military-style attachment webbing.

Any item that is an option is shown as an outline square □□□

COLOUR: Primary colour of Jacket or panel or webbing if it's a web-only harness. Secondary or web colours are shown in the square's outline frame.

MARKET GUIDE

Climbing HELMETS

meeting or equivalent to EN12492 (mountaineering)

TeamWendy SAR (Tactical)


Petzl Vertex Hi-Viz

This is the first of a series of HELMET GUIDES in our three print titles and you'll notice a bit of an orange theme for this one just to be arty, the others coming up in WILDERNESSSAR are:

- Water Rescue helmets,
- Ski-Mountaineering helmets

This issue is for general climbing helmets that adhere to, or are certified as EN12492 the sport mountaineering standard, but these cross over into many other rescue activities. EN 12492 is obviously a European, not worldwide standard but the definitions make for a useful delineation of helmet types with the majority being vented to help limit overheating and with a high strength chin strap and all capable of being used for rope rescue to some degree. However, rope rescue is often perceived purely as an urban/industrial fire-service discipline (despite the fact that wilderness teams deploy ropes far more frequently) and these often require EN397 or US ANSI Z89.1 industrial standards. Some of the helmets in this Guide meet both. TECHNICALRESCUE magazine will have a GUIDE to USAR and rope rescue helmets that will capture the more fire-service/industrial helmets but may still be of interest to WSAR readers. ARBCLIMBER will have arborist helmets which includes EN12492 climbing helmets with visors and ear-defenders.

In truth, wilderness and mountain teams can generally choose from either the mountaineering or industrial standard helmets and there would be even more crossover if it weren't for two or three niche elements of the standards: EN397 requires clearance between the shell and the cradle and doesn't allow for any lining in direct contact with the shell. It uses a 5kg test load from 1metre which must exert no more than 5kN of force to the head whereas climbing helmets use a 5kg mass falling 2metres but exerting no more than 10kN to the head. That higher impact load means expanded foam linings can absorb enough impact when in direct contact with the shell but that means a whole lot of climbing helmets are excluded from the industrial standard. Not sure why a construction site worker should be able to take less cranial impact than a climber? Vent size must be less than 4.5cm² of total shell area for EN397 whereas for Climbing it needs to be well ventilated in excess of 4cm² of area. However, that does mean there is crossover if a shell has between 4 and 4.5cm² of vent area – that would meet both standards. Resistance to electrical conductivity, flames and molten metal ingress also negates having vents. And then there's chin strap strength which in climbing helmets requires it to keep the helmet in place during a fall and when resisting an impact. Industrial helmets, which often includes rope rescue, requires the chin strap to separate or break at less than 25daN because, oddly, it is felt that there is a greater risk of being strangled if the helmet gets hung up on an obstruction during work. You would think that those at the greatest risk of hang-up would be arborists and yet they are specifically mandated towards EN12492 helmets with high-strength chin straps and NOT EN397's breakaway straps. There are presumably good reasons for these subtle differences which cause otherwise near-identical helmets to belong to an entirely different class despite the commonalities of use and it's rope-rescuers helmets that fall through the gap between mountaineering and industrial standards. We've always found that our rescue helmets, whether used for rope rescue on cliffs or USAR in and around buildings, have always been more likely to need to protect us from falling debris (or simple bump-protection) than from a fall, especially a fall that would result in being hung up by the helmet strap such that we would be strangled to death – it would be interesting to know how often that has occurred versus being hit on the head because your helmet has come off? It's very rare for rescuers, even in wilderness terrain, to lead climb to perform a rescue rather than top-down or less often, top-roping. But in either case a sport-climb style fall is far less likely than impact from debris. A number of manufacturers have one or two helmets in their ranges that meet both EN12492 AND EN397 but this often requires you to switch out the chin strap with the resulting problem that you could still fall foul of local protocols if you had the wrong one on. These helmets are often called 'hybrids', not to be confused with 'hybrid' as a type of helmet manufacture. Many more helmets, especially outside of Europe, will meet the impact resistance (including sharp-object penetration) requirements of EN12492 but not necessarily the chin strap requirement. It's a strange dilemma since we're not at all convinced of the validity of a breakaway chin strap for rescuers. *Heightec's Duon* has gone some way to solving this dilemma by using a chin-strap buckle that adjusts between weak and strong. The enhanced EN14052 standard that requires better top, side and frontal impact tests for industrial helmets effectively mimics EN12492 impact testing but it's not clear what EN14052 expects of its chin strap – presumably enhanced impact tests and a breakaway chin strap (as required of industrial helmets) are mutually exclusive? This one has not yet been adopted by all so only relatively few including Kask, have it.

CAVING, CANYONING & WATER RESCUE

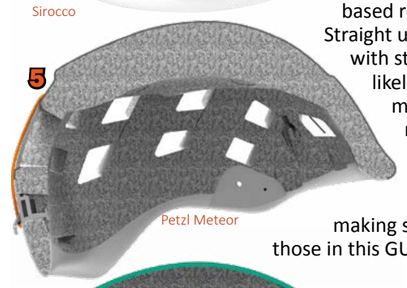
In the absence of a mandated or recommended service helmet, choice for wilderness rescuers does not depend on any standard, just subjective fit, comfort and functionality. Cave rescue is NOT the same as industrial confined space rescue which rarely involves extreme confines that constantly scrape the helmet shell as it can in caving. Caving doesn't necessarily involve any vertical work which is why you still see the odd building site bump-helmet in sport caving, but we ALWAYS assume it does and that a true caving helmet needs to be tight fitting, robust, low profile and have lamp clips/brackets. Canyoning or canyoneering shares some similarities with caving where it gets confined but can otherwise use lighter shells with a tighter fit to the head providing more heat insulation but able to take a lamp, maybe a goggle-visor and operate in water. Water rescue complicates the issue because many teams seek to use the same helmet for vertical and in-water rescue. Water rescue by itself doesn't have a defined standard though the NFPA's 1952 Surface Water Operations guidelines define the need for no rear brim (because it can catch water and snap the head back), be free draining, have high visibility and a degree of flotation. So technically a great many of these helmets can be used for water rescue but they should primarily be free draining and hi-viz with no rear flare to the shell. Handling water craft is different again and may require an EN1385 canoeing or rafting helmet but this is not for vertical work or indeed powered craft handling. We'll look at water rescue helmets in

Joe Brown Helmet

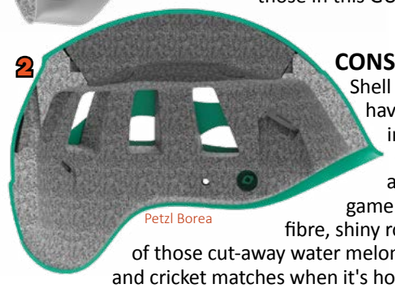
Title pic by P. Vidi

Petzl Stratos

Petzl Sirocco



Petzl Meteor



Petzl Borea

a separate GUIDE but in this GUIDE we have included only helmets suitable for vertical + water as defined above requiring the helmet to remain stable on the head during swimming and not retain water within the shell that would increase weight and load. Personally, we have always worn Petzl and Gallet helmets, the latter now part of a class of multi-role helmets for Technical Rescue so neither are particularly light for wilderness use but both offering the versatility of vertical and water-use and of attaching visor, goggles, ear comms and nape-guard etc. If weight and cost were not a consideration then one of these multi-role helmets is worth consideration though they are the heaviest in this GUIDE, they can be used for a number of different disciplines. Team Wendy's SAR and the MH4 version of Future Safety's *Manta4 h*ave the, as yet, unique versatility of rails. This allows use of military accessories but for rescue, cameras, night vision, laser-pointers as well as more regular headlamps using a slot-in adapter are all things becoming more prevalent in rescue in the modern era, we may see rails catch on more in civil rather than just military or law enforcement-based rescue teams but it's a rare beast at the moment. Straight up wilderness use is a much simpler proposition with standard climbing/mountaineering helmets more likely to be competing to drive weight down rather than meet multi-roles and in that respect it's still the traditional mountaineering names that dominate the market and Italy in particular especially with specialist helmet manufacturer Rock Helmets making so many of those in this GUIDE.

1 Hard Shell
2 Hard-Shell Hybrid
3 Soft Shell
4 Hybrid (hard shell-In-Mold)
5 In-Mold (In-Mould)

CONSTRUCTION

Shell materials have changed in recent years – there was a time in the 70's and 80's when the only game in town was a glass-fibre, shiny round dome like one of those cut-away water melons you see at football and cricket matches when it's hot. The venerable Joe Brown helmet weighed almost as much as a small planet and used a layer of expanded foam to line the inside of the shell for warmth and increased impact protection. It was basically a modified motorcycle helmet and it soon became clear that in order to resist an impact from above, either the non-conforming shell had to change or the lining had to be improved. The answer initially was to keep the glass fibre shell and increase the clearance between the head and the shell. Glass fibre was good at showing you where you'd taken an impact and when it was time to buy a new one. Too many spider's web bulls-eyes may have been a badge of honour but it not only meant the shell was ripe for failure it meant you were doing too much off-piste climbing. Building site helmets had something of an answer with their adjustable plastic head band and concentric plastic 'spokes' joined at the crown but more comfort was needed and this included improving ventilation or airflow to the head which was otherwise encased in a hot and sweaty goldfish bowl. Enter the age of substantial sized air vents and a webbing cradle initially riveted around the shell and with an inch or two of clearance between the top of your head and the inner shell. In the event of a heavy rock hitting the top, the shell can deform to absorb some impact before the shell and/or foam reaches your crown. This allowed superior materials to creep into helmet production – lighter, stronger and more resilient to wear than glass-fibre, mostly plastics, thermoplastics and polymer mixes.. The *Petzl Vertex Hi-Viz* is a current industrial model and it's fair to say that both Petzl and Italian company Kask have dominated the rope access markets while traditional climbing companies like *Edelrid, Camp, Black Diamond* and *Kong* dominate the mountaineering market. But originally, *Edelrid* dominated the mountaineering market with their *Durace* and then *Ultralight* etc. while *Petzl* dominated the caving market with their enormous mk1 *Ecrin*. The *Edelrid Ultralight* in particular showed the problem of relying more on cradle-clearance for your impact protection – it sat very high on the head, almost comical when you look at it today and not so useful for confined spaces. The *Ultralight* is still a prominent model with a broader-looking shell

Edelrid Ultralight III

Petzl Sirocco

Black Diamond Vision

Kask SuperPlasma PL

Climbing Technology Stark

Grivel Duretto

with enhanced ventilation and sitting much lower on your head! The next couple of decades saw various combinations of hard-shell plastics that deformed to absorb impact and cradles that tried their best to keep your crown clear of the shell. Some shells began to re-incorporate fibres into the plastics to improve durability, not quite back to the traditional glass-fibre days and certainly a feature of the more robust shells. Meanwhile, some cradles were replaced by a full 'cap' or dome of polystyrene instead of webbing straps to improve comfort, all the while making the helmet lower in profile than the original pimple-on-your-head *Joe Brown* and original *Ultralight.* Carbon fibre came and went and still appears every now and then but perhaps the most obvious modern change has been more extensive use of EPS (Expanded Polystyrene) and latterly the slightly denser EPP (Expanded Polypropylene) leading to three new classes of helmet in addition to the existing hard-shell and expanded foam. Good luck differentiating some of the 'hybrids' from some of the 'in-Molds' (or in-mould as it probably should be in the UK but never gets listed as such – a sign of European dominance in the market). In the pictures opposite, the *Petzl Sirocco* is a sectional hybrid of two different areas of material brought together for manufacture while *Black Diamond*'s *Vision* has the two materials 'fused' together simultaneously in one in-molded process. A hard shell hybrid has a complete polycarbonate or ABS shell on the entire outer with the entire inner lined with an expanded foam.

Hard shell is now the traditional and less common design with a web cradle and/or small EPS crown insert in a full ABS or polycarbonate shell. A few that will be more suited to the TECHNICALRESCUE Guide like *Pacific* use a kevlar reinforced composite so are renown for being tough but are again too heavy for many a wilderness rescuer. What looks like polystyrene is now carefully crafted as EPS and EPP and is used as a shell liner instead of the traditional web cradle.

It is also used as the shell itself or part of the shell covered by a protective layer of polycarbonate. EPP and EPS are very light, they insulate and are soft allowing thicker cross-sections to absorb impact well. It can be shaped to fit pretty much anything you like allowing intricate designs to improve air flow, follow the shell contours, cut around ears and extend down at the nape all while allowing enough deformation/compression to absorb impact and protect your head. The initial problem with these materials is durability – it's a weak material when it comes to resisting having chunks knocked or scraped out of it, good for short rock climbs and day trips but not so good on a multi-day mission where any degradation of the shell would leave you very exposed. Helmets like *Petzl*'s ground-breaking *Sirocco* are true hybrids that use a partial polycarbonate or polypropylene panel in key area(s) to improve durability but maintain lightness, this one being the lightest in our GUIDE at 160/170g/6oz. *Black Diamond*'s *Vison, Edelrid*'s *Salathe* and *Petzl*'s *Meteor* are In-Molded where the EPS is injected directly onto and around the polycarbonate shield element rather than as a separate component subsequently attached to the polycarbonate. Hard-shell hybrids have EPS and EPP lining a full hard shell of ABS and ***many described as hybrids and hard shells are technically hard shell hybrids***.

Grivel are better known for their hardware but they have the innovative *Duetto* with an entire EPP shell complete with 'stealth' shaping with both climbing (EN12492) and ski-mountaineering (EN1077A/B) certification. It weighs only 215g although that is still heavier than the *Petzl Sirocco*.

Of special mention in helmet construction is the MIPS enhanced head protection we see most often in ski-helmets that code-share as climbing helmets and the *MIPS* ***MIPS*** stands for ***M***ulti-directional ***I***mpact ***P***rotection ***S***ystem and is basically a licensed element to helmet linings from the Swedish inventors that limits rotational impact because the special liner allows the head to rotate within the shell. Companies basically buy in the *MIPS* expertise in helmet safety and incorporate it into their helmet designs Like the *BD Capitan MIPS* on the left (yellow section). It's a bit like clothing manufacturers adding *GoreTex* as a key and prestigious feature. One of the newest helmets on the market is the US *Studson* helmet which purports to have merged the best of sport helmets with industrial to produce a sleek and well featured model that actually would suit a number of wilderness rescue types were it not a bit on the heavy side as is the case with virtually all multi-role helmets. It uses a similar system to *MIPS* called *Brainshield* and made by *Shield-X*. The *Studson* also uses another safety addition which is the *Koroyd* honeycomb liner most notably used by *Pfanner* in their *Protos* (pic left) and by New Zealand's *Zero Height Safety* in their *Pinnacle* series. Koroyd crumples on impact to absorb far more energy than a solid liner or web cradle.

Where's it all going? Well, there will come a time when you'll unpack your helmet from a container the size of a cigarette packet, (NB: cigarette packets won't exist by then). You may remember *Edelrid*'s innovational *Madillo* helmet launched in 2007 which collapsed into itself for easy storage, folding into a shallow elongated bowl. This is no longer in *Edelrid*'s line-up but it did meet EN12492 and the concept is bound to be resurrected sometime by someone because it's such a useful storage alternative for a bit of kit that is always awkward to store whether it's in your pack full of wet socks and underwear or on the outside.

MULTI-ROLE HELMETS

The other direction is likely to be towards multi-role where one climbing helmet fulfils a number of different activities. At present that means it's bigger, heavier and more expensive but that will change. Casco GAMS, *Pfanner's Protos Climber, PAB's MP1/2, Future Safety's Manta mk4 and Gallet's F2XR* are excellent examples with climbing, urban/industry rope rescue, firefighting, quad-bikes, skiing and water rescue etc. catered for in one helmet. These are a good indication of how things will evolve for WSAR if they can get weights down because these are still heavier than your average mountaineering helmet for true wilderness use; the *MSA/Gallet F2XR and PAB's MP1/2* actually incorporate an integral headtorch, in the *F2RX*'s case, a dual-beam 250 lumen and rear indicator lighting so they are heavy but useful. As already mentioned the biggest crossover we should start to see more is in combination climbing and water rescue helmets as these two disciplines are most applicable to the majority of wilderness rescue teams be they mountain, cave or lowland wilderness rescue. At present, very few meet actual water-use standards and in fact there is no true water *rescue* helmet standard as yet so it doesn't even get a separate mention in our STANDARDS rows though you will find whitewater (canoeing/rafting) and boat handling listed under the green asterisk as an additional standard.

It's testament to the dominance of European manufacture in helmets that even the key rescue suppliers like *CMC Pro* and *RocknRescue* stock only European models though another big US player, *PMI* does offer its own models branded from New Zealand's *Pacific* as well as imports. Ultimately, ALL of the helmets in this GUIDE are suitable for mountain, cliff, remote areas and upland use as climbing helmets but weight and more importantly, durability are often the prime consideration for rescuers as distinct from sport climbers who are always looking to shave some grams/ounces. Helmets aimed more at 'professional' use than sport are included but will virtually always be heavier and more expensive. The cheapest helmet in this GUIDE is French sports outfitter *Decathlon*'s *Maskoon* at £25. While the top tactical climbing models with rails will set you back £$€200 or more. The lightest weight full 'foam' and even some hybrids and in-molds may be deemed too 'delicate' for the abuse that is encountered in rescue not just in the execution of an incident but in the transport of the helmet when not on your head. As already stated, having chunks knocked out of your super-light foam helmet could render you 'combat-ineffective' when you reach the incident scene. Finally, at the lower end of the price spectrum are the 'Activity Centre' helmets aimed at adventure centres, training centres and high-ropes-courses but equally applicable to team use as no frills, robust options and more often than not with interchangeable and washable components like the comfort padding, head band and even entire cradles. The definition as an adventure centre helmet is more of a marketing thing since any of the simpler hard-shell models could reposition themselves as a helmet especially for adventure centre use. The *DMM Coron* and *Beal's Mercury* by specialist Italian helmet manufacturer *Rock Helmets* are good examples of excellent all round helmets but aimed specifically at multi-person use in centres. With so much competition in the helmet market it's good to have a niche.

KASK
Zenith X PL Combo

ACCESSORIES: This Kask Zenith X PL Combo shows some of the extras you may get on a standard and multi-role helmet. The cog or dial headband adjuster, reflective decals and it may be able to accept ear comms/defenders and visors or goggles that clip into the shell or the goggles may be integral and stow within the shell although these are usually much heavier models. Also note the red eyelet or D-ring on the chinstrap – this is for hanging the helmet on your harness for transport or for storage. Helmet clips for lighting come in various guises, classic elastic V-shape or square on the front and extraneous plastic clips around the shell. Some, like this are recessed and the head band is held beneath. Some will have a clip on the back but this Kask model has a space for a name or ID label on the back (beneath the KASK label.

FEATURES

VENTS You won't see vents on a lot of industrial models because of the risk of debris ingress, water ingress and in some cases the ingress of molten liquids or an electrical discharge. Wilderness rescuers however, are invariably working hard trudging up steep inclines or hauling a casualty over boulder fields or through the tight confines of a cave so generate a lot of heat that is best vented through the head. These vents may be comprised of few but quite large openings like *Petzl's Meteor* or *Mammut's Crag Sender* while others have opted for a colander-style array like the *Edelrid Ultralight* The disadvantage of larger openings is the possibility of twigs and stones getting in – a risk that is negated in the *CT Stark* with a stainless steel mesh but in most models is countered by offsetting the internal lining to partially occlude the opening or in others by having variable vent covers or clip-on covers. Helmets with only minimal vents are indicated by ● in the tables.

SIZE ADJUSTMENT There are three main options for adjusting the fit of a helmet: Headband, Chin Strap and what we'll call the Yoke Union. The first two are self-explanatory but the yoke union is where the chin strap meets the Y-sheaped helmet attachments and there is often a plastic buckle here that can adjust the chin strap forward and backwards in relation to the shell. The headband is generally padded for comfort and sweat retention and often detachable and washable. It needs to fit snuggly around your head and, together with the chin-strap, ensures the helmet won't fall off or tip forwards/backwards when you look up or down. Originally tightening was achieved with a simple belt-style pin and hole adjustment later modified to much safer and lower profile plastic lugs on one end of the headband pushing into a set of holes in the other end. What we have called Slide Adjust and indicated by a ■ in the tables. We did see *Velcro* for a time but that quickly evolved back to a more substantial lug and hole or zip-tie/cable tie style ridges of plastic. This gave rise to the idea of using a knob, cog or dial to drive the two sections over each other and lock into place at wherever you stopped the ratcheting. These ratchet adjusters were originally seen only on fire-rescue and industrial helmets and it was decades before they started to appear on climbing helmets. This may have been because they were perceived to be too heavy or because the knob was deemed a hindrance or even hazard to the back of the head in the event of a fall. Either way, they've now well and truly evolved into the design of many a lightweight climbing helmet shown in our tables as ■

When you adjust that headband and marvel at the snug fit, consider that you may need to ensure it has enough adjustment left to expand and fit over a balaclava or fleece head-covering for winter work. Some helmets offer a second larger size but this often only adjusts between much narrower margins than the regular sized helmet. It could be that your helmet choice is whittled down by the head size range it will adequately fit. Some models have a small and a large size option, often with the smaller size described as a Junior or kid's size but for smaller headed folk and women in particular this may be a better option. For those with a pony-tail, some, like BD and Petzl, have 'women's' versions with a slimmer fit and a cut-away at the back. Female versions are often available in different colours, particularly pink though this seems to be a bit sexist, probably plenty of men who have a pony-tail and would like a magenta or turquoise shell?

CONCLUSIONS

A broad assessment of the current market is tricky because there are so many good products, none of the key players produces any rubbish so it would be very much down to best fit, most comfortable and most applicable features. No overt Chinese representation here as it's the Italians that dominate but there are one or two like CZZ that may be worth a look. *Petzl, Kask* and *Black Diamond* probably remain the market leaders for hard shell and hard-shell hybrid helmets and there's no doubt that companies like *Kask, Rock Helmets, Team Wendy* and *Future Safety* have only one thing on their plate – helmets – so you would expect them to be key innovators. But the European old guard of mountaineering companies like *CAMP, Kong, Edelrid, Grivel, Mammut, Salewa, Simond* and *Stubai* are still producing (or rebadging and selling) excellent helmets. Even the relative new-comers to helmets (though not

climbing kit in general) like *Singing Rock, Skylotec* and *Climbing Technology* continue to push the design envelope so it is far from an easy choice. Tactical or industrial grade helmets (more suited to TECHNICAL**RESCUE** mag's GUIDE) that still meet EN12492 for wilderness work are an easier decision because there are only a handful of options like *Pfanner*, *MSA-Gallet*, *Team Wendy* and *Future Safety* but the multi role aspect will become more prevalent in lighter weight helmets as we are already seeing with the *Kask PL* models and *CAMP Ares Plus*.

IN THE FOLLOWING TABLES:.....

ORIGIN: The main flag refers to the manufacturer's home country, this may not be where the helmet is made. If we know, we show an inset flag. The figures in this Guide are verified by the manufacturer but you often see different spec on some supplier websites and for rebadged models. No idea why!

COST: Recommended Retail Price. Often sold for less so rough guide only – varies due to exchange rates (unusual Euro-Dollar parity in 2022), taxes etc. and we usually round the price up. In the UK, helmets have no VAT when purchased for personal use.

WEIGHT: for the helmet MINUS any accessories

STANDARDS (with thanks to some Team Wendy definitions)

UIAA: The top sport climbing body for mountaineering

(BS)EN12492 Climbing/Mountaineering: Impact tests are performed at the front, rear and sides of the helmet to measure the force transmitted to the headform as well as two drop tests using a sharply-pointed weight (conical striker) on different points around the shell. Climbing helmets also require ventilation as greater than 4cm^2 of the shell area. Chin strap retention should be **greater than 50kg** loading for 2minutes

(BS)EN397 is an industrial standard and where shells may be the same as an EN12492 shell but vents may be less and the chin strap must be able to detach/break at **less than 50kg** to avoid the risk of strangulation in a hang-up. There may also be associated requirements for ingress protection in certain industrial disciplines that preclude the use of vents.

BS/EN14052: an enhancement of EN357 for impact tests

ANS: This an industrial standard (ANSIZ89.1) but many of the C-class (conductive) helmets used for rope access and rescue are covered by this if not by EN12492 as it does not have the breakaway chin-strap requirements of the equivalent European industrial standard (BS)EN297

CSA / AUSNZ: Canadian and Australian/New Zealand industrial standard with some crossover for climbing helmets

EN1077 A & B – Alpine Skiing and Snowboarding: The helmet has to be lightweight and can't significantly impede the user's hearing or field of vision. Drop (impact) tests are conducted at room temperature, in cold temperatures and with artificial UV aging. Class A helmets can't have detachable ear covers since the ears are required to be protected at all times with a greater protective coverage area and higher penetration resistance (ski racing). Class B helmets have more ventilation, less protective coverage and lower impact resistance (ski-touring).

EN1385 is a whiteater (canoeing/rafting) standard

EN16473 is the Technical Rescue standard but is mainly concerned with USAR and ground activities – we have only included climbing-capable helmets as per EN12492

MIL: refers to any number of military standards so you will need to check specific models (only *Team Wendy* and *Future Safety* in this GUIDE) but for SAR it does NOT refer to full ballistic protection.

MATERIALS: PP=Polypropylene (for the outer shell and some components). EPS=Expanded Polystyrene (especially for the shell liner. EPP=Expanded Polypropylene (especially for the crown insert). ABS= Acrylonitrile Butadiene Styrene (thermoplastic polymer) for the outer shell.

USES: *Subjective if outside of a defined standard. -retailers may list uses not shown by manufacturer*

ROCK CLIMBING: Ultralight models for technical route climbers but we've shown what the manufacturer considers a rock climbing helmet which may include more robust multi-pitch, multi-day rock climbing including sea cliffs.

ALPINE/REMOTE: Light but robust for mountaineering as well as remote low angle missions that may involve boulder fields etc.

SKI – A/B TOUR refer to the STANDARDS for actual adherence to ski standards. Ski-touring is a separate CE activity class that does NOT involve high speed downhill skiing.

INDUSTRIAL This covers multiple industrial disciplines – refer to EN397 for models with the breakaway/low-strength chin strap of an option to swap the chin strap. This involves work at height but NOT on-rope activities covered by the next category

ROPE RESCUE: While some of the helmets may meet impact testing requirements of EN397 they will not normally use the low-strength chin strap when used for mountain/cave rescue. ***ALL of the helmets in this guide could be used for rope rescue in a wilderness environment*** but some are far from ideal and some manufacturers, like CT, consider 'rope rescue' to be more of an urban activity and therefore do not list it as a standard use in our Guide despite the fact that their helmets are more suitable than many that are listed as suitable for rope rescue. Always check the requirements of your local protocols before selecting a specific helmet.

CAVING: Most of these helmets can be used but should ideally be tougher shelled, with lower profile and lamp fittings. ***Those shown here as suitable for caving/canyoning are either as specified by the manufacturer or as sold by caving/canyoning retailers.***

CANYONING: Combination of robust and rapid draining.

WATER RESCUE: Refers primarily to swiftwater/flood rescue which doesn't have a specific standard but there are whitewater & boat-handling standards indicated by a green asterisk in the NOTES.

GROUP/TEAM: Lighter weight, usually a more basic design that is tough, inexpensive with components and padding/ headband/chinstraps that can be replaced or cleaned. Sized to fit the widest range of head sizes. Tend not to be the most comfortable but very capable across a range of disciplines.

VENTS VENT COVERS: Virtually all of these helmets have obvious air holes (vents) in the shells shown as a black square ■ but some have less than others, particularly the more industrial oriented helmets. Those with minimal vents are shown with a black circle ● Vent covers are shown as a square ■ for those with the ability to completely close of the vent or with a circle ● for those that have a mesh cover to restrict the ingress of twigs and debris.

LAMP CLIPS BRKT where **BRKT** refers to ***either an elastic retainer or a solid bracket*** at the front or rear of the helmet

COLOURS different colour options are shown as the main colour with trim or secondary colours shown in the box outline.

images NOT to scale		MODEL Variant/ AKA	COMPANY	ORIGIN	COST inc Tax	WEIGHT	SIZES	CONSTRUCTION SHELL INNER STRAPS/HEADBAND	STANDARDS: MIL EN1077 A/B	STANDARDS: ANSI CSA AUSNZ	STANDARDS: EN397 EN14052	STANDARDS: EN12492 UIAA *	USES: ROCK CLIMBING	USES: ALPINE/REMOTE	USES: SKI-TOUR	USES: INDUSTRIAL	USES: ROPE RESCUE	USES: CAVING	USES: CANYONING	USES: WATER RESCUE	USES: 'GROUP'/TEAM	FEATURES: VENTS COVERS	FEATURES: DECALS REFLECT	FEATURES: VISOR GOGGLES	FEATURES: EAR MOUNTS	FEATURES: LAMP CLIPS BRKT	HEAD: SLIDE COG ADJUST	HEAD: REPLACE PADDING	CHIN: PADDED	CHIN: CLICK-RELEASE	COLOURS	NOTES	WEBSITE
		SHELL.DON	AUSTRIALPIN		£63 $65 €55	360g 12.7oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS EPS Polyster/Nylon				■	□	□	-		□	○	□	-	□	■	-	-	-	4	■	■	■	■	■ ■	previous white version may be around 10% cheaper, Also new *Helm.ut Light +* see *Rock Helmets Skyline+* for same model.	austrialpin.at
		Capitan Capitan MIPS	BLACK DIAMOND		£60 £100 $70 $120 €65 €115	295-325g 10.4-11.4oz 320-355g 11.2-12.5oz	53-59cm 20.9-23.2" 58-63cm 23-24.8"	HYBRID ABS EPS/EPP Nylon			●	■ ■	□	□	-		□		□	-	-	■	-	-	-	2 1	■	■	-	■	■ ■ ■ ■ ■ □	*MIPS* is enhanced protection against rotational impact. Also a *Kids* & *Kids MIPS* versions	blackdiamondequip-ment.com
		Half Dome Womans'	BLACK DIAMOND		£58 $60 €55	330-350g 11.6-12.3oz 330g 11.6oz	50-58cm 20.7-22.8" 56-63cm 22-24.8"	HARD SHELL ABS EPS Nylon			●	■	□	□	-		□	□	□	-	-	■	-	-	-	4	■	■	-	■	■ ■ ■ ■ ■ ■		blackdiamondequip-ment.com
		Vapor Womans'	BLACK DIAMOND		£130 $140 €140	186-199g 6.6-7oz 186g 6.6oz	53-59cm 20.9-23.2" 58-63cm 23-24.8" 53-59cm 21-23.2"	IN-MOULD Polycarbonate EPS Nylon				■	□	□	-		□		□	-	-	■	-	-	-	4	■	■	-	■	■ ■ ■ ■ ■ ■ ■		blackdiamondequip-ment.com
		Vision Vision MIPS	BLACK DIAMOND		£90 £120 $100 $140 €90 €125	215-225g 7.5-7.9oz 240-250g 8.5-8.8oz	53-59cm 20.9-23.2" 58-63cm 23-24.8"	IN-MOLD ABS/EPP EPS Nylon	■			■ ■	□	-	□	□	□		□	-	-	■	-	-	-	2 1	■	■	-	■	■ ■ ■ ■ ■ ■	MIPS is enhanced protection against rotational impact	blackdiamondequip-ment.com
		Vector	BLACK DIAMOND		£90 $90 €90	231-240g 8.1-8.5oz	53-59cm 20.9-23.2" 58-63cm 22.8-24.8"	IN-MOLD Polycarbonate EPS				■	□	□	-	-	□		□	-	-	■	-	-	-	4	■	■	-	■	■ ■ ■		blackdiamondequip-ment.com
		Ares Air 0748 Ares Air Plus 2641	C.A.M.P.		£70 $110 €76	475g 480g 16.8oz 16.9oz	54-62cm 21.3-24.4"	HARD SHELL ABS/Polycarbonate HD EPS Nylon			■ ●	■	-	-	-	□	□	○	○	-	□	■ ■ ●	■ □	■	■	4	■	■	■	■	■ ■ ■ ■ ■ ■ ■	Originally called Ares Air ANSI. ●Metal mesh vent covers *Air-Plus not in Green or Blue	camp.it
		Armour 2595 Armour Pro 2644	C.A.M.P.		£50 $60/80 €55	315-370g 11.1-13.1oz 360g 13.1oz	50-57cm 19.7-22.4" 54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS HD EPS Nylon			●	■	□	□	-	-	□	□	□	-	-	■	□ □ □ □	□	■	■	■	■	■ ■ ■ ■ ■ ■ ■ ■	Pro version has mounts for ear/eye protection and is available in red, orange, yellow, white only.	camp.it
		Rockstar 0202	C.A.M.P.		£36 $50 €45	400g 14.1oz	53-62cm 20.9-24.4"	HARD SHELL HYBRID Polypropylene HD EPS Nylon	-	-	-	■	□	□	-	-	□	□	□	-	□	●	□ □	-	-	1 1	■	-	■	■	■ ■ ■ ■		camp.it
		Speed Comp 2458	C.A.M.P.		£105 $120 €120	350g 12.4oz	54-60cm 21.3-23.6"	IN-MOLD Polycarbonate EPS Nylon	■	-	-	■	-	□	□	-	□	○	□	-	-	●	□ □	□	■ *	1 2	■	■	■	■	■ ■ ■ ■ * *	* cold weather ear covers (not industrial ear-defenders)	camp.it
		Storm 2457	C.A.M.P.		£72 $100 €82	S-230g S-8.1oz L-250g L-8.8oz	48-56cm 18.9-22" 54-62cm 21.3-24.4"	IN-MOLD Polycarbonate HD EPS Nylon	-	-	-	■	□	□	-	-	□	○	□	□	-	■	□ □	-	-	4	■	■	■	■	■ ■ ■ ■		camp.it

NOTES: N/A = info Not Available/not given COST: Approx. Inc local tax/VAT VENTS: ■ = closeable ● = mesh covers ○ = minimal openings USES: ● or ● = OK BUT NOT IDEAL ○ in STANDARDS = Meets impact but NOT Chin strap requirements. ■ □ = OPTION

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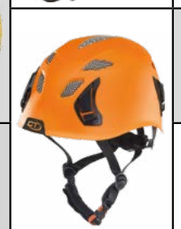
		**Titan** 2127 Junior	**C.A.M.P.**		£44 $54 €50	385g 13.6oz 435g 15.3oz	48-56cm 18.9-22" 54-62cm 21.3-24.4"	HARD SHELL ABS HD EPS Nylon	-	-	-	■	□	□	-	-	□	□	□	-	□	■	□ □	-	-	4	■	■	■	■	■ □ □ ■	Can be entirely dismantled	camp.it
		**GAMS Outdoor**	**CASCO**		£119 $135 €118	500g 17.6oz	50-56cm 20.7-22" 56-59cm 22-23.2" 59-63cm 23.2-24.8"	HARD SHELL HYBRID Polycarbonate EPS Nylon/HDPE	■	-	-	■ *	○	□	□	□	□	□	□	□	-	■	□ ■	-	-	4	■	■	■	■	■ □ □	*EN1385 Whitwater EN1078 Cycling Nomex/Winter liner option	casco-shop.eu
		**Aries Tree**	**CLIMBING TECHNOLOGY**		£87 $90 €85	400g 14.1oz	53-63cm 20.9-24.8"	HARD SHELL ABS EPS Polyester/PP	-	-	-	■	-	-	-	-	□	-	-	-	-	■	□ □	□ □	■	4	■	■	-	■	■ □ ■ ■		climbingtechnology.com
		Eclipse	**CLIMBING TECHNOLOGY**		£48 $55 €50	280g 9.9oz	48-56cm 18.9-22"	HARD SHELL HYBRID ABS EPS Polyester/PP	-	-	-	■ ■	□	□	-	-	○	□	□	○	□	■	-	-	-	4	■	■	-	■	□ □ □ □ □ ■	Option of absorbant or washable non-absorbant lining	climbingtechnology.com
		**Galaxy** X-Arbor	**CLIMBING TECHNOLOGY**		£60 $65 €57	350g 12.3oz	50-61cm 20.7-22"	HARD SHELL HYBRID ABS EPS Polyester/PP	-	-	-	■ ■	□	□	-	□	○ □	□	□	○	□	■	□ □	■	■	4	■	■	-	■	□ □ □ ■ ■		climbingtechnology.com
		Moon	**CLIMBING TECHNOLOGY**		£55 $70 €63	295g 10.4oz	50-61cm 20.7-24"	HARD SHELL HYBRID ABS EPS Polyester/PP	-	-	-	■ ■	○	-	-	-	○	○	○	-	□	■	-	-	-	4	■	■ ■	-	■	□ □ □ □		climbingtechnology.com
		**Orion**	**CLIMBING TECHNOLOGY**		£95 $110 €105	230g 8.1oz	52-56cm 20.5-22" 57-62cm 22.4-24.4	IN-MOULD Polycarbonate EPS Polyester/PP	-	-	-	■ ■	□	□	-	-	○	□	○	-	-	■	-	-	-	4	■	■	-	■	□ □ □		climbingtechnology.com
		**Sirio**	**CLIMBING TECHNOLOGY**		N/A	220-240g 7.7-8.5oz	53-57cm 20.9-22.4" 58-62cm 22.8-24.4"	IN-MOLD Polycarbonate EPS Polyester/PP	-	-	-	■ ■	□	□	-	-	○	□	○	-	○	■	-	-	-	2 1	■	■	-	■	■ □ □ ■	released in 2023	climbingtechnology.com
		**Stark**	**CLIMBING TECHNOLOGY**		£68 $80 €71	380g 13.4oz	53-62cm 20.9-24.4"	HARD SHELL HYBRID Polypropylene EPS Polyester/PP				■ ■	□	□	-	-	○	□	○	-	□	■ ●	-	-	-	4	■	■	■	■	■ □ □ □	Vents protected by stainless steel mesh. Also rebadged by *BORNACK*	climbingtechnology.com
		Venus Venus Plus	**CLIMBING TECHNOLOGY**		£48 $60 €50 €60	340g 12oz	50-61cm 19.7-24"	HARD SHELL HYBRID ABS EPS Polyester/PP				■ ■	□	□	-	-	○	□	□	-	□	■	-	-	-	4	■	■	-	■	■ □ □ □		climbingtechnology.com
		Coron	**DMM**		£50 $65 €55	365g 12.9oz	55-62cm 21.6-24.4"	HARD SHELL HYBRID ABS EPS Polyster/Nylon				■	□	□	-	-	○	□	□	-	□	■	-	-	-	4	■	■	■	■	□ ■ ■		dmmwales.com

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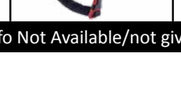
		**DNA** 08-0000048471	**DYNAFIT**		**€154**	**300g 10.6oz**	**56-62cm 22-24.4"**	**IN-MOLD** Polycarbonate/EPS EPS Polyster/Nylon	■			■	□	□	□	-	□	○	□	-	-	■	-	-	-	3	■	■	-	■	■	**Magnetic buckle. *Dynafit* is dual certified but designed more for sport ski-racers.**	**dynafit.com**
		**Radical** 72048	**DYNAFIT**		**€130**	**230g 8.1oz**	**56-62cm 22-24.4"**	**IN-MOLD** Polycarbonate/EPS EPS Polyster/Nylon	■ ■				□	□	□	-	□	○	□	-	-	■	-	-	-	4	■	■	-	■	■ ■ ■	**Magnetic buckle.**	**dynafit.com**
		**Salathe** 72048	**EDELRID**		**£95 $110 €100**	**210-217g 7.4-7.7oz**	**50-58cm 20-22.8" 52-62cm 20.7-24.4"**	**IN-MOLD** ABS EPP Polyster/Nylon	■				□	-	-	□	□	-	□	○	-	■	-	-	-	2 1	■	■	-	■	■ ■	**Designed to be used with ski goggles**	**edelrid.com**
		**Salathe Lite** 72057	**EDELRID**		**£85 $100 €90**	**180-187g 6.3-6.6oz**	**50-58cm 19.7-22.8" 52-62cm 20.7-24.4"**	**IN-MOLD** Fibre-Reinforced ThermoPlastic EPP Polyster/Nylon	■				□	□	-	-	○	-	□	○	-	■	-	-	-	2 1	■	■	-	■	□	**Designed to e used with ski goggles**	**edelrid.com**
		**Shield II** 72036	**EDELRID**		**£75 $100 €80**	**248-274g 8.8-9.7oz**	**48-56cm 18.9-22" 56-62cm 22-24.4"**	**IN-MOLD** Polycarbonate EPS Polyster/Nylon	■ ■				□	-	-	□	□	○	□	-	-	■	-	-	-	2 1	■	■	-	■	■ □ □ ■		**edelrid.com**
		**Zodiac**	**EDELRID**		**£50 $65 €55**	**359g 12.7oz**	**54-62cm 21.3-24.4"**	**HARD SHELL HYBRID** ABS EPS Polyster/Nylon	■				□	□	-	-	□	□	□	○	-	■	-	-	-	4	■	■	-	■	■ □ □ □		**edelrid.com**
		**Ultralight Junior**	**EDELRID**		**£50 $73 €55**	**410g 14.5oz**	**54-60cm 21.3-23.6" 48-58cm 18.9-22.8"**	**HARD SHELL** Polypropylene None Polyster/Nylon	■ ■				□	□	-	-	□	□	□	○	□	■	□ □	-	-	6	■	■	-	■	■ □ □ □ ■	**Junior is white or red**	**edelrid.com**
		Venturi	**EDELWEISS**		**£65 $90 €70**	**240g 8.5oz**	**56-61cm 22-24"**	**IN-MOLD** Polycarbonate EPS Polyester/Nylon	■				□	□	-		□	-	□	-	-	■	-	-	-	2 1	■	■	-	■	□ ■ ■	**All 3 models DISCONTINUED. Beal & Edelweiss are part of the same group so these same models are also sold as Beal Atlantis, Ikaros & Mercury and are also discontinued. Still available from some retailers until remaining stock is sold and replacement models are introduced. All 6 models have Magnetic buckles.**	**edelweiss-ropes.com**
		**Vital 2**	**EDELWEISS**		**£50 $70 €40**	**350g 12.3oz**	**51-62cm 20-24.4"**	**HARD SHELL HYBRID** ABS EPS Polyster/Nylon	■				□	□	□	-	□	□	-	-	■	-	-	-	4	■	■	-	■	□		**edelweiss-ropes.com**
		Vertige Junior	**EDELWEISS**		**£45 $75 €55**	**380g 13.4oz 365g 12.9oz**	**48-58cm 18.9-22.8" 54-62cm 21.3-24.4"**	**HARD SHELL** ABS EPS Polyster/Nylon	■				□	□	-		□	□	□	-	□	■	□	-	-	4	■	■	-	■	■ □ □ ■ ■		**edelweiss-ropes.com**
		**Pro Lite Evo**	**FIXE CLIMBING GEAR**		**£60 $75 €67**	**240g 8.5oz**	**54-62cm 21.3-24.4"**	**HYBRID** Polycarbonate EPS Polyester/Nylon	■				□	□	-	-	□	□	□	□	-	■	-	-	-	3	■	■	■	■	■ □	***Fixe* also sells the *Pro-Lite* see *Rock Helmet Zephyr* for details**	**fixeclimbing.com**

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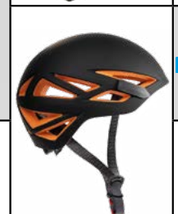
		Manta SAR 4/ Tactical/Extreme MH4 Manta SAR2/3 MH3	FUTURE SAFETY		£114 £83 $220 €150	670g 23.6oz 570g 20.1oz	53-62cm 20.9-24.4" 63-65cm 24.8-25.6"	HARD SHELL HYBRID ABS EPP Polyester/Nylon			□	■ ●	○	○	○	□	□	○	○	□	-	● ■	□ ■	■ ■	■	2 1	■	■	-	■	■ ■ ■ ■ ■ ■ ■ ■	*PAS028 Marine safety EN16471 Wildfire EN16473 Fire-Technical Rescue FS/ATV1 Quad/ATV/Snowmobile *COLOURS: also Navy Blue MH2/3 NOT Fire standards 'Extreme' =also NFPA	future-safety.com
		Duetto	GRIVEL		£130 $170 €140	215g 7.6oz	53-60cm 20.9-23.6"	SOFT SHELL EPP none Polyester/Nylon				■ ■	□	○	□	-	○	-	○	○	-	■	-	-	-	4	■	■	■	■	■ ■ ■		grivel.com
		Stealth Stealth Recco	GRIVEL		£90 £110 $120 $130 €95 €110	190g 6.7oz	53-61cm 20.9-24"	HARD SHELL HYBRID Polycarbonate EPS Polyester/Nylon				■ ■	□	□	-	○	□	□	□	○	-	■	-	-	-	4	■		-	■	■ ■ ■	*HS* version discontinued *Recco* has embedded avalanche trasnponder for *Recco* system.	grivel.com
		Salamander	GRIVEL		£60 $70 €63	360g 12.7oz	54-61cm 21.3-24"	HARD SHELL ABS EPS Polyester/Nylon				■ ■	□	□	-	□	□	□	□	□	□	■	-	-	-	4	■		■	■	■ ■ ■ ■ ■ ■		grivel.com
		Duon Air MH02	HEIGHTEC		£75 $96 €90	350g 12.3oz	52-66cm 20.7-26"	HARD SHELL ABS Polyester Web-only Polyester/Nylon			■ *	■ *	□	-	-	□	□	□	□	○	□	■ ■	□ □	□ □	■	4 2	■	■	-	- *	■ ■ ■ ■ ■ ■ ■	*chin strap buckle can be switched between high and low strength break-away to meet both standards	heightec.com
		Zenith XAir*/PL* WHE00084/79... Hi-Viz WH00085-P*/80*...	KASK		£65 £85 $154* $170* €104 €120	480-490*g 16.9-17.3*oz	52-63cm 20.7-24.8"	HARD SHELL Polypropylene EPS Nylon/Nylon			■ *	□	■	□	-	□	□	□	□	○	-	■	□	□ □	■	4 2	■	■	-	■	■ ■ ■ ■ ■ ■ ■ ■	*Zenith X PL*=CE EN12492 version. **Zenith X Air* = US Ansi/ EN12492 vented version (not European *X-Air* CE397) *Also in Hi-Viz versions	kask-safety.com
		Superplasma PL AHE00005... SP PL Hi-Viz AHE00006...	KASK		£74 £82 $130 $145 €96 €105	420g 14.8oz	51-62cm 20.-24.4"	HARD SHELL HYBRID ABS EPS Nylon/Nylon			□ □	■	□	□	-	□	□	□	□	○	-	■ *	□	□ □	■	4	■	■	*	■	■ ■ ■ ■ ■ ■ ■ ■	*Also in Hi-Viz + ■ (Lime EU)with fluorescent shell, luminous clips,reflective decals. *Mesh-lined *Eco Leather	kask-safety.com
		Kosmos 997100..... Kosmos Full 997105.....	KONG		£75 £93 $126 $146 €80 €100	385-415g 13.6-14.6oz 455-485g 16-17.1oz	53-58cm 20.9-22.8" 58-62cm 22.8--24.4"	IN-MOLD polycarbonate EPS Nylon/Nylon	■			■	□	□	□	-	□	□	□	○	-	■	□ □	-	-	3	■	■	■	■	■ □	Note: image shown with and without full ear cover	kong.it
		Leef 997002.....	KONG		£100 $139 €130	230g 8.1oz	54-61cm 21.3-24"	IN-MOLD polycarbonate EPS Nylon/Nylon				■ ■	□	□	○	-	□	□	□	□	□	■	□ □	□ □	□	4	■	■	■	■	■ ■ □ ■ □ □	Used by *Italian National Alpine and Speleological Rescue Corps*	kong.it
		Mouse Sport MouseTactical 99716.....	KONG		£55-60 £62 $78-91 $95 €57-61 €64	375g 13.2oz 380g 13.4oz	52-64cm 20.7-25.2"	HARD SHELL ABS Web or EPS? Polyester			□	■	□	□	-	-	□	□	□	□	□	■ ●	□ □	□ □	□	2 1	■	■	■	■	■ ■ □ * □	*Yellow is Hi-Viz version. Sport version=Gloss black Tactical=matt black. Also available with industrial version EN397 chin strap	kong.it
		Defender RX	LACD		£77 $100 €90	195-205g 6.9-7.2oz	53-59cm 20.9-23.2" 58-63cm 22.8-24.8"	IN-MOLD Polycarbonate EPS Polyester				■	□	□	-	-	○	○	□	□	-	■	-	-	-	3	■	■	-	■	■ ■ □ □ □		lacd.de

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		Protector 2.0	LACD		£55 $60 €50	394g 13.8oz	53-61cm 20.9-24"	HARD SHELL Polypropylene EPS Polyester				■	□	□	-	-	□	□	□	-	-	■	-	-	-	4	■	■	-	■			lacd.de
		Combo	LA SPORTIVA		£130 $165 €153	290g 10.2oz	52-59cm -23.2" 60-61cm 23.6-24"	HARD SHELL HYBRID Polycarbonate HD EPS	■			■	○	□	□	-	□		□	○	-	●	-	-	-	2	■	■	-	■	□		lasportiva.com
		Wall Rider 2030-00141 MIPS 2030-00250	MAMMUT		£90 £135 $110 $180 €100 €170	220g 7.8oz	52-57cm 20.5-22.4" 56-61cm 22-24"	HYBRID Polycarbonate EPP	-	-	-	■	□	□	-	-	□	○	□	□	-	■	-	-	-	2 1	■	■	-	■	□	*MIPS* version White/Blk only and has enhanced rotational protection	mammut.com
		Crag Sender 2030-00260	MAMMUT		£80 $100 €90	210-220g 7.4-7.8oz	52-57cm 20.5-22.4" 56-61cm 22-24"	IN-MOLD POLYCARBONATE/ EPS/KEVLAR EPS	-	-	-	■	□	□	-	-	○	○	□	□	-	■	-	-	-	2 1	■	■	-	■		*MIPS* version is called *Norwand MIPS* and is listed separately but called *Crag Sender MIPS* by some	mammut.com
		Skywalker 3.0 2030-00300	MAMMUT		£60 $70 €60	330g 11.6oz	53-61cm 20.9-24"	HARD SHELL HYBRID ABS EPS/EPP	-	-	-	■	□	□	-	-	□	□	□	□	□	■	-	-	-	4	■	■	-	■			mammut.com
		Nordwand MIPS 2030-00290	MAMMUT		£140 $170 €160	229-249g 8-8.8oz	52-57cm 20.5-22.4" 56-61cm 22-24"	IN-MOLD POLYCARBONATE/ EPS/KEVLAR EPS	-	-	-	■	□	□	-	-	○	○	□	□	-	■	■	-	-	3	■	■	-	■	□ ■	*Crag Sender* shell and referred to as *Crag Sender MIPS* by some stockists. Black/Orange still available in the US.	mammut.com
		Canyoning	MASKOON		£25 $35 €28	350-380g 12.3oz	50-57cm 19.7-22.4" 54-61cm 21.3-24"	HARD SHELL HYBRID ABS EPS PP	-	-	-	■	□	□	-	-	□	□	□	□	□	■	-	-	-	4	■	■	-	■	■		decathlon.com
		Summit Pro	MILLET		£84 $110 €100	265g 9.35oz	*	IN-MOLD Polycarbonate/EPS EPS Polyester	-	-	-	■	□	□	-	-	○	○	□	□	-	■	-	-	-	2	■	■	-	■	■	*comes with two sets of foam inners to suit all sizes	millet-mountain.com
		F2XR	MSA GALLET		£160 $170 €150	700-750g 24.7-26-5oz	52-65cm 20.5-25.6"	HARD SHELL Thermoplastic Polyester/Nylon/ Plastane Flame-retard mix	-	-	-	■ *	-	-	-	□	□	○	○	○	□	■ ■	■ □	□ □	■	2+ *	■	■	-	■	□ ■ □ ■ * ■	*EN16471 wildland firefighting *EN16473 Technical Rescue *Also Hi-Viz Yellow, Orange and Photoluminescent. *integrated rear & optional front lighting. Clip-in ear guards for water rescue	msasafety.com
		V-Guard H1 TriVent	MSA		£96 $95 €85	515g 18.2oz	52-64cm 20.5-25.2"	HARD SHELL HD PolyEthylene EPS Polyester/Nylon	-	■ ■	-	■	-	-	-	□	□	○	○	-	○	● ●	□ □	□ □	■	3	■	■	-	■	□ ■ * ■	*Also Hi-Viz Yellow	msasafety.com
		MP1 Pro	PAB		£150 $170 €160	830g 29.3oz	52-64cm 20.5-25.2"	HARD SHELL Thermoplastic Heat Resist Foam Flame retardent	-	-	●	■ *	-	-		□	□	□	□	□	-	■	□ ■	□ ■	-	1+ □ *	■	■	■	■	□ ■ □ ■ *	* BS/EN1385 Whitewater EN 16473 – Fire Fighter Technical Rescue Helmet EN 16471: 2014 – Wildfire *Luminous *Option Velcro light fixtures	pab.hr

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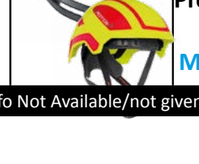
		MP2	PAB		£150 $170 €160	820g 29oz	52-64cm 20.5-25.2"	HARD SHELL Thermoplastic Heat Resist Foam Flame retardent	-	-	●	■ *	-	○		□	□	□	□	□	-	●	□ ■	□	■	1+ □ *	■	■	■	■	■ □ ■ ■ *	* BS/EN1385 Whitewater EN 16473 – Fire Fighter Technical Rescue Helmet EN 16471: 2014 – Wildfire *Luminous *Option Velcro light fixtures	pab.hr
		R5SLV R7HVS	PACIFIC HELMETS		£195 $230	n/a	52-65cm 20.5-25.6"	HARD SHELL Kevlar composite None (Web Cradle) Polyester/Nylon	-	■ ■	■	□	-	○	-	□	□	○	○	○	-	■ ■	□ □	□ □	□	3	■	■	■	■	20 inc	Simplest *R5S* version has a clean shell, no vents and no accessories. *R5T* version has integral lighting mount for *UK/Peli* or similar.	pacifichelmets.com
		R6 Dominator	PACIFIC HELMETS		£290 $350	n/a	52-65cm 20.5-25.6"	HARD SHELL Kevlar composite None (Web Cradle) Polyester/Nylon	-	■ ■	□	■ *	-	○	-	□	□	○	○	○	-	■ ■	□ □	□ ■	□	3	■	■	■	■	20 inc	Fully modular -specify fitting like Rails, lighting clips, colours,decals,water drainage/air vents etc. *EN16471 wildland firefighting *EN16473 Technical Rescue	pacifichelmets.com
		Borea A048....	PETZL		£57 $65 €55	295g 10.4oz	52-58cm 20.5-22.8"	HARD SHELL HYBRID ABS EPP/EPS Polyester/Nylon	-	-	-	■ ■	□	□	-	-	□	□	□	□	-	■	-	-	-	4	■	■	-	■	■	Sized to fit female and smaller heads with rear-cutaway for pony-tails. Replaced the *Elia*	petzl.com
		Boreo Caving A042....	PETZL		£57 $65 €55 €85	285-295g 10-10.4oz 325-335g 11.5-11.8oz	48-58cm 18.9-22.8" 53-61cm 20.9-24"	HARD SHELL HYBRID ABS EPP/EPS Polyester	-	-	-	■ ■	□	□	-	-	□	□	□	□	-	■	-	-	-	4	■	■	-	■	■	Caving version has front and rear mounts for Duo Headlamps.	petzl.com
		Meteor A071AA..	PETZL		£80 $90 €85	225-240g 7.9-8.5oz	48-58cm 18.9-22.8" 53-61cm 20.9-24"	IN-MOLD Polycarbonate/EPS EPS Polyester	-	-	-	■ ■ *	□	□	□	-	○	○	□	□	-	■	-	-	-	2 1	■	■	-	■	□ ■ ■	Extended shell for greater protection for rear compared to previous model. *CE Ski-Touring	petzl.com
		Panga A030....	PETZL		£55 $60 €54	295g 10.4oz	48-61cm 18.9-24"	HARD SHELL HYBRID ABS EPS Polyester/Nylon	-	-	-	■ ■	□	□	-	-	○	□	□	-	□	■	□	-	-	4	■	■	-	■	□ ■ ■ ■	Specifically designed as a 'group' helmet. Often sold in packs of 5 helmets	petzl.com
		Sirocco A073AA..	PETZL		£110 $110 €111	160-170g 5.6-6oz	48-58cm 18.9-22.8" 53-61cm 20.9-24"	HYBRID Polycarbonate/EPP EPS Polyester	-	-	-	■ ■ *	□	□	□	-	○	○	□	□	-	■	-	-	-	2 1	■	■	-	■	□ ■	Magnetic chin-strap buckle *CE Ski Touring, UKCA	petzl.com
		Strato Vent Hi Viz A020BA..	PETZL		£77 £87 $130 $140 €95 €107	415-425*g 14.6-15oz	53-63cm 20.9-24.8"	HARD SHELL HYBRID ABS EPP/EPS Polyester/Nylon	-	■ ■ ■	■ *	■ *	○	○	-	□	□	□	□	□	□	■	□ □	□ □	■	4	■	■	■	■	■ * *	*Hi-Viz Yellow & Orange with luminous clips. *Supplied with EN397&12492 chinstraps. *UKCA. Also a non-vented version. *Vent* aka *Wind*	petzl.com
		Vertex Vent Hi Viz A010CA..	PETZL		£93 £100 $100 $110 €83 €102	490-495*g 17.3-17.5oz	53-63cm 20.9-24.8"	HARD SHELL ABS None (Web Cradle) Polyester/Nylon	-	■ ■ ■	■ *	■ *	○	○	-	□	□	□	□	□	□	■	□ □	□ □	■	4	■	■	■	■	■ * * * ■	*Hi-Viz Yellow & Orange with luminous clips. *Supplied with EN397 &12492 chinstraps. *UKCA, EAC. Also a non-vented version. *Vent* aka *Wind*	petzl.com
		Protos Integral Climber Mountaineer	PFANNER		£144 $170 €156	629g 22.2oz	53-62cm 20.9-24.4" 56-64cm 22-25.2"	HARD SHELL HYBRID ABS EPS/Koroyd Polyester/Nylon	■	□	■	■ *	○	□	□	□	□	□	○	-	□	■ ■	□ □	□	-	■	■	-	■	28+ inc	Huge colour range inc solid and contrast & Hi-Viz. *GoPro*-style bracket available * EN 1078 Cycling and EN397 with optional chin-straps	protos.at

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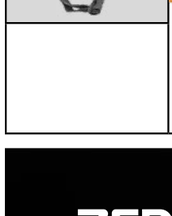
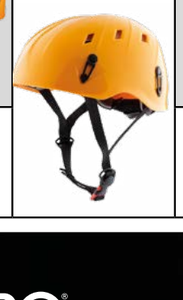
		Ventilator	PMI		£211 $255	510g 18oz	52-64cm 20.5-25.2"	HARD SHELL Kevlar composite None (Web Cradle) Polyester/Nylon	-	■ ■ ■	●	-	○	○	-	□	□	□	□	-	□	■ ■	■ ■	-	-	4	■	■	■	■	■ □		pmirope.com
		Combi RC05..	ROCK HELMETS		£40 $55 €40	390g 13.75oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS EPS PolyesterNylon	-	-	□	■	□	□	-	□	□	□	□	□	□	■	-	-	-	4	■	■	■	■	■ ■ ■ ■ ■ ■ ■ ■	Colours also Matt Black	rockhelmets.com
		Dynamo RC05.. Dynamo Plus RC05P..	ROCK HELMETS		£50 $55 €53	410g 14.5oz 420g 14.8oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS EPS Polyester/Nylon	-	□	□	■	□	□	-	□	□	□	○	□	■ ●	□ □	□ □	■	-	4	■	■	■	■	■ ■ ■ ■ ■ ■ ■ ■ ■	+ Florescent yellow, orange and green, Hi-Viz Yellow & matt black. Plus also has luminous version. *Plus* has mesh-covered vents	rockhelmets.com
		Goliath RC11..	ROCK HELMETS		£50 $60 €55	320-350g 11.3-12.3oz	54-62cm 21.3-24.4" 43-53cm 16.9-20.9"	HARD SHELL HYBRID ABS EPS Polyester/Nylon	-	-	-	■	□	□	-	-	○	□	□	-	-	■	□ □	-	-	4	■	■	■	■	■ ■ ■ ■ ■ ■ ■ ■		rockhelmets.com
		K2 Plus Dolomite RC07P..	ROCK HELMETS		£40 $52 €45	430g 15.1oz	54-62cm 21.3-24.4"	HARD SHELL ABS EPS/web cradle Polyester/Nylon	-	-	-	■	-	□	-	-	□	□	□	-	□	■	-	-	-	4	■	■	■	■	■ ■ ■ ■ ■		rockhelmets.com

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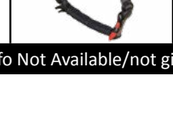
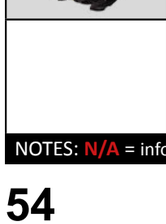
		**Master** RC04.. **Junior** **Junior Pro** RC04J/JP	**ROCK HELMETS**		£50 $60 €57	450g 15.9oz 350-410g 12.3-14.5oz	54-62cm 21.3-24.4" 48-57cm 18.9-22.4"	HARD SHELL ABS EPS/web cradle Polyester/Nylon	-	-	-	■	□	-	-	-	-	□	□	-	□	■	-	-	-	4	■	■	■	■		The second black is matt	rockhelmets.com
		**Morpheus+** RC09..	**ROCK HELMETS**		£60 $80 €62	270g 9.5oz	54-62cm 21.3-24.4"	IN-MOLD Polycarbonate EPS Polyester/Nylon	-	-	-	■	□	□	□	-	○	□	□	□	-	■	-	-	-	3	■	■	■	■			rockhelmets.com
		**Skyline+** RC06..	**ROCK HELMETS**		n/a	240g 8.5oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID Polycarbonate EPS Polyester/Nylon	-	-	-	■ *	□	□	□	-	○	□	□	□	-	■	-	-	-	3	■	■	■	■		* meets EN cycle standard. The second black is matt Also available as the *Austrialpin Helm.ut*	rockhelmets.com
		**Zephyr** **Zephyr AP** RC010..	**ROCK HELMETS**		£50 $66 €55	365g 12.9oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS EPS Polyster/Nylon	-	-	-	■	□	□	-	-	○	□	□	○	□	■	-	-	-	4	■	■	■	■		*Zephyr AP* does not have contrast-coloured shells	rockhelmets.com
		**Piuma 3.0** ..2244	**SALEWA**		£100 $135 €130	175g 6.2oz	51-58cm 20-22.8" 57-61cm 22.4-24"	IN-MOLD Polycarbonate/EPP EPP Polyester/Nylon	-	-	-	■ ■	□	□	□	-	○	○	□	□	-	■	-	-	-	-	■	■	-	■	■			salewa.com
		**Pura** ..2300	**SALEWA**		£55 $70 €60	310g 11oz	48-58cm 18.9-22.8" 56-63cm 22-24.8"	HARD SHELL HYBRID ABS EPS Polyester/Nylon	-	-	-	■ ■	□	□	□	-	□	□	□	○	-	■	-	-	-	4	■	■	-	■	■ ■ ■		salewa.com
		**Toxo 3.0** ..2243	**SALEWA**		£42 $50 €45	390g 13.8oz	53-61cm 20.9-24"	HARD SHELL HYBRID Polypropylene EPS Polyester/Nylon	-	-	-	■ ■	-	□	□	-	□	□	□	○	□	■	-	-	-	3	■	■	-	■	■ ■	*Salewa Pura* discontinued	salewa.com
		**Vaya 2.0** ..1027	**SALEWA**		£130 $165 €150	280g 9.9oz	54-59cm 21.3-23.2 " 59-63cm 23.2-24.8"	HYBRID Polymer ceramic/ Carbon reinforced EPS/EPP Polyster/Nylon	-	-	-	■ ■	□	□	□	-	□	○	□	□	-	■	-	-	-	2 1	■	■	-	■	■ ■ ■	Magnetic chin-strap buckle	salewa.com
		**Vega** ..2297	**SALEWA**		£90 $110 €100	250g 8.8oz	53-59cm 20.9-23.2" 59-63cm 23.2-24.8"	IN-MOLD Polycarbonate EPS/EPP Polyester/Nylon	-	-	-	■ ■	□	□	□	-	□	○	□	□	-	■	-	-	-	2 1	■	■	-	■	■ ■ ■	Magnetic chin-strap buckle	salewa.com
		Vert ..1745	**SALEWA**		£140 $175 €160	350-400g 12.3-14.1oz	54-58cm 21.3-22.8" 59-62cm 23.2 -24.4"	IN-MOLD Polycarbonate EPS/EPP Polyester/Nylon	■	-	-	■ ■	-	○	□	-	○	-	□	-	-	■ ●	-	-	-	2 1	■	■	■	■	■ ■ ■	Magnetic chin-strap buckle	salewa.com
		Climbing	**SAR PRODUCTS**		£45 $55 €50	395g 13.9oz	54-62cm 21.3-24.4"	HARD SHELL ABS EPS/web cradle Polyester/Nylon	-	-	-	■	□	-	-	-	□	○	○	-	□	■	-	-	-	4	■	■	■	■			sarproducts.com

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images NOT to scale		MODEL Variant/ AKA	COMPANY	ORIGIN	COST inc Tax	WEIGHT	SIZES	CONSTRUCTION SHELL INNER STRAPS/HEADBAND	STANDARDS: MIL EN1077 A/B	STANDARDS: ANSI CSA AUSNZ	STANDARDS: EN397 EN14052	STANDARDS: EN12492 UIAA *	USES: ROCK CLIMBING	USES: ALPINE/REMOTE	USES: SKI-TOUR	USES: INDUSTRIAL	USES: ROPE RESCUE	USES: CAVING	USES: CANYONING	USES: WATER RESCUE	USES: 'GROUP'/TEAM	FEATURES: VENTS COVERS	FEATURES: DECALS REFLECT	FEATURES: VISOR GOGGLES	FEATURES: EAR MOUNTS	FEATURES: LAMP CLIPS BRKT	HEAD: SLIDE COG ADJUST	HEAD: REPLACE PADDING	CHIN: PADDED	CHIN: CLICK-RELEASE	COLOURS	NOTES	WEBSITE
		**Rock**	**SIMOND**		£26 $35 €30	350-414g 12.3-oz	50-57cm 20.7-22.4" 54-61cm 21.3-24"	HARD SHELL HYBRID ABS EPS PP	-	-	-	■	□	-	-	-	□	□	□	□	□	■	-	-	-	4	■	■	-	■	□ ■ ■		**simond.com**
		**Sprint**	**SIMOND**		£50 $55 €47	180-200g 6.4-7oz	55-59cm 21.6-23.2" 59-62cm 23.2-24.4"	HYBRID Polycarbonate/EPP EPP	-	-	-	■	□	□	-	-	○	○	□	○	-	■	-	-	-	2 1	■	■	-	■	■		**simond.com**
		**Hex** C0900	**SINGING ROCK**		£64 $70 €67	300-330g 10.6-11.6oz	52-58cm 20.5-22.8" 55-61cm 21.6-24"	HYBRID ABS EPP Nylon/PP	-	-	-	■	□	□	□	-	○	□	□	-	□	■	-	-	-	2 1	■	■	-	■	■ ■ □ ■ ■	*Kappa* discontinued	**singingrock.com**
		**Penta**	**SINGING ROCK**		£75 $84 €79	205g 7.23oz	51-60cm 20-23.6"	IN-MOLD Polycarbonate/EPS EPP Nylon/PP	-	-	-	■ ■	□	□	□	-	○	□	□	-	-	■	-	-	-	4	■	■	-	■	■ ■ □ ■		**singingrock.com**
		**Aero**	**SKI TRAB**		£145 $165 €150	290g 10.3oz	52-58cm 20.5-22.8" 59-62cm 23.2-24.4"	IN-MOLD Polycarbonate/EPS EPS	■	-	-	■ *	□	□	□	-	○	-	○	○	-	■	-	-	-	3	■	■	■	■	■ ■ □	*EN1078 - Cycling *Gara* discontinued	**skitrab.com**
		**Attiva**	**SKI TRAB**		£122 $130 €120	210g 7.4oz	52-58cm 20.5-22.8" 59-62cm 23.2-24.4"	IN-MOLD Polycarbonate/EPS EPS	-	-	-	■	□	□	□	-	□	□	□	□	-	■	-	-	-	4	■	■	■	■	■ □		**skitrab.com**
		**Inceptor GRX Mnt** BE590.. **GRX Mnt Ref** BE591..	**SKYLOTEC**		£110 £139 $115 $145 €110 €138	470g 16.6oz	54-63cm 21.3-24.8"	HARD SHELL Polycarbonate/ABS EPS/web cradle Polyster/Nylon	-	-	■*	■	□	□	-	□	□	○	○	-	-	■ ●	□ ■	□ □	■	4	■	■	-	■*	■ □ ■	*When used with optional <50kg chin strap. *Buckle is a magnetic clip. Ref=Reflective decal version not available in Black	**skylotec.com**
		**Skybo** BE-1015..	**SKYLOTEC**		£61 $70 €60	370g 13oz	56-62cm 22-24.4"	HARD SHELL ABS EPP/web cradle Polyster/Nylon	-	-	-	■	□	□	-	-	□	□	□	-	-	■	-	-	-	4	■	■	■	■	□ ■	Replaced the *Skycrown*	**skylotec.com**
		**Viso** BE-1020..	**SKYLOTEC**		£86 $96 €85	260g 9.2oz	53-61cm 20.9-24"	IN-MOLD Polycarbonate EPS	-	-	-	■ ■	□	□	-	-	□	○	□	□	-	■	-	-	-	2 1	■	■	-	■	■ ■		**skylotec.com**
		**Fuse Light 3.0** 901005/6	**STUBAI**		£50 $65 €55	350g 12.3oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS EPS Polyster/Nylon	-	-	-	■	□	□	-	-	□	□	□	○	-	■	□ □	-	-	4	■	■	-	■	■ □		**stubai-sports.com**
		Spirit 901007/8	**STUBAI**		£65 $75 €70	280g 9.9oz	55-60cm 21.7-23.6"	HARD SHELL HYBRID ABS EPS Polyster/Nylon	-	-	-	■	□	□	-	-	□	□	□	○	-	■	-	-	-	4	■	■	■	■	■ □ □		**stubai-sports.com**

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		Nimbus Plus	STUBAI		£69 $88 €80	240g 8.5oz	51-62cm 20-24.2"	IN-MOLD Polycarbonate/EPS EPS Polyster/Nylon	-	-	-	■	□	□	-	-	□	○	□	□	-	■	-	-	-	2 1	■	■	■	■	■ ■ ■		stubai-sports.com
		SHK-1	STUDSON		$140	495g 17.5oz	53-59cm 20.9-23.2" 58-63cm 22.8-24.8"	HARD SHELL ABS EPS/Koroyd Nylon	-	■	-	■	○	○	-	□	□	○	○	○	-	■	□ □	■	■	4	■	■	■	■	■ ■ ■ ■ ■ ■	Includes a MIPS style enhanced impact system called *Brainshield*. Also a Non-vented version. Embedded NFC chip with emergency information	studson.com
		Ascender Ascender MIPS	SWEET PROTECTION		£150 £180 $160 $220 €140 €180	400g 14.1oz 430g 15.2oz	53-56cm 20.9-22" 56-59cm 22-23.2" 59-61cm 23.2-24"	IN-MOLD Polycarbonate/ABS EPS Nylon	■	-	-	■ *	□	□	□		○	○	□	-	-	■ ●	-	-	-	4	■	■	-	■	■ □ ■ ■	*ASTM2040 ski	sweetprotection.com
		EXFIL SAR Back Country Tactical	TEAM WENDY		£235 $192* $326 €240	630g 22.2oz 720g 25.4oz	53-63cm 20.9-24.8"	HARD SHELL HYBRID Lexan Polycarbonate Copolymer EPS 5/8" Nylon	■ *	-	● ●	■ *	□	□		○	□	○	○	□	-	■ ■	□ □	□	□	1*	■	■	■	■	■ ■ ■ ■ ■ ■ ■ *	* Add $39 for rails. Weight is without rails. *Buckle is a magnetic clip * requires $10 adapter *ACH combat blunt impact. *BS/EN1385 Whitewater	teamwendy.com
		Orbix XT-Orbixgreen	TENDON (LANEX)		£60 $75 €62	240g 8.5oz	54-62cm 21.3-24.4"	IN-MOLD Polycarbonate EPS Polyester/Nylon	-	-	-	■ *	□	□	□	-	○	□	□	□	-	■	-	-	-	3	■	■	■	■	■ ■ ■	* meets EN cycle standard	mytendon.com
		Cirrus	TRANGO		$60	461g 16.3oz	53-62cm 20.9-24.4"	HARD SHELL HYBRID ABS EPS Nylon	-	-	-	■	□	□	-	-	□	□	□	-	-	■	-	-	-	4	■	■	■	■	■ ■ ■ ■	Fidlock magnetic buckle	trango.com
		Halo	TRANGO		$100	225g 7.9oz	54-62cm 21.3-24.4"	IN-MOLD Polycarbonate EPS Nylon	-	-	-	■	□	□	-	-	□	○	□	□	-	■	-	-	-	3 1	■	■	-	■	■ ■	Fidlock magnetic buckle	trango.com
		Technical Rescue HEPAB3.EV	WRS INTERNATIONAL		£150 $170 €160	850g 30oz	52-64cm 20.5-25.2"	HARD SHELL Thermoplastic EVA Nylon/Leather	-	-	-	■ *	-	○	-	□	□	□	□	□	-	●	□ ■	■ ■	■	1+ □ *	■	■	■	■	■ ■ ■ *	* BS/EN1385 Whitewater EN 16473 – Technical Rescue EN 16471: 2014 – Wildfire PAS028 - Saltwater corrosion *Luminous *Option Velcro light fixtures	wrsinternational.com
		Apex Exo APX05	ZERO HEIGHT SAFETY		£65 $80 €62	410g 14.5oz	51-62cm 20-24.4"	HARD SHELL HYBRID ABS EPS Nylon	-	□ ■	●	■	□	○	-	□	□	○	○	-	-	■ ●	□ □	■ □ *	■	4	■	■	■	■	■ ■ * *	*Fluoro Orange & Lime *Direct fit half face visors available EN166	zeroheightsafety.com
		Pinnacle Zertec ZPZK01 Pinnacle Exo ZPE01	ZERO HEIGHT SAFETY		£118 £78 $140 $90 €132 €85	450g 15.9oz 440g 15.5oz	54-62cm 21.3-24.4"	HARD SHELL HYBRID ABS EPS/Koroyd* Nylon	-	□ ■	●	■	□	○	-	□	□	○	○	-	-	■ ●	□ □	□ □	■	4	■	■	■	■	■ ■ * *	*Zertec* has NFC chip with emergency contact details. **Exo* does NOT use *Koroyd* and has mesh vents. *Fluoro Orange & Lime, luminous white	zeroheightsafety.com
		SecureFit x5000 Hi-Viz	3M		£90 £126 $110 $145 €92 €140	400g 14.1oz	50-63cm 19.7-24.8"	HARD SHELL ABS EPS/web cradle Nylon/HDPE	-	□ *	■ *	■ *	○	○	-	□	□	□	□	-	-	■ ■	□ □ *	□ □	■	4	■	■	-	■	■ □ * * ■	*option of EN397/ANSI &12492 chinstraps. Has UV Radiation exposure indicator. Add approx 10% for reflective on standard helmet, *Hi-Viz comes with reflective in price.	3m.com

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REMOTE ANCHORING

By Mitch Sasser & Mike Croslin

Dr Mike Croslin is co-founder of the world's first swiftwater rescue program, and co-inventor of the very term 'swiftwater rescue' along with fellow water rescue legends Jim Segerstrom, Warren Berg and Barry Edwards. They went on to form Rescue3.

Mitch is the CEO of training company Tandem Rescate in Chile formed 20 years ago. He was originally trained by Jim Segerstrom, Mike Croslin and Jim Lavalley

TOP: Using a *Reach* to establish a remote anchor and then self-belay across.
BOTTOM: Once across, recover the *Reach* and/or belay across the next person

INTRODUCTION

[ED: This year's disastrous flood events in Pakistan, India, Australia, Canada, parts of Africa, Tennessee in fact virtually everywhere in the world, have reinforced Jim Segerstrom's loudly voiced contention (back in calmer times) that EVERY rescue service needed to prepare for the coming floods.
Back then, the great Californian water rescue group of Jim, Michael Croslin, Barry Edwards and Warren Berg pioneered the teaching of swiftwater rescue pretty much on the fly based on their extensive experiences in whitewater rafting in fast flowing water and of flash flooding. Often, their techniques and teachings were modified in response to an incident and these techniques continued to be taught for decades afterwards sometimes as a lower priority method but still without any real retrospective review of efficacy. In the last issue Mike Croslin voiced concerns that parts of his own teachings from the 80s and 90s regarding shallow water crossings were flawed, often based on a reaction to single events that meant teams were missing out on techniques that could have been a help rather than hindrance or danger. The next issue of TECHNICAL RESCUE carries a modification of his original, unpublished chapter from the first Swiftwater Rescue manual that formed the basis of Rescue3 teachings for the next 4 decades. This issue continues with his more recent mantra that water-entry should be a last resort and should always be properly protected, take note of his more radical thought that ***Downstream Protection is NOT Protection i****n some of these articles. In the last WSAR we looked at the* Continuous Loop *technique with the emphasis on team safety. This time around Mitch and Mike go into more detail about securing safety lines via remote anchoring using the grapple-like abilities of the REACH device. Of course, they're both entirely biased but I can attest to the excellent ability of the Reach to hook onto just about everything, anytime, even when you don't want it to! While we haven't seen any direct competitors to the Reach emerge, there is a plastic snag device on the market which bizarrely claims that....* Current throwbag technology does not allow for fast and efficient access to another throw rope in the water. *I think Mike and the previous three decades might have something to say about that so he kicks off with how and why the Reach was born...]*

HISTORICAL BASIS FOR THE REACH DEVICE

One of the first uses of remote anchoring in modern swiftwater rescue dates back to the 70's when Kern County SAR in California developed a line canon to deliver a stainless steel rod with three 6 inch sections of rebar welded onto the rod facing forward when loaded into the barrel of the mortar. A steel ring/eye was welded on the end to attach up to a 11mm Rescue static line (PMI caving Pit rope) carefully flaked out forward of the canon mortar. The propellant was 1 grain of black powder per foot of judged distance. Once fired the rod would invert and was aimed at the foliage of the largest trees or a jumble of rocks likely to jam or snag in the trees or rocks. This was then used to move a rescue craft belayed to the opposite shore.
Jim Segerstrom, Warren Berg and myself witnessed the use of this line launcher during a swiftwater rescue class taught for Kern Co., San Diego Lifeguards, and LA County Fire in 1978.
So impressed with its ability to shoot an 11mm modern Static kermantle line easily up to 400ft, we commissioned one to be made for Rescue3 and for close to ten years we closed every SRT course with a “fire-in-the-hole” demo of its utility. If faced with a need to cross a big volume, high velocity channel with a rescue line in a single explosion this remains the only viable method to do so other than short-haul with a helicopter.
Kern County SAR, in its early days, would fire the canon at a common recurrent nightmare SAR site called Helicopter Isle,

a densely vegetated isle that rafter and recreational boaters would get deposited and stuck on. This was named after several unfortunate incidents with a jungle penetrator and twin Jet Hueys out of China Lake Naval air station that nearly crashed due to tangled lines. Once the rescue line was delivered, they would use its snaggy nature to remote anchor a pendulum or tension diagonal to the isle. Faced with the regulatory and occupational safety concerns of this home-made canon and issues with flying it around the US we abandoned its use around 1985. However it planted the seed for the usefulness of placing an anchor on the opposite shore where there is no access during big volume, or in steep gradient channels that could not be crossed by anyone safely. But a remote anchor could be established and tested and utilized safely in extreme circumstances. It was clear to me, Jim and Warren that a miniaturization of some form of throwable device that could reliably snag, chock or jam in vegetation and rocks would be of great utility. From the start the primary goal of such a device was to allow for thrown accurate placement with up to 70ft of attached 1/4 floating poly-spectra, the metallurgy used would need to stand up to repeated bashings against hard rock without deformation or stress fractures for the lifetime of the device and would simultaneously capture up to 1/2 inch diameter floating and non-floating rescue line.

The result was the *Reach* device which became the first technical rescue, multi-discipline tool that was designed to be thrown far and land against hard rock and jam, chock or snag in brush/trees /vegetation to support dynamic floating rope-based evolutions that are the backbone of modern swiftwater rescue. Many think of the Reach as a line capture tool, which of course it is…line capture is just one form of remote anchoring and is no doubt highly prized for this reason alone. However, this is only one aspect of remote anchoring based on capturing lines. Lines thrown short, line crossings, *Kiwi* method looping evolutions, rope recovery, gear recovery all rely on some degree of this essential function. This is only half the story regarding the broad utility and purpose built design of the Reach. Its design is to act as a form of protection, remotely placed by a rescuer to aid in the crossing of high-risk channels or close to terminal features where the risk of a swim could prove high probability of grave injury or fatal.

Remote anchoring is an essential skillset, not an advanced optional, not a 'maybe' skillset that might come in handy. It is simply too important in risk mitigation, access and self rescue capability across a broad range of swiftwater challenges that benefit from increased protection, and the speed at which it can be created safely. It adds an expanded access capability to SAR personnel tasked with getting hands on to those who need airway support or are prone to cold stress in technically challenging locations that no swimmer or traditional technical rope approach could access safely.

PPE has evolved to include not just the equipment we wear but how to maximize its capabilities. Now PPE is a broader term with respect to rescuer safety. We can carry an enhanced package for each rescuer that includes a swimmable 70ft throw bag, waist belt and a *Reach* in a separate pocket on the PFD, closed, secured and collapsed.
In this piece we hope to inspire your own journey into trusting and depending upon the Reach as a remotely placed anchor, whether its placement specifics are seen or unseen, within a set of standard pre-checks and pull tests through the vector load arc. Lots of images of placements, throws, series of sequential images should enhance understanding of how useful remote anchoring can be and how to do it competently and safely. Keep an open mind, avoid contempt prior to first-hand experience. For rope rescuers in particular this may seem counter-intuitive; to trust an anchor you cannot examine up close. But we are invariably working across water rather than exposed to a high fall and we're looking for any mechanical advantage we can construct that will enhance access, and mitigate what is otherwise a poorly or even unprotected risk. It´s a noble skill-set with clear benefits for any SAR role and it's quite an enjoyable sport/activity in itself so training could actually become a sporting event!

HOW TO.....

We learn to throw the *Reach* across the channel into a location we have scouted as ideal based on likelihood of jamming, chocking between rocks or clipping a vegetative small diameter collection of foliage (brush). The spring arms of the *Reach* will clip then strip the leaves and smaller branches as its pulled back, especially if you can get penetration with a hard short toss, or a high arc trajectory penetration with a longer throw. With a little practice one learns to trust the tenacity of a jam- snag- strip-&-set anchor that can't be pulled out by the arc of loading you anticipate using. Of course you will have chosen a section of river that allows easy exit at the end of a simple tension traverse pendulum, or possibly more aggressive upstream progress against the current if gloved for hand over hand self belay. Or better yet, a progress capture device that gives both better grip and power. This greatly expands the range of gradient, volume, and speed of the channels that can be crossed with a solo protected crossing on channels, steep creeks or streams that otherwise would be impossible. In essence we can now swim or wade upstream if we can locate a remote anchor that lines up with a vector headed in the desired direction.

Don't just think above the waterline. We can also use 'wet' anchors by capturing tree roots or boulders below the water line where they have deposited near shore or even in mid-channel if they serve as ascendable vector or pendulum arc vector useful to facilitate a safe traverse. A specific example

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is an extreme (solo) kayaker who was trapped in a vertical pin for over an hour. He was ultimately able to chock a *Reach* he carried on a 15ft webbing leash and was able to lower and drag to a jammed underwater location between boulders that gave him the adequate pull vector to exit his boat, a potentially deadly entrapment that is duplicated out of water below.

I will let Mitch discuss the broad category of Loop anchors as they relate to fast attack, safe approaches to anything that can be looped, including entire isolated large islands, or trees in flooded areas that pose tremendous danger to boat access unless belayed from a downstream approach. Progressive upstream angled throwbag tosses past trees and subsequent line capture of the trailing rope in the current allows safe upstream movement through flooded treelines. This is an amazingly safe access approach using the fast reliable line capture function that helps sew shoreline to target with remote line retrieval looped anchors around tress, rocks, isles, bridge abutments, vehicles, or logs and strainers to gain access, or evacuate, or remove boats or debris without risk, remotely or with minimal exposure. In essence a turbo charged class of enhanced kiwi method looping manoeuvres to allow protected fast attack hands-on access quickly with minimal gear carried by each rescuer as part of their PPE package. All is possible with a lighter, faster, more versatile but minimal equipment load.

Mitch: **REVERSING THE TREND** OF SENDING A RESCUER OUT ATTACHED TO A LINE

For years we have protected rescuers from the shore utilising their QRS Belt system which is far from fool-proof due to placement of the quick release buckle in the center of most Type V PFD´s. Sending a rescuer out with a line attached to them inhibits forward progression to some extent and may well hinder safe and quick access in actual rescues. The weight and diameter of the line affects the degree of drag experienced by the rescuer and by the control line to shore. Where live-bait training is undertaken it should be challenging and the 'push' element of being belayed should be contrasted with the reverse method of pulling towards your objective using self-belay. Because our contention is that self-belaying from an established remote anchor at or close to the target site provides more stability and freedom of movement – effectively you belay yourself towards the target under your own control rather than be belayed from shore with the inherent risk that your belayers may give slack or take in at inopportune times and slow your progress or even cause you to come off your feet. For a belt-&-braces approach, a line can be attached to the QRS belt also, just make sure the line can be well managed during the crossing, it should be possible to give more slack than if this were your only safety/progress line.

Direct Remote Anchor – is created by connecting/tying the *Reach* to your desired floating rescue line which is coiled and then thrown or tossed at a relevant angle with the intent of the *Reach* snagging and making a sound anchor 'connection'. When I say 'connection', there are a number of ways to do this in different environments. Through the action of remote anchoring whether it be a secure clip to another line, chocking, jamming or wedging between stable rocks, boulders, trees, logs or live vegetation and then pulling firmly to jam in a crack or 'grapple' multiple branches or a more substantial branch/root/stem. We can also lightly 'mend' the line (a technique commonly used in flyfishing for tending the floating line on the surface while slightly manipulating the fly for the correct presentation for the fish to take) and let gravity do its work. The current can gently tumble the *Reach* downstream almost crawling the device into position. This skill has many facets even using the current in the river as drag on the line in a downstream belly as a way to turn the *Reach* into the desired position for a solid placement and allowing you to move on safely. In my own training I created the challenges of making as many river crossings as I could in a 60mt downstream progression format. The dynamics of the swiftwater and combined obstacles make this challenging and a great learning experience when working alone crossing the river from one pendulum swing to the next. It did not take long to feel the freedom of protective movement while swinging from remote anchor to the opposite shore micro-eddy. Using a progress capture device (a handled ascender or non-handled rope grab) while crossing improved my grip and enabled me to ascend upstream if needed just to escape downstream or turbulent currents.

On virtually all rivers there are many anchor options to choose from and among many alternatives I would find that anchoring my *Reach* throwing from upstream to downstream across the channel would angle and chock my reach best for the next downstream pendulum swing. Aim the *Reach* directly in the slots and chokes that are a visually obvious. The moment you think your placement is where you want it, (in line with the desired arc of the pendulum and current vectors to cross), a series of sharp tugs at different angles will set it and you are ready to progress into the current.

UNHOOKING THE REACH

On occasion, I've thrown my *Reach* a full rope length to an anchor that isn't ideal for my intended route so to retrieve it I move well upstream, if possible gain a little elevation over the anchor site and I have then been very successful in being able to 'mend' the line and pop the *Reach* out of its placement. I should make it clear that the shorter the throw the greater the accuracy so a 'big throw' must weigh up the balance of the time saved in creating a one-hit crossing and the potential

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Above: A substantial tree trunk that has been 'chocked' for many years provides scope for a Kiwi-Looped remote anchor that can give a mid-stream anchor from which to search the full width of this otherwise difficult to access, deep gulley. The main line throw bag is dropped into the upstream flow on the nearside the log. It can then captured by a Reach on the downstream side and can be clipped back onto itself and cinched up to the log for a solid anchor. With a short release cord added to the bag-end (that gets cinched up) the main line can be recovered remotely to save having to access and traverse that log!
Meanwhile, on California's Pacific Crest Trail, (pic right), unless it's an absolute last resort, this classic shallow water crossing method is a very preventable accident waiting to happen.
Above-right: Just as cave and mountain rescuers pre-install strategic anchors at known risk sites so water rescuers can manage the vegetation to provide anchors and ease access/egress

time lost in having to reposition. For throws greater than 20 meters gaining some elevation can be of great help in improving accuracy and surety of placement. If the *Reach* is still stuck a second Reach can modify the vector of the line and Reach for a release. In addition if retrieval is a must, a simple 3:1 mechanical advantage system will fold the arm backward at around 1kN. You shouldn't have to do this if well orchestrated. It will depend on the way the Reach is chocked into place. No one we know has ever done this except us so send a picture and we will replace the arm for free. I prefer 6mm to 7mm high strength floating rescue lines combining smart position on shore in relation to the current, the drop of the river and the anchor placement to mend and pop the *Reach* out of placement.

PREPLANNING: IMPROVED SPEED & VIABILITY OF BASIC SYSTEMS

In making a decision to include a *Reach* on a SAR call as a piece of technical gear in a hasty pack depends on the terrain in the area of operation. Instruct all SAR Team members of the importance of revisiting pre-plans now that you have a *Reach* as PPE or as a part of a group or team. Its inclusion could radically alter your previous pre-plans and timings. There is a continual need to improve, simplify and enhance rope systems used in swiftwater in order to continually mitigates risk exposure to rescuers during an emergency response. Here in California, *Reach* systems have been used heavily for over a decade by many teams and agencies tasked with swiftwater response and have therefore modified their approach significantly in all rope based evolutions. They have incorporated it into their self rescue and team-mate-in-trouble protocols such that *Reach* is considered PPE for each rescuer. This is an image of a preset prepared anchor, they can be flagged in a preplan for operations at well known, recurrent incident and training locations. Recorded and logged/inspected for live viability and pruned each year. These are immensely useful during heavy rain/ flooding conditions to quickly move a boat to a stranded car with occupants etc. This is a example of an altered operational plan that the Reach compels for preventative SAR, and speed of access and egress. Same could be created at high risk crossing sites along major thru hiker trail routes where there is historical data suggesting high risk. Remove foliage above, clean out any dead/decaying stems and provide a clean target and strong placement. Training to use such sites will inspire confidence in students to look for and plan remote anchoring as part of their operations.

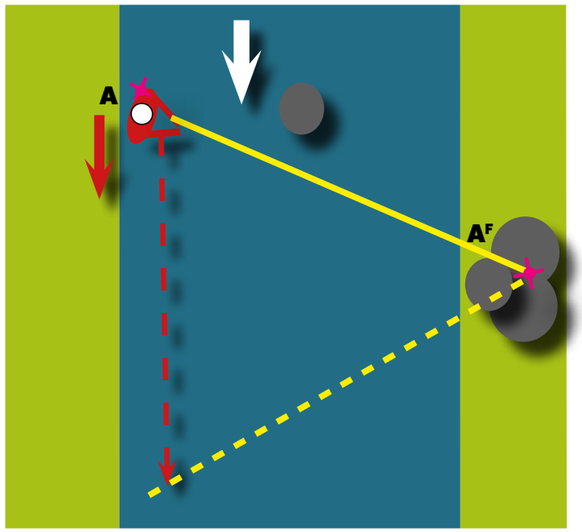
Actually, we have been remotely anchoring for a long time. The definition of remote is that you are not actually present at the site to place the anchor; you are at a distance. The *Reach* can clip another line thus anchoring to it and joining the two in the middle. Secondly, the Kiwi method showed us that we could clip remotely to another line on the far side of an obstacle; a tree, rock, boulder or group of natural features, thus creating an anchor point at the desired location or close enough to fine tune the location by way of the vectors in the joined lines. We then progressed to flossing or adjusting the lines up or downstream to remove the *Reach* from the system for possible further use and proceed with clean lines. Our experience told us that multiple lines are often not available. So we clipped the main line back on itself placing the *Reach* line into reserve and then created a girth hitch with the main line around the mid-stream or far-bank obstacle. We now moved to apply the main line in a single format for tension diagonal or pendulum access to the site. Everyone in swiftwater rescue should know these options exist. They are field tested and provide a clear path to evolving most rope-based swiftwater rescue scenarios. This is the Kiwi method as we will describe in detail below.

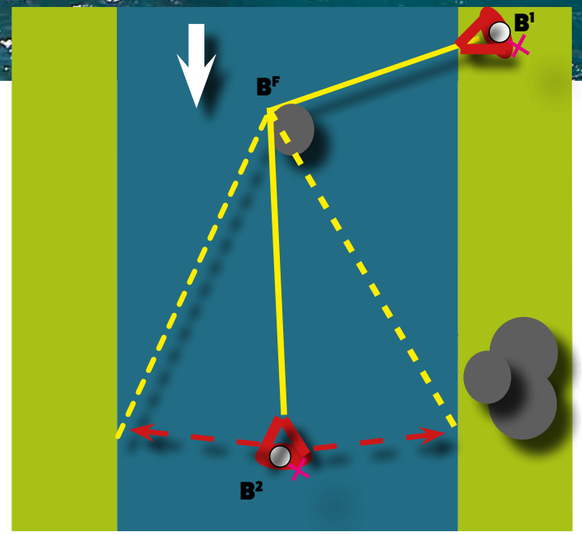
Short of placing lines with drones the *Reach* is the first, and currently *only*, mechanical device to demonstrate improved viability of remote systems and enhance the safety of rescuers and the efficiency of swiftwater and flood rope systems operations. As things progress and we see drones/UAV being used more in water rescue, the *Reach* will always be your cheaper, smaller and more reliable option capable of being carried by each and every team member.

With remote placement having been checked for integrity through experience and maybe backed up visually with judicious use of binoculars, a remote anchored line can be used as a ***fixed pendulum*** line created in seconds (**A**). This is probably the most significant and brilliant uses of the *Reach* for personal and team safety improving speed of operation.

Together with a ***Kiwi-loop***-established mid-stream anchor (**B**,**C**&**D**) these options give excellent and safe access across a the full longitudonal and transverse span of a river.
A (below) shows how safe wading (or float-swimming) of an entire segment of river is possible with remote anchor placement of a Reach on the opposite bank $\mathbf{A^F}$. In the case of a mid-stream anchor $\mathbf{B^F}$ once the line has been captured by rescuer $\mathbf{B^2}$ the line can either be fixed on a near-shore anchor or use a belayer at $\mathbf{B^1}$ to provide dynamic length adjustment to the rescuer $\mathbf{B^3}$.

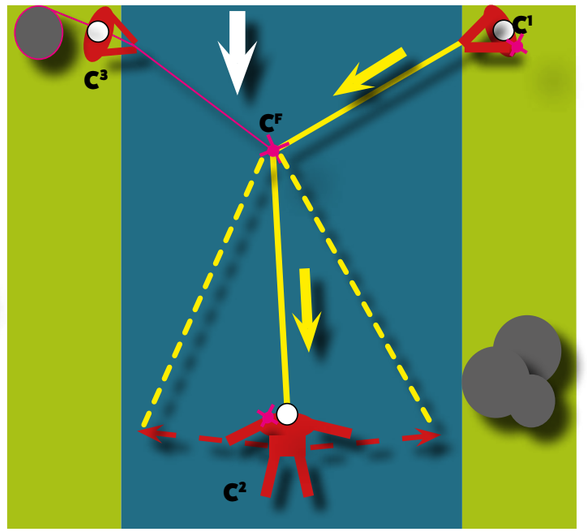
Safer crossings can be made in different ways. One can remote anchor to a wide variety of obstacles that are good solid anchor placements and then perform a fixed line wading crossing or if the channel is deep, a floating active rescuer pendulum can be performed to access the site or the far side of the river. Take a minute before committing to a fixed line shallow water wadding crossing to consider and understand the changes of force on





the system when a wading crossing turns quickly into a floating rescuer on a pendulum swing. Why does this not hinder the operation? Because reduction of forces are significant and beneficial with floatation and correct stream-line body position.

You can create an artificial mid-stream anchor $\mathbf{C^F}$ to provide the cross-width security of a mid-stream pendulum by deploying a *Reach* $\mathbf{C^3}$ to capture the line of a rescuer $\mathbf{C^2}$ being belayed from the upstream opposite bank by $\mathbf{C^1}$. To start with, rescuer $\mathbf{C^2}$ commits to the water heading for mid-stream being belayed from further upstream by $\mathbf{C^1}$. The line behind him/her is captured by a *Reach* line deployed from the other bank by rescuer $\mathbf{C^3}$ and then secured firmly to a solid anchor. The rescuer $\mathbf{C^2}$ can then pull away from this mid-stream anchor $\mathbf{C^F}$ created by the *Reach* and is able to pendulum the full width of the river. However, this system will usually progressively take the mid stream rescuer closer to the bank each time the *Reach* anchor slips down but with experience a combination of actions by all three rescuers can correct this.



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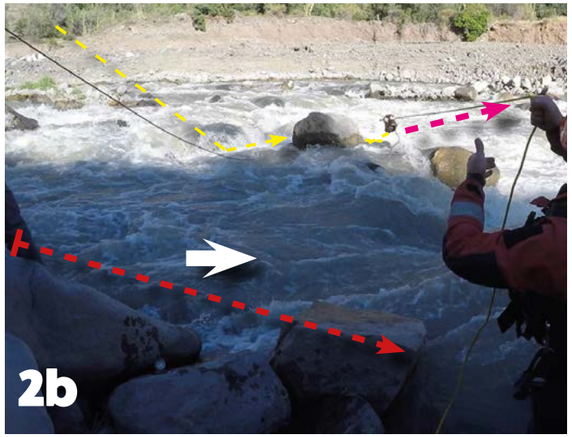


Kiwi Looping – Remote Anchor Options:

- Using the very ends of one rescue line for shorter distances (the bagged/knotted end is thrown upstream of the target anchor and the other end with *Reach* attached, is thrown across the first section of line as it comes past the anchor. We are essentially creating a continuous loop out and around the desired obstacle which might be a mid-stream rock, tree or an island that will be solid and stable enough to create the vectors in the line needed for crossing the currents.
- Using one long line where the rescuer self belays or is belayed from the near-side bank, upstream of the target anchor and wades or floats towards and past the mid-stream anchor which is then used as the pendulum fulcrum for full river width searching/rescue operations.
- Using two independent lines with one or two rescuers. As per option 1 but with much greater flexibility and scope/range of operation. The amount of line used will be determined by a number of factors, primarily the distances between the main shore-line and the desired obstacle but changes in water level and elevation from anchor or belayer will also be factors to consider.

Kiwi Looping – Single Line Looped Remote Anchor

[Diagrams 1 to 4 Below. Note each rescuer has a *Reach or two!*]
More commonly this operation is done using two independent lines.

1) First the main line is thrown upstream and to the far side of the desired obstacle leaving the bag and remainder of the line floating downstream of the obstacle.

2) From a suitable vantage point, a second line with a *Reach* is deployed out to capture/securely cross-clip the main line. The *Reach* and its partnered line from upstream are then pulled into shore downstream. Remove the Reach from the captured line.

Now you have your *Reach* back with you and it is not involved in the system. Apply a locking carabiner to the end of the main line and clip it back on itself. Rescuer **D1** moves downstream of the anchor to effect a better position to cinch the line up

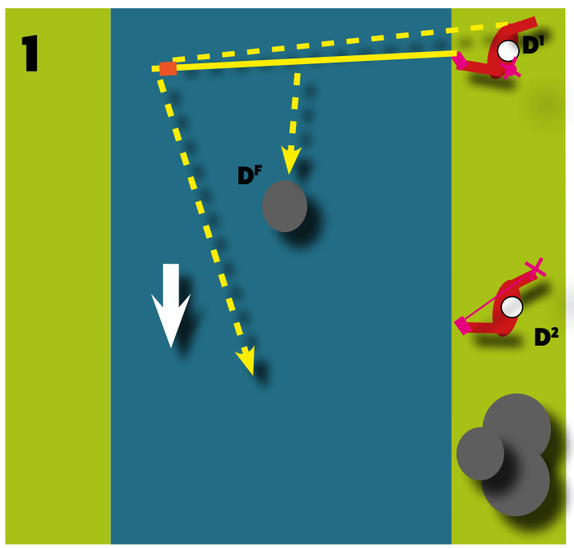
3) Haul in on the main line so that the carabiner slides upstream along the rope and cinches around the anchor. This creates a closed loop or Girth Hitch and rescuer **D1** can start to move into the flow pulling against the anchor in a secure pendulum.

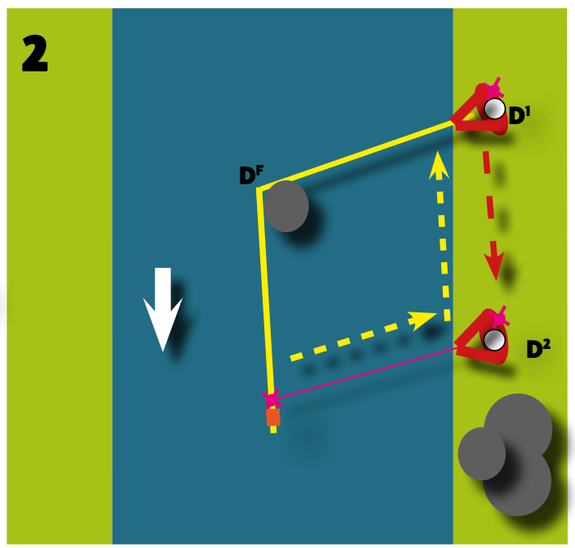
4) Rescuer **D2** stands by with a Reach and all on-scene rescuers are equipped with their own Reach system stowed 0n their harness in the same way as a regular throwbag. Rescue **D1** can manoeuvre into the flow either by wading while pulling against the anchor or by float-swimming. On completion of the rescue or search evolution the rescuer moves up the main line to free the choked carabiner and retrieve the line. The *Reach* can be thrown to remotely capture a shore anchor or a colleague can manually place the *Reach* to provide a secure self-belay anchor. What are some of the challenges you might face working this type of system? First, the main line thrown out to be clipped or anchored to must be managed to maintain position – in image **2a** opposite you can see how the current has taken the slack in the line to form a deep bow before being dragged back once the *Reach* has captured the bag-end. Secondly before the initial throw or presentation consider known or unknown facts about the lines being used. Will the first line thrown be the main line used for the crossing? Normally it should be or all lines should be equally strong but what if the *Reach* is attached to the best line in your inventory? If used as the main line, the *Reach* would need to be retrieved around the obstacle where friction is highest and likely not possible. Do not try to pull the *Reach* around an obstacle, it is designed to snag and that's exactly what it will do. The upstream line is used in current and flow and with bodyweight loading all contriving to maximise the forces on it. Certainly, rescuers will need to run a profile on those who need to be rescued; the operation may include the need for only access, only egress or the sum of the two. Do your best to keep the *Reach* with you and in-play as much as possible. Rescuers should always have a second bag close by to extend your line out quickly if needed.

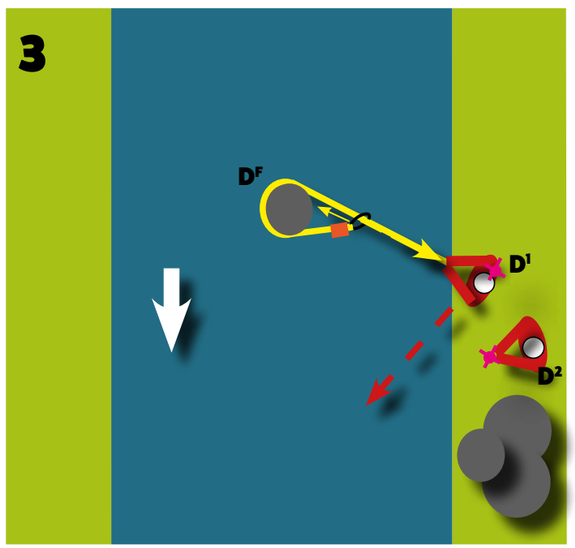
These remote anchoring options provide a belay for the first-crosser. This is otherwise the highest risk move in any swiftwater rescue if unprotected by direct attachment as distinct from the throw-&-hope possibility of a throwline from a colleague on-shore reaching you should the need arise. They replace the need to put multiple unprotected rescuers in a shallow water crossing for stability or QRS/Live-bait strong swimmers in high-risk situations without effective assistance.

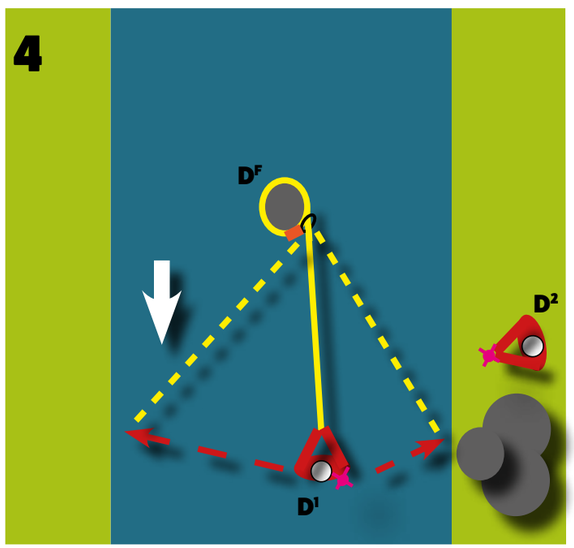
MAKING THE MOST of REACH-style SYSTEMS

Mike: Mountain SAR teams/groups not normally equipped for getting in the water but may very well still need to cross streams, channels or rivers. They may also be caught in flash floods, debris slides and increasing water volume due to rainfall in the area. Any team's risk assessment that covers water-crossing or inundation with the classic multi-person shallow

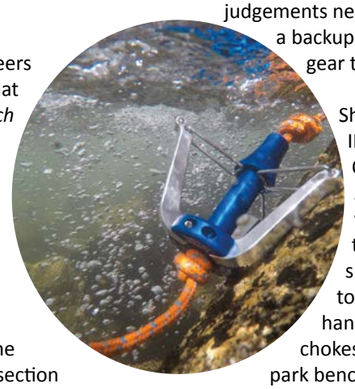








water crossing techniques using multiple rescuers in-line or in a wedge to counter the force of the current washing the whole team downstream are flawed. Belay options together with the *Reach* giving remote anchoring (self-belay) give you much better and more secure options.



Thru hikers, trekkers, backpackers, mountaineers and rescuers all have similar risk potentials that warrant carrying the extra 6oz/170g of a *Reach* and whatever light weight, high strength, small diameter line you're carrying to protect anticipated swollen creeks, streams or negotiate crossings during heavy rainfall and spring runoff. Preplanning necessitates researching the terrain, weather patterns, and local info on stream crossings during specific time of year. In my own backyard on the Pacific Crest Trail for example (pic p68), the most dangerous part of the entire PCT is the section between Tuolumne Meadows and Sonora Pass during Spring runoff from March through June. Then it is wise to carry some form of first-crosser protection since there are 5-6 high risk crossings on drainages that may force miles of searching to find an ideal spot, or to choose super sketchy log hops and many must make moves with a heavy pack. Being in moving water while carrying a pack is an additional big problem not always covered in water rescue training and ironically those already carrying a lot of weight may feel they don't want the added weight and bulk of a *Reach* system so listing 'traditional shallow water crossing techniques' on their risk assessment planning seems like a fair compromise. They have fallen prey to the teachings of SwRT courses (including ours!) that deem shallow water crossing techniques as safe when, in fact, they are sketchy at best and when there is increased flow there is no real protection should the formation misjudge the depth, velocity, river bottom stability or simply panic since most have little experience of true flash flooding or inundations. Heavy pack and no PFDs are a recipe for disaster without effective (rather than illusionary) pre-planning. If there were even a single rope in the group the best practice would be to have a single *Reach* & light floating rope pack, use it to remote anchor and protect the first crosser and set up a steep angle tension diagonal for each team member and pendulum belay the last crosser. The sturdy vegetation and/or boulders and any number of man-made fixtures along most rivers is ideal for anchoring the *Reach*, and simply impossible to imagine you not being able to locate an adequate solid anchor placement within a 20m arc of almost anywhere you're standing

Just to reiterate, self-belaying via a remote anchor, with or without an additional belay, should be the gold standard for a water crossing. Instead, the gold standard is more often deemed to be a belayed first crosser followed by the establishment of a tension diagonal for any others associated with the Group, the final crosser protected by a pendulum belay. This is how the experts do it, this is how we did it. Shallow water crossings, solo with props, and multi person formations are excellent tools for professional rescuers to gain access during routine operations and will continue to be used heavily, no doubt, BUT experienced water rescuers have PFDs, field training and real-world experience to make the judgements necessary having trained to swim out and have a backup plan with additional personal and the right gear to pick up the pieces downstream…hopefully.

Shore-based teams and even those who use IRB´s or manual powered crafts (paddle or Oar) would also benefit from carrying the *Reach* in their PPE and this is something we may look at in a later article. Recent hot training sessions at IWARP in Indiana USA show teams remotely anchoring the *Reach* to a wide array of urban structures such as hand rails, concrete curbs and water drainage chokes, and closely paired street signs and bolted park benches as bomber anchors for light weight first crossers and even the fastest deployment of V-Lower access ever seen in Swiftwater Rescue. We may expand on this too in a later article!

A precise placement of the *Reach* will sustain 3KN of force. Use high strength lines to meet the balance in projection of the throw of *Reach* and line with the need for a thicker line to get the job done. Higher diameter lines will be heavier and more cumbersome to throw so you need to strike a balance and there are more and more suitable lines coming onto the market so make sure you stay up to date with developments.

CONCLUSION – Remote Anchoring is the way forward

River search in technical terrain remains one of the most dangerous and challenging aspects of clearing a search area, more so in areas prone to flashing during heavy rainfall. Add night deployment and the risk rises to extreme proportions. Climbing-style belaying requires rescuers to work in buddy pairs to master paying out slack to the lead crosser (enough slack to move freely, not so tight that you pull them off their feet – unless they are already swimming!) or pulling in a pendulum return should they fail to cross. This is the lowest grade of real protection, not a colleague with a throwbag though it still depends on the skills of a well trained vigilant partner. But even this adds no power or stability correction to the crossing. Contrast this to a cross-channel, remote anchor that is pull tested properly; the rescuer is in the best position to both protect their own crossing, and add stability and power to reach their goal. Add a belayer from behind with a second line clipped into their quick release harness and this is the ***highest level of real protection***. Channels that are too steep, too deep and too fast for anyone to cross safely are too often inadequately protected despite the assurances of SwRT instructors and courses. Remote anchoring and self-belay provides enhanced access and real protection versus what should only ever be an absolute last resort, the lesser technique of relying on downstream safety.

See *Crossline Reach* Facebook page for video demonstrations.

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