

WILDERNESS SAR

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



ISSUE
9

DOLPHIN 1

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WILDERNESS SAR 9



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SMC APEX PULLEY

Photos by John Evans

ED: With a whopping 38kN MBS and a swivel eye you could drive a bus through, the SMC Apex swivel pulley is a welcome addition to a growing class of hardware pioneered by Rock Exotica with their Omni range. As always, you need to keep looking over your shoulder having produced a ground-breaking product because if it's good enough the other key manufacturers will soon follow suit with their own variations like Petzl's Spin and now SMC's APEX. This is what SMC have to say about their new baby:

SMC combined 54 years of design and manufacturing knowledge with an uncompromising program of innovation, prototyping and user feedback to create our new Apex Swivel Pulley. The result is a pulley with unmatched security and deceptively simple ease of use.

The Apex is a mid-line attachable pulley that secures the rope using a low-profile, patented, triple-action lock mechanism that can easily be opened with one hand. This robust lock is operated by three distinct actions: pivot the lock button, depress it, then swing open the side plate. Simply closing the sideplate re-engages the lock mechanism and solidly secures the rope. The operation is intuitive and ergonomic.

The Apex features symmetrical side plates which are optimized for integration with prusik-based progress capture systems. This streamlines system set-up and minimizes the possibility of mis-rigging.

The swivel eye was designed to accommodate up to three

carabiners so you can use the Apex in virtually any rigging scenario. The cold-forged design features softgoods-compatible, rounded profiles for situations where you want to eliminate the carabiner altogether. The swivel eye's versatility allows it to excel in a wide range of rigging configurations.

Whether your ropework discipline is rescue, rope access, or arborism, the Apex Swivel Pulley, is the most easy-to-use, secure option out there. This robust, American-made pulley will give you the confidence to complete your operation, no matter how complex the challenge.

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ON THE COVER



| | SMC APEX 1.5 | Rock Exotica OMNI 1.5 | Petzl SPIN L1 |
|----------------------|------------------|---|--|
| Origin | USA | USA | France |
| Sheave (inner) | 38mm / 1.5" | 38mm/1.5" | 40mm/1.5" |
| MBS | 38kN | 36kN | 36kN |
| WLL | 9.4kN | 8kN | 6kN |
| Length | 149mm/5.86" | 135mm/5.3" | 150mm/5.9" |
| Width | 74mm/2.9" | 63.5mm/2.5" | 70mm/2.75" |
| Weight | 306g / 10.8oz | 303g / 10.7oz | 290g / 10.2oz |
| Rope Capacity | 13mm/ ½" | 13mm/ ½" | 13mm/ ½" |
| Bushing or Bearing | Bearing | Bearing | Bearing |
| Materials – Frame | Aluminium | Aluminium | Aluminium |
| Materials – Sheave | Stainless Steel | Stainless Steel* | Aluminium |
| Prusik Minding (PMP) | Yes | Yes | No* |
| Midline Attach | Yes | Yes | Yes |
| One-Way Lock | No | No | No* |
| Standards | NFPA, CE pending | NFPA, CE | NFPA, CE |
| COST: | £97 /\$98 /€120 | £98 /\$99/€121 | £98 /\$105/105 |
| NOTES | | *Also available with Aluminium sheave 9.2oz | *L1D version= PMP with one-way sheave lock |

CAVE RESCUE HARNESS by KONG ITALY



The New TARGET sit harness and SMART chest harness from Kong has been developed for caving and rescue, improving comfort and safety for rope-users. Cost is around €180 and €52. The loop hanging down in this photo is an adjustable hardware attachment

loop.

Kong say:

Sport and Work EN

Certification for use in industry, sport and rescue. The SMART

chest harness can be integrated to form a complete FALL ARRESTER (CE EN

361) harness that can be used in helicopter rescue operations, by caving rescue or canyon rescue teams.

The SMART chest harness positions the chest ascender by means of retractable, adjustable webbing and is equipped with loops for carabiners. The sit harness and the chest harness are connected by an extension joint with a lark's foot knot.

MAIN FEATURES:

- wide ventral waist band and padded leg loops make it very comfortable during suspension, even when transporting heavy materials, thanks to the load distribution
- the descender's main attachment point is raised compared to a classic caving harness, which keeps the body's centre of gravity in a lower position, improving sitting comfort and balance
- conceived with the needs of exploratory caving in mind, it is also oriented for chimney climbing and subterranean ascent
- the main belay loop allows the descender good torsional mobility, avoiding critical twisting that can occur between descenders and closing quick links
- secondary attachment point for connecting a chest ascender: thanks to a webbing bridge sewn between the leg loops, the ascender is in a lower position
- 4 large lateral tubular gear loops (max load 10 kg)
- 4 belt transport loops offering a high attachment point for

a tool bag when moving on unstable slopes or for carrying bolting bags (max load 50 kg)

- barycentric sling attachment for bag transportation (max load 50 kg). Easy to adjust and replace, with two hanging points according to the user's ergonomics
- padding made of strong nylon to withstand abrasion in meanders and bottlenecks

- sturdy buckles that can be easily adjusted using a looped piece of cord
- elastic retaining straps in the leg loops which are easy to replace

Completely made in Italy!

www.kong.it



PICCOLO PULLEYS

From Canada, AMAROK is Performance Manufacturing's product brand and if neither name is familiar, you WILL know their products as they make many of CTOMS tactical products, Sterling's PDQ and CMC's Pulleys and Escape Artist so quality is

definitely not in question.

These weeny prusik minding pulleys (PMPs) are amongst their first forays into promoting AMAROK as a separate brand in the rope rescue market. The Piccolo pulleys are diminutive, super-light using up to 10mm rope but super strong with bearings not bushing and still weighing only 46g for the single while giving Working Load Limits of 7kN (double) and 4.5kN for the single pulley. The large eyes will take 3 carabiners. Expect to see more from Amarok Technical Gear in your gear stockist but in the meantime the 'tactical' version of this is available from CTOMS as the Prodigy (single) in black or orange for \$59. www.perf-mfg.ca <https://ctoms.ca>



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TYROMONT RESCUE DOG HARNESS



WSAR issue 8 featured a **GUIDE to Rescue Dog (suspension) Harnesses**, in other words, safety harnesses designed for rescue dogs to be abseiled/winned/raised/lowered/rappelled into or out of a helicopter and up or down vertical faces.



(there will be a separate GUIDE to SAR Dog Flotation Harnesses) Tyromont subsequently released an update to the EVO model we included with 3 variations of the same harness which we think is generically called the 'Dog-Strap' and can perhaps be described as being akin to a human evacuation triangle style harness. All three harnesses have the following features with the differences mentioned separately:

TYROMONT DOG-STRAP (3 versions)

- Light, small dog harness designed for quick use.
- Cordura body panel.
- Can be folded up small for transport – comes with a bag.
- Large Velcro strip on the back allows flexible adjustment.
- Rear leg straps are lightly padded for better support.
- Rigging plate with 2x Triactlock carabiner optionally available (# 93724).
- Sizes: M, L, XL
- Weight: L 540g XL 850g

Tyromont TyrLiner (93355) Blue/Red & **Tyromont Tactical** (93721) Olive
Tyromont Tyr-Strap BW (93355): Side belt reinforcement & two extra handles on the rear legs to help control and steer the dog.
www.tyromont.com

REVECTOR DETECTOR UAV MOBILE PHONE/CELL LOCATION for RESCUERS

ED: This is an example of a specialist company from outside of our sector having a product that suits the needs of Search & Rescue perfectly. In this case, Revector is best known as a security and fraud analysis and detection company but along the way, they realised that their mobile phone detection system had other uses – while it helped in catching the bad guys it would also help in finding the lost! It does this by pretending to be a base station – you often hear in police drama's that they can locate a perp by triangulating pings off nearby towers. In this case if the phone won't come to the tower/base-station, the tower goes to them. This works well as a heli-borne system but inevitably evolved into a UAV-carried system enabling wilderness and disaster area rescuers to detect mobile-phone carrying targets more cost-effectively. They call it RDD with D for drone which is catchier than the UAV. We used in the titles. The drone shown above may have been superseded by a model similar to Darryl's Scottish Mountain Rescue model in this issue giving up to 90minutes of flight time but the basic principle, based on their IMSI Catcher system, remains the same and can presumably evolve with drone improvements to use whichever model Revector feels is most suitable:



Revector IMSI Catcher can locate mobile telephones in challenging airborne Search and Rescue scenarios where accuracy and time are critical to ensure safety and wellbeing of human life. Locating the cellular phone of a person, seriously injured, in distress or in a life-threatening situation, Revector IMSI Catcher operates on the local Network coverage, or where there is poor or no coverage.

Nearly everyone has a cellular phone and being able to turn this into a rescue beacon that can be tracked by search and rescue could mean the difference between life or death. The system is user-intuitive and provides accurate and fast location capabilities whilst minimising crew involvement and workload. Using the latest technology, hardware and cellular protocol stacks designed, developed and tested by Revector and optimized for use in helicopters and UAV drones. Revector IMSI Catcher is a natural complement to traditional search and rescue techniques and practices.

As well as Search and Rescue, Revector Detector can locate any powered cellular phone in a disaster area. Providing critical access to trapped or incapacitated individuals to locate as well as communicate including sending and receiving messages & calls from those in need of rescue and assistance.

web: revector.com



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PRODUCTS

Heli-Offshore Harness

The 497 TRITON is LSC's second generation helicopter hoistable rescue harness with dual recovery capability. It is standard equipment for the USCG Aviation Rescue Swimmers and Canadian SAR Techs. Building on the foundation and comfort of the 487 TRI-SAR, the TRITON offers numerous enhancements. A new low profile flotation vest provides variable buoyancy up to 35 lbs with reduced bulk. Several equipment pockets have been transferred to the waist belt for improved weight distribution and comfort. Quick release buckles have been added to the leg straps for easier donning and doffing of the harness, and a chest strap added for better fit adjustment. The recovery hook has been updated to LSC's Talon IIS safety hook with swivel and locking gate. All components and materials are corrosion resistant for the marine environment. The 490 Triton II incorporates all the features of the #497 with the exception of the standard equipment pockets. They have been replaced with MOLLE Strap Panels on the waist belt of the harness and MOLLE straps on the front of the flotation vest. Numerous MOLLE pockets are available to allow the user to customize the needed configuration for the mission.

COST APPROX \$1100

WEB: lifesavingsystems.com



NORTHERN DIVER **SEA HAWK** water rescue helmet



Great all-round protection. Suitable for white water and swift water rescue. The shell drops below the ear for extra protection and helmet stability. The split-mould injection process creates a very rigid shell and an ergonomic "negative draft" shape that follows the natural curves of the head, protecting the forehead and base of the cranium.

- ABS plastic shell
- ABS plastic extends to ears
- Twist lock adjustment
- Lightweight
- Colours: gloss red, white and orange; matte yellow and black
- Conforms to EN 1385:2012
- COST £35

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WATER RESCUE

ND **ARCTIC SURVIVOR** EVO Range of PFDs

Northern Diver's Arctic Survivor Range of professional PFDs still includes the Evo5 and Evo5 XXXL. The Evo X is a low profile Kayaker style PFD while the Evo 6 is a full-height general purpose PFD. Both PFDs have these features in common: Tested to EN 12402-5:2006 & 12402-6:2006

Outer body: Red 500D CORDURA®

Inner body: ISO approved soft floatation foam

- Cowtail and carabiner
- Padded adjustable shoulder straps
- Excess webbing can be stored in strap keeper pockets for no snag hazard
- Removable orange pealess PFD
- Fail Safe System load tested to 3.2kN and meets ISO 12402
- 25mm Reflexite® prismatic bands & narrow reflective piping
- Front, rear/shoulder 4-way lash tabs & Plastic D-rings
- Removable encapsulated identification panels on the rear (panels can be customised, 2 sizes available)
- Removable Flexi-Light pocket -ND Flexi-Light 5 colours options
- Anti slip waistband prevents PFD from riding up in use
- Reinforced stitching strengthens high wear areas
- Internal hand warmer / docs pockets
- Drawstring storage bag

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EVO 6

Medium – chest < 106cm/42"
weight: 76kg (>100N)
Large: chest <116cm/46"
weight: 5kg (110N)
XL: chest <142cm/56"
weight: 115kg (>120N)

- 50mm removable chest harness with 316 stainless steel O-ring
- Single-handed quick release buckles for front entry
- Two front Velcro close cargo pockets with clip-in points and drain holes
- Whistle on retractable lanyard
- 25mm yellow branded removable crotch/leg straps

COST: £125



EVO X

Medium – chest < 106cm/42"
weight: 76kg (>75N)
Large: chest <116cm/46"
weight: 95kg (80N)
XL: chest up to 142cm/56"
weight 115kg (>85N)

- 40mm removable chest harness with Quick release x-loc buckles
- Front entry
- Tough grip shoulder panels
- Zipped front pouch

COST: £115

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ARCOS

ASSISTED RESCUE CONTROL SYSTEM

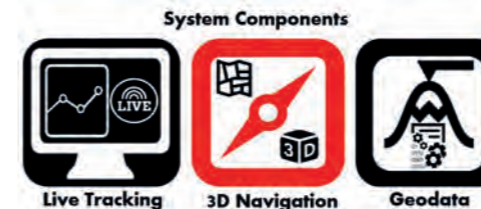
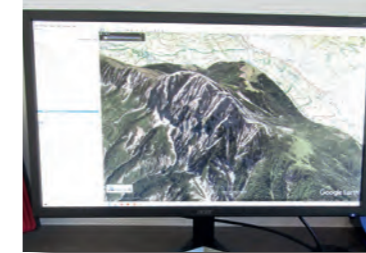
A Free-to-Use Monitoring System for Rescuers



by **Marco Gabl**

Marco Gabl MSc. Geographer, Member of ÖBRD Oberes Drautal Mountain Rescue Team in Austria and Developer of ARCOS

A coordinated and effective approach to mountain rescue operations is a key challenge for rescue services. Accidents in alpine regions and searching for missing persons in natural disasters such as avalanches, is always a race against time. To improve response times and meet the challenges of rescue in the best possible way, the free to use *Assisted Rescue Control System* (ARCOS) was developed in 2016 as an expedient mission control system, based on the cornerstones of live-



tracking, navigation and free geodata. The goal of ARCOS is to optimize processes in mountain rescue operations, to enable faster and more effective assistance and to increase the rescue team's own safety in the process. As the developer of ARCOS, however, it was also a great concern of mine to focus on free geodata and a lean as well as robust system architecture in addition to a system that is as simple and intuitive to use as possible. In addition, there are no costs for the software and no license fees. In other words, a system by and for voluntary and professional rescue organizations.



WEIGHT: 35g / 1.25oz
WATERPROOF: IP68
GNSS: GPS & GLONASS; SBAS; A-GPS powered by u-blox

Fig 1: GNSS Tracker Module



The Austrian mountain rescue service (Österreichische Bergrettungsdienst, ÖBRD) is supported by around 13,000 volunteer members providing year-round response to alpine and lowland incidents, around the clock and in all weathers. The Austrian Mountain



Rescue Service is divided into 7 regional organizations with a total of almost 300

local chapters. This results in a uniquely dense network of a voluntary, alpine rescue teams in a relatively small area. I have been a member of mountain rescue station ÖBRD Oberes Drautal for over a decade. With more than 50 members, we serve an area of approximately 550 km² / 342 miles².

Yearly increasing numbers of missions, mainly rescue operations of injured persons as well as search operations in difficult accessible terrain, prompted me to develop an instrument that could support us in our operations in the best possible way. Thus, the mission control system ARCOS was born.





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ABOVE & BELOW ÖBRD Oberes Drautal uses a custom-built, Long Wheel Base, Twin Cab Iveco

ABOVE & Main Title Image on p42 Night search and rescue operation of an injured alpinist In addition to a challenging search the team had to perform vertical and steep angle evacuation to rescue the casualty



an Internet-based, free tracking portal and then transferred to the personalized mission-monitoring station/desk (Fig. 3). Each tracker module is equipped with an internal battery and can be connected to a power bank for longer missions. At the touch of a single button, the GNSS Tracker can be switched on. Rescuers place the tracker in their backpack, in the emergency vehicle or on the collar of the rescue dog- that's it, and off they go! Data transmission is handled via mobile internet or telephone network. Now the command center knows where the team is located and can give navigation instructions to the rescue team members or warn them if they are drifting into a dangerous area for example. If there is no data network in an area, the position data is temporarily stored on the tracker and passed on to the control center when it is received again, so that no position data is lost. In addition, the rescuers are equipped with analog radios that work throughout the area to be able to communicate with the control center. The mission monitoring system itself, is essentially based on Google Earth Pro and, in addition to the already high-performance 3D navigation, has been modified with topographic maps, higher-resolution aerial images (20 cm per ground pixel), relevant geodata such as helipads and thematic maps such as slope maps for avalanche operations. Different layers can be overlaid, for example the slope map can be overlaid on the topographic map (Fig4.). The Command Center 'cockpit' (Fig2) can be easily customized for the respective operational organization with the appropriate data sets. In addition, simple editing functions such as the delimitation of a search area or the import and export of GPX tracks are available. In addition to the use of real-time position



Fig 2: ÖBRD Oberes Drautal mountain rescue team Command Center



Fig 3: System Architecture of ARCOS

HOW DOES ARCOS WORK?

An essential component is the live transmission of real-time position data of the field-rescuers to the mission monitoring system. This is achieved with rugged GNSS (GPS) trackers (fig1). The coordinates are transmitted in real time via the cellular network to a web browser. The live data is received in

data with our GNSS trackers, we also use conventional Garmin handheld devices for navigation. These provide robust tracking with unrestricted terrain capability (snow, rain, storm) and good battery performance at the same time. In any case, these are superior to most smartphones when it comes to outdoor navigation. Figure 3 outlines the structure of the ARCOS system architecture.

In order to keep the system as simple as possible, I decided to avoid the use of smartphones and to handle positioning with the smart GNSS trackers. In principle, however, it is also possible to perform live tracking and navigation using

smartphones. Another useful feature is the automatic archiving of the missions. Thus, all missions are archived and mission statistics can be calculated.

In the last five years, more than 200 missions and numerous exercises and training evolutions have been carried out with ARCOS. In the process, suggestions for improvement made by our mountain rescue members have been continuously implemented in the system. Among them are the expertise of a flight room supervisor, army mountain guides, geo-statisticians and suggestions of all our mountain rescue members; these are all taken into account. Thus, the system is constantly evolving.

SEARCH MANAGEMENT

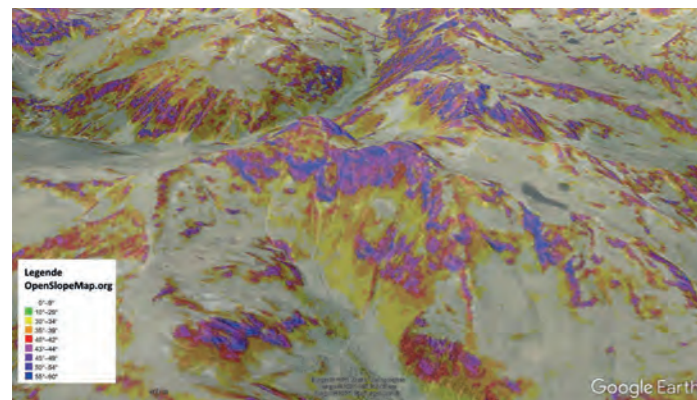


Fig 4 (above): Map Layers (Slope Map over High-Res Aerial Image).



above: ...another variant of our topographic map layers. This is an OGD variant of basemap.at and the live location of the rescuers (POI Flag). The strength of this map is the terrain shape, which was derived from LIDAR data and is based on a 1x1 metre resolution hillshade. In particular, all way-graphs are official geodata and institutionally georeferenced and controlled, nevertheless freely available (OGD).

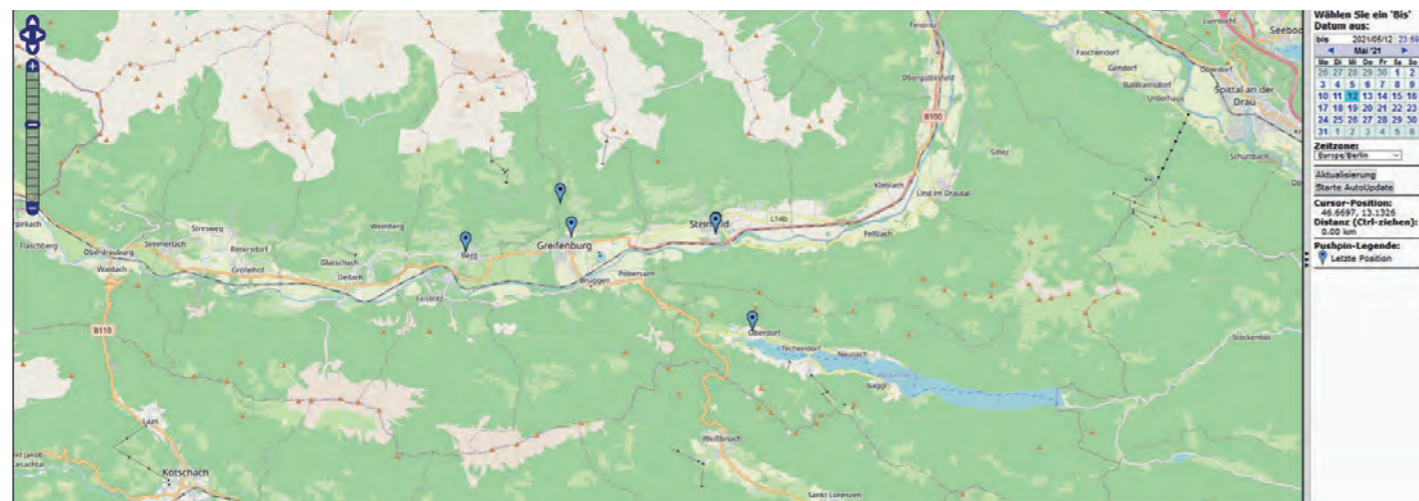
The experience of the last years shows that the use of the Assisted Rescue Control System has positive effects on the situation control during mountain rescue operations. The advantages of a real-time based mission control system are improved efficiency and effective coordination of the rescue team in the field. Not only can valuable time be saved but monitoring also increases the safety aspect for the mountain rescuers themselves. These positive results are further



above: a classic search operation with the delimited search area (black polygon) and the real-time position (POI Flag) as well as the covered track (red) of the crew.

enhanced using photo-realistic 3D maps. With the help of the mission maps it is possible to capture and interpret the terrain in the best possible way. The mission control system, which is essentially based on Google Earth, is characterized by a simplified mode of operation that can be quickly learned even by non-experts. In addition to the aforementioned comparable ease of use, the cost factor was also given significant consideration during development. As the founder and developer of ARCOS, it gives me great pleasure to make the system of the Mountain Rescue Team Oberes Drautal known to a larger group of voluntary rescue organizations.

right: Short-haul using an H135 Series from Airbus Helicopters. Specifically, this is an EC 135 P2+ from the federal ministry (BMi: Bundesministerium für Inneres) with snow-skids and the ability to perform night flights (FLIR system).



above: our web-based tracking portal with an OSM map as background, which we use for a quick overview on the road, away from the operations centre. This allows operations to be managed on the move, e.g. from a smartphone or tablet. In addition, all operations are archived on the online server.

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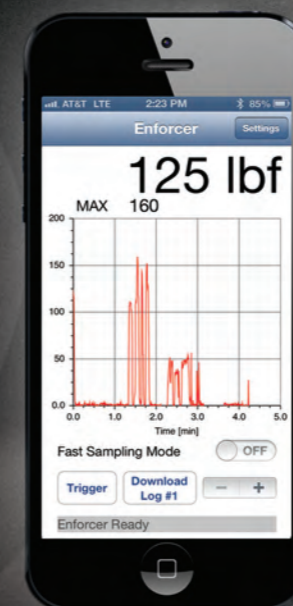
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*App sold separately
For use with 4S or newer



Weighs just 14oz. (397 gm) with batteries!





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task at hand.

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Tech HTP rope is suited for the harshest conditions where heat and abrasion resistance are critical. Technora® sheath's 900+ degree high melting point protects against accidental heat exposure, as well as cutting and abrasion, while the low-elongation polyester core offers a smooth feel to minimize bounce and stretch.

The SYNC hydrophobic high tenacity polyester sheath and low-elongation nylon core offer a balanced construction for increased strength with a smooth feel, ideal for raising and lowering systems.

UL certified to NFPA 1983 General Use, this offers fire departments and rescue technicians the opportunity to lighten their rescue systems while staying G-rated compliant.

Tech HTP

Available in two tracer colors.
Sheath/Core: Technora/Polyester
MBS (lbs): 8,090
MBS (kN): 36.0
Elongation @ 300lbs (%): 1.5
Weight (g/M): 95
NFPA 1983 Rating: Technical

SYNC

Available in four colors
Sheath/Core: Polyester/Nylon
MBS (lbs): 9,014
MBS (kN): 40.1
Elongation @ 300lbs (%): 4.3
Weight (lbs/100'): 5.9
NFPA 1983 Rating: General



SAR SAFETY

PART 3 ROPES & SYSTEMS

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.



Crevasse Rescue in Italian Alps Photo by P. Vidi

www.rescuemagazines.com

ROPE & WEBBING

The past several years has seen so much happening in the development of ropes due to the introduction of new materials / fibres being used in their construction. These developments have seen the mean breaking strengths of new technology ropes increase, while the diameter of the rope decreases. Ropes are now more cut and abrasion resistant, can withstand higher temperatures and elongate less under load.

One rope manufacturer has developed a 60m length of rope that will incorporate 30m of dynamic rope, and the remaining 30m will be a static rescue rope.

Ropes are generally constructed from a single material, for example: 100% Nylon rope, 100% Polyester rope or 100% Technora rope. More recently manufacturers have been incorporating two materials into the construction of a single kernmantle rope, thereby utilising the performance properties of both fibres, for example:

- Nylon core / Polyester sheath,
- Polyester core / Technora sheath,
- Spectra core / Polyester sheath.

Advances in rope construction naturally cross over into the construction of webbing, accessory cord, sewn slings, sewn prusiks and other "software" items relating to climbing, canyoning, caving, rope rescue and industrial rope access. Many rescuers emphasised the need to test the compatibility of all components of a rescue system, especially when introducing new rope or ancillary equipment such as slings, webbing and cord. One example given was a drop test (200kg load, 3m rope and 1m drop) using a new low stretch 11mm HTP rope (polyester construction) with an 8mm tandem prusik belay. The load repeatedly hit the ground on multiple tests, whereas all previous tests using a semi static 11mm Nylon rope with an 8mm tandem prusik belay successfully held the load. This is also an example of where little or no stretch components such as HTP ropes, Spectra / Technora / Kevlar slings and cord can increase the impact forces on a rope system and alter the way they function.

While ropes of kernmantle construction are considered as the standard for rope

Issue 9 **WILDERNESS**SAR

WILDERNESS ROPE RESCUE



Above: Ogwen Valley MRT in Wales use bags.
Below: Peloton de Gendarmerie de Haute Montagne in Grenoble France use hanks.



rescue applications, one of the Italian rescue teams was using a specially designed 8mm braided spectra rope for their highline system, and a USA based rescue team was using a yachting braid for their rescue rope.

Rescue teams are using dynamic ropes of 9mm diameter through to 11mm diameter, and generally in 60m lengths. Traditional static ropes between 9mm

and 11mm are also used depending on the type of terrain and angle of operation. Short lengths of 9mm static rope are used for simple rescues and for constructing anchors, and rescue ropes from 60m to 200m are standard inventory for rescue teams.

DESCENT CONTROL DEVICES

There are a plethora of friction or belay devices currently on the market, many are similar in design and operation, with some minor differences to make them unique to a particular manufacturer.

Like most equipment used in rope rescue, each has its strengths and weaknesses. This is where knowledge, skill and judgement play an important role in the selection, operation and application of friction or belay devices in mountain rescue.

The following is a list of descent control devices used by the rescue teams and organisations involved in this research:

- Petzl ID
- Petzl Gri Gri
- ISC D4
- Petzl Reverso
- CMC Multi Purpose Device (MPD)
- Conterra Scarab
- Petzl Tuba Brake Tube
- Black Diamond ATC XP & ATC Guide
- Kong GiGi plate (Belay)
- HMS Carabiner & Italian Hitch
- Brake Bar Racks (various)
- Custom made friction rack



Photo courtesy of Alpine Rescue Team — Petzl Tuba Brake Tube and a twin rope system

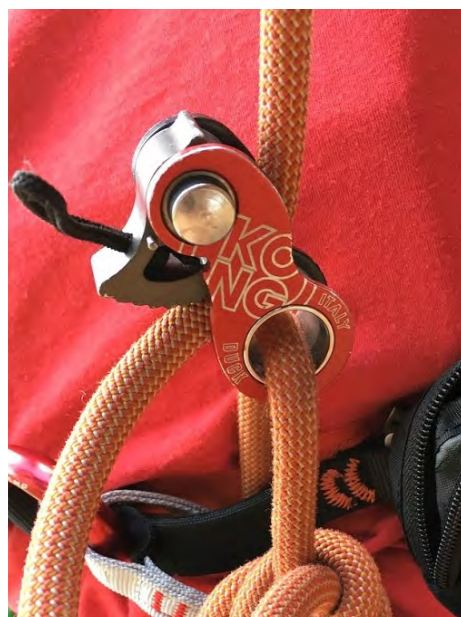
MECHANICAL ROPE GRABS



Petzl Rescucender used as a Haul Cam

Mechanical rope grabs were used by rescue teams for ascending a fixed rope, attaching mechanical advantage to a rope (haul cam), for progress capture and adjusting the length of a lanyard. The following are examples of rope grabs used by rescue teams:

- Petzl Rescucender (pic above)
- Petzl Shunt • Petzl Tibloc
- Handled & Chest ascenders (various)
- Rock Exotica Rope Grab
- Kong Duck Ascender (pic below)
- Wild Country Ropeman
- Petzl Traxion and Petzl Micro Traxion



SOFT ROPE GRABS



Prusiks used in highline rescue system

The most commonly used soft rope grab was the traditional 3-wrap prusik. Where the variations between rescue teams and countries came into play with the 3-wrap prusik was in the diameter of the cord used, and the material used in the construction of the cord. Diameter of the cord used ranged from 6mm to 8mm, with the 8mm option being the most frequently used as part of a rescue system on a compatible diameter rescue rope. The traditional Nylon kernmantle cord was the most frequently used in both sewn and tied-loop versions. With influence from the arborist industry, there are new blends of material and construction being used for soft rope grabs, and they are now becoming popular with climbers, rescuers and rescue teams. For example the Bluewater 8mm VT Prusik is an open-end prusik constructed with a Nylon core and a Technora sheath, has a mean breaking strength of 19.5kN end to end, and is promoted as being suitable for forming symmetric prusiks and asymmetric prusiks such as the Schwabish and Distal hitches, the Valdotain Tresse (VT) and the French prusik. In comparison, the Sterling 6.8mm Hollow Block sewn prusik loop has a rectangular profile, is constructed from 100% aramid fibres and has a mean breaking strength of 14kN. Promoted as being suitable as a rope grab for ropes

as small as 7mm in diameter, it can be rigged in all conventional prusik formations, and as it is available in two lengths, it can be used in a tandem prusik hitch belay.

For most rescue teams involved in this research, friction hitches were constructed from a loop of cord (prusik loop), or an open-end cord with sewn eyes which were brought together in a carabiner. A friction hitch commonly used by the Italian rescuers was the Bellunese Hitch, [ED: an arborist Blakes Hitch which may use a triple stack for rescue rather than the double stack-pic below] which utilises only one end of a piece of cord to form the friction hitch.

Research and testing is always being undertaken on the performance of various friction hitch configurations and the various materials / products used to construct them. A research paper on this topic was presented by Mike Gibbs from Rigging for Rescue at the International Technical Rescue Symposium in the USA in November 2019.



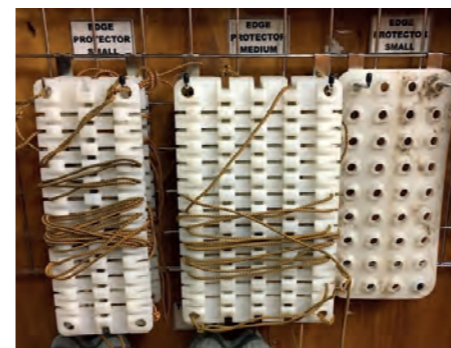
PERSONAL ANCHOR SYSTEM (PAS)

A personal anchor system being a method by which a climber or rescuer secures themselves to an anchor or safety system directly from their harness. In most cases, rescuers selected a method based on the principle that the piece of equipment used should have some degree of energy absorption. The most commonly utilised items of equipment for a personal anchor system were:

- Adjustable lanyards, commercially made from dynamic rope, such as the Petzl Connect
- Improvised adjustable lanyard made with dynamic rope, and a friction hitch or friction device like the Kong Duck (pic left)
- Purcell prusik lanyard either commercially made or constructed by the rescuer
- Linked slings lanyard made from Nylon, such as the Sterling Chain Reactor

ROPE PROTECTORS

Safeguarding fixed and moving rescue ropes from sharp edges and abrasive rock was a high priority for mountain rescue teams. Where it was not possible to protect the rope physically, rescuers took care where they positioned their ropes in relation to hazards. Rescuers operating in small teams and needing to cover significant ground on foot, opted for lightweight rope protectors or edge protection over the heavier aluminium edge rollers. This is also one of the very few, if not ONLY items of equipment that can be 'home-made'.



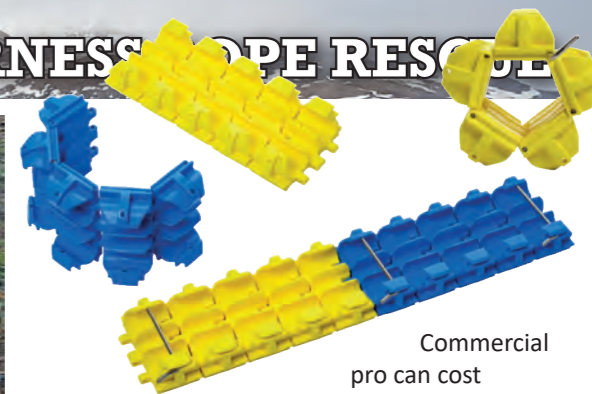
Selection of edge protection - Ogwen Valley MRT



SMC Rope Tracker edge protection



Edge protectors in use with Rocky Mountain Rescue Group



Commercial pro can cost from \$45 for CMC's wraparound (right) to \$140 for the hard plastic channel models (above & below left).

Examples of lightweight protectors are,

- Simple mats – either made by the teams or commercially available like the CMC Pad
- commercial “wrap around” rope protectors like the CMC on the right
- pieces of retired canvas fire hose
- flexible synthetic mats or tracks that contour with the rock and keep the ropes in place The SMC Rope Edge Pro (above), CMC's Ultra-Pro (pic left and the first two examples in the pic far-left), SMC Tracker and SMC Flex (third example in pic far left).

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RESCUE SYSTEMS

Rescues in mountainous or remote environments are undertaken by relatively small groups of physically and mentally fit, self-sufficient,

equipment, and back to climbing equipment (but modifying how climbing equipment is used). Brian acknowledges that the Mountain Guiding training and qualifications that his staff possess, "... gives a very high level of skill, knowledge and understanding, and this allows

The number of rescuers involved in a rescue may be restricted or determined by:

- Terrain (technical)
- Method of access (lead climb)
- Working area around the casualty (small ledge on the cliff face)
- Distance to lower and/or raise (number of rope pitches)
- Availability of rescuers (limited staff or volunteers rescue team members available)

Lt Colonel Roland Mijo, Director of Training for Rescues in Perilous and Mountainous Areas, France, explained that the training centre taught their rescuers the skills to undertake rescues with a minimum of two, however their optimal rescue team size was five. This provided the ability to have two rescuers with the casualty, two rescuers operating the technical rope system, and one rescuer operating as the leader / safety officer.

Rescue teams were quick to acknowledge that when the terrain changed from vertical to lower angles, along with an increase in obstacles to negotiate, the rescue generally became physically more difficult for those small rescue teams. In those situations, the smaller teams would



Eldorado Canyon Rescue
Photos courtesy of RMRG



knowledgeable, skilled and experienced rescuers.

Due to the challenging terrain and distance from vehicular support, rescuers are required to hike in all personal and team equipment. For this reason, this research project focused on rescue techniques suitable for small teams and light-weight rescue systems. Both of these rescue strategies (small rescue teams and light-weight systems) have been adopted by many of the teams and / or organisations involved in this research project, such as Parks Canada Visitor Safety Specialists and Canadian Air Division – SAR Technicians.

Brian Webster – Manager, Visitor Safety Specialists, Banff National Park has seen the evolution from using climbing equipment to using rescue specific

them to do a lot of things with climbing equipment and the gear that they have on their harness."

This also applies for the European and US based rescue teams who have qualified Mountain Guides or Climbing Guides within their teams. Other rescue teams and organisations like the Canadian SAR Technicians, train specifically to be able to undertake technical rescues in mountainous and austere environments while only operating as a rescue team of two. Philip Johnson, Climbing Ranger, Yosemite National Park reinforced that this capability is valid and safety systems can be maintained with the following statement:

"Absolutely ... two rescuers can perform a rescue and incorporate redundancy"



Pic courtesy of Photo courtesy of Llanberis MRT

draw on other staff trained for rescues in the lower angle terrain, or other nearby rescue groups for assistance. For example, assistance with constructing and operating a Highline or Guideline, assistance with a stretcher carry or stretcher pass, clearing the path ahead of a stretcher team, or just helping carry

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Low angle stretcher system
Pic courtesy of Austrian Mountain Rescue Service

equipment. Additional rescuers are often required to operate "heavier" rescue systems. Their level of involvement will be conditional to their knowledge, skill and ability. One component of a heavier rescue system that benefits most from additional personnel is the haul system. Phil Johnson, YOSAR recommends "keeping the rope based mechanical advantage as low as possible and use more people to increase the real mechanical advantage, and where possible have them haul downhill." As a precursor to the National Mountain Rescue Association



YOSAR Haul System.
Pic courtesy of Charles Farbee

(MRA) Conference at Mt Hood, USA, I participated in the Small Party Assisted Rescue (SPAR) course conducted by Eddy Cartaya of the National Cave Rescue Commission, who described the course thus: "It is about self rescue from often deep, technical, vertical obstacles, using only the gear on the harnesses of 3 or 4 people. That is what makes these skills so useful for hasty teams ... not just expedition teams." The SPAR course provided numerous options for solving technical rescue situations when 'confined' not only in a cave system, but confined by physical location (tied-in on a cliff face) or confined / isolated from additional assistance or resources.



Small Party Assisted Rescue (SPAR) Course Photo by Eddy Cartaya

Issue 9 **WILDERNESSSAR**



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While the rescue systems included in the SPAR course were geared towards caving and single rope technique, many could be supplemented to meet the generally accepted requirement of a two rope system for traditional rope rescue, and mountain rescue.

Deeply embedded throughout the rope rescue community, including mountain rescue, is awareness of the Belay Competency Test (BCT) requirements developed initially by the British Columbia Council of Technical Rescue (BCCTR) and later by the Emergency

Hand in hand with the BCT, is the awareness and in most cases acceptance of the principle of a rope rescue system containing a main rope and a safety / belay rope. There is currently much debate and discussion around what the two rope rescue system should look like. In 2016 the EMBC commissioned evidence-based research and a comprehensive overhaul of rope rescue standards, systems and techniques for British Columbia Search and Rescue Teams. Basecamp Innovations Ltd was contracted to conduct the rope rescue research and testing portion of the

between the DC TTRS and what Gibbs terms Single Main Separate Belay (SMSB) technique instead of DMDB.

It was evident that the research and work undertaken by EMBC, Kirk Mauthner, Mike Gibbs and other experts in the rope rescue industry has had widespread influence over the operations of mountain rescue teams involved in this Churchill Fellowship project. However, it was also evident that there is not a blanket implementation of the DC TTRS or the SMSB technique for all rescue situations relating to mountain rescue. Instead, rescue teams evaluated the following aspects for each situation: the terrain and gradient, the environmental hazards, the potential load, path of travel, the location and type of anchors, working room, the number of rescuers, skill and experience of rescuers, equipment available, the condition of the casualty and risks to rescuers.

Based on this dynamic risk assessment, rescue systems could look like the following:

- A 'text book' dual capability two tensioned rope system
- A 'text book' single main separate belay rope system
- Twin tensioned rope system, controlled through the one descent control device
- Fixed main rope (descend / ascend) and separate belay rope controlled from above
- Fixed main rope (descend / ascend) and separate fixed safety rope (self-belay)
- Single main rope no separate belay rope
- Single belay rope

Many rescue teams look at the BCT test conditions as being the worst case scenario, therefore by improving one or more of the parameters of the test conditions, they can reduce the impact forces on the rescue system should there be a failure. A reduction in the potential impact force may then allow the use of alternative equipment or techniques to perform the rescue.

Some examples of improving the parameters given were:

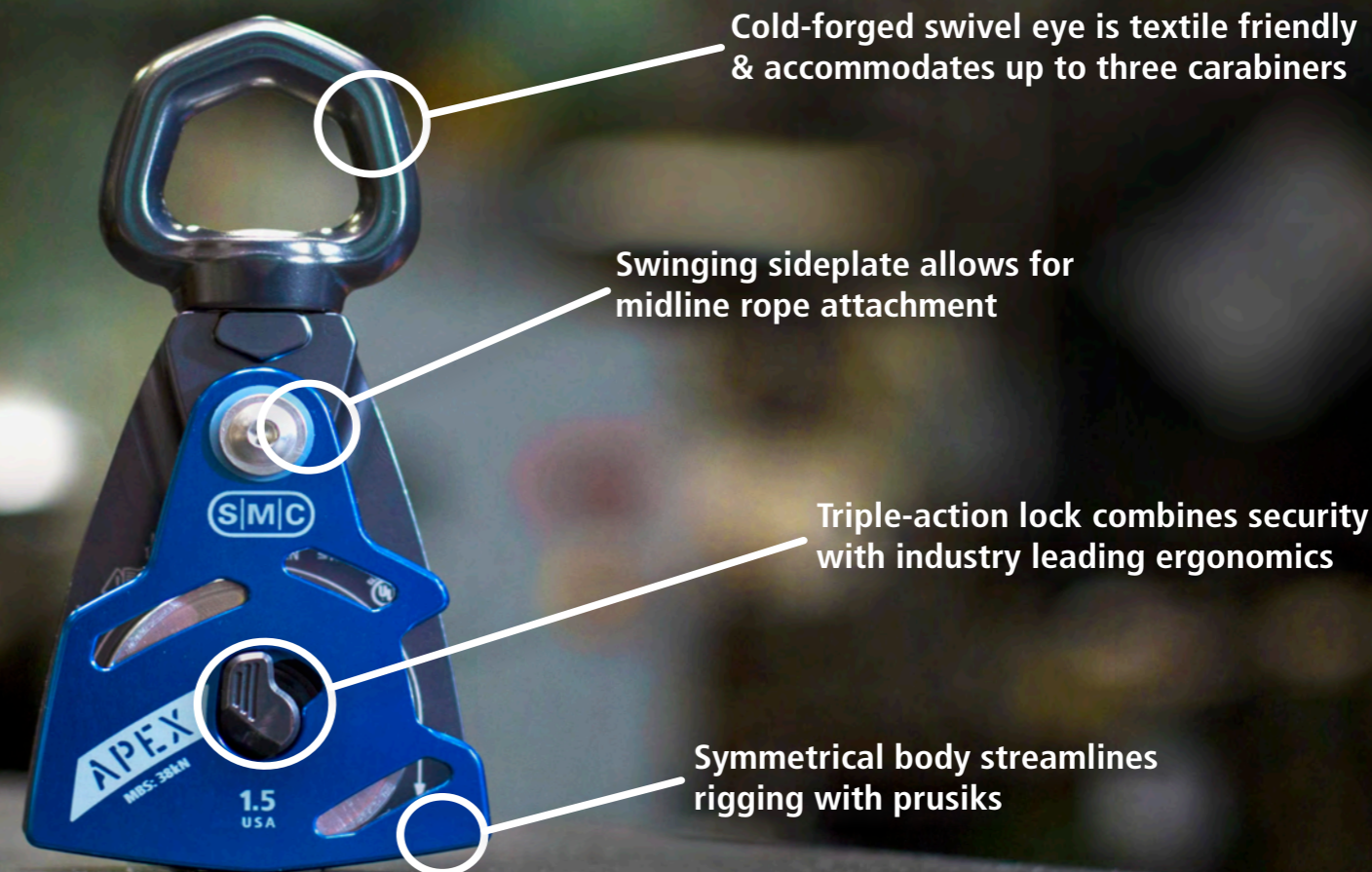
- Increase the length of rope in the



Stretcher lower using a guideline
Pic courtesy of Rocky Mountain National Park (RMNP)

Management British Columbia (EMBC). The current Belay Competency Test (BCT) involves a mass of 200kgs being dropped 1m on a 3m length of rope that is controlled by a descent control device, back-up device or technique. The 200kg mass was determined to be indicative of a two-person rescue load, the 1m fall a possible fall distance when negotiating a 90 degree edge with a stretcher. The required results to pass the test are for the system to result in no more than a 12kN maximum arrest force, with no more than 1m of stopping distance, the system must remain functional after the test drop and retain at least 80% of the original rope's strength. Source: Mauthner, K. "Dual Capability Two Tensioned Rope System", ITRS (2016)

project. Source: Mauthner, K. "Dual Capability Two Tensioned Rope System", ITRS (2016) The EMBC research project and technical rope rescue system overhaul resulted in the recommendation of a Dual Capability Two Tensioned Rope System (DC TTRS) over the previously used Dedicated Main Dedicated Belay (DMDB) technique. Mauthner, developed the DC TTRS after assessing factors that affect system failure such as: human factors, environmental factors, material (equipment) factors and method (technique) factors. Mike Gibbs of Rigging for Rescue published a 55 page article titled "Two Tension or Not to Tension – much ado about 4 meters" in response. This paper analysed the differences and similarities



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| MBS: | 38kN |
| WLL: | 9.4kN |
| Rope size: | up to 13mm |
| Sheave Major Diameter: | 2.0" |
| Sheave Tread Diameter: | 1.5" |
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SAR SAFETY



Dual Capability Two Tensioned Rope System
Pic courtesy of RMNP



YOSAR Dedicated Main Separate Belay Rope System
Pic courtesy of Charles Farabee



Twin Tensioned Rope System Pic courtesy of RMRG



Two Tensioned Rope System with Munter Hitch
Pic courtesy of Austrian Mountain Rescue Service

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system before undertaking a 90 degree edge transition so that there is more rope in the system to absorb impact forces.

- Keep the stretcher low to the ground during the edge transition, therefore reducing the potential fall distance.
- Select a sloping edge or ground to undertake the raise or lower of the rescue load, therefore the rescue load will slide, not free fall, resulting in lower impact forces.
- Where possible construct the anchors and the system(s) for raising and lowering, above the rescue load.
- Reduce the rescue load by removing the rescuer from the system until the edge transition has been negotiated or for entire raise / lower. The rescuer(s) operate on a separate system.
- Protect the rope from sharp edges

- Identify and avoid areas of loose rock
- Train out the deficiencies, therefore eliminating the potential for human error.

The following are examples of two rope systems used by some of the rescue teams involved in this research for lowering a rescue load on vertical or near vertical terrain:

- Mirrored system using Munter Hitches (super/double Munter for large loads)
- Mirrored or twin rope system using one or two Kong GiGi/FULL plates (pics left).
- Mirrored or twin rope system using carabiner brake rack
- Mirrored or twin rope system using Scarabs (+/- a back-up friction hitch)
- Mirrored rope system using ATC or Reverso (pic right) redirected and with a back-up friction hitch on the load or brake side of the device
- Contrerra Scarab on the main rope and CMC MPD on the belay rope
- CMC MPD on the main rope and CMC 540 Belay on the belay rope
- Mirrored Contrerra Scarabs or CMC MPDs
- Mirrored Petzl IDs or Petzl Rigs
- Mirrored CMC/Harken Clutch (> 2020) (Pic top right)

With a change in terrain from vertical to a lower angle, there were often one or more changes in the components of the rescue system used. For example:

- The use of a single rope
- Descent control device or technique (e.g. Petzl Gri Gri, Munter, ATC)
- Smaller size (diameter) rope and / or construction (e.g. Kevlar, Technora, Spectra, Polyester).

Next issue Helicopter Ops



WILNESSAR Issue

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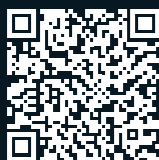


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Looking into the abyss



Search Strategies for Small Unmanned Aircraft used in rural and mountain environments part2



by **Darryl Ashford-Smith**

Darryl is a Scottish Mountain Rescue Training Officer. A veteran of USAR in London Fire Brigade for over 21 years, Darryl has served as a member of RAF Mountain Rescue and is now resident in Scotland

This is the second of a two-part article that discusses the difficulties and solutions for small, line of sight, off the shelf UAS' used for rural and mountain search and rescue. The previous part described the importance of having a search strategy and the initial actions before getting the UA airborne to conduct the search. This part describes different search types, flight patterns and the search of specific mountain features.

SEARCH TYPES

Searches can be broken down into two main types, linear and area. Although the types are defined, a combination of each may have to be used. Each type of search will require a search pattern to be used. The following information details search patterns which will enable the pilot and sensor operator to have a constant starting point to work from. The pattern may have to be modified due to ground features. Having set search patterns allows pilots and sensor operators to know, understand and use common terminology relevant to the specific pattern.

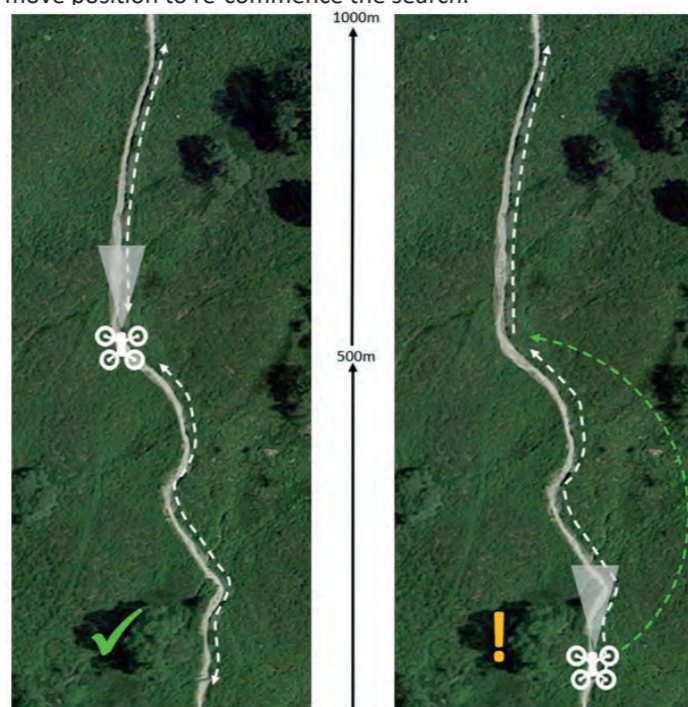
Search patterns:

- Flying linear search – Searching a linear feature such as track or river while flying
- Static linear search – Searching a linear feature such as track or river while stationary
- Creeping line search – Searching out to either side of a linear feature in a specific direction
- Point of interest search – Searching from point to point making best speed between each
- Area search – Searching an area in a grid pattern
- Mountain face search – Searching the face of a mountainside or a cliff face.

LINEAR SEARCH

To carry out a linear feature search (track/river etc.) efficiently, the UA Team should be positioned in a location where they can search to their full extent along the feature either side of their location rather than at the start of the search area. The search distance will depend on clear line of sight. This method allows double the distance to be searched initially. A linear search can either be with the UA held static or moving or using a combination of both.

In the example below (if each broken white line represents for example 500m line of sight) the UA team in the left-hand image could search 2 x 500m from their position whereas in the right-hand image, the team could only search 500m before having to move position to re-commence the search.



FLYING LINEAR SEARCH

A flying linear search is where the UA is flying the route of the linear feature and it is used where the casualty/MISPER is likely to travel on the actual feature.

With a linear feature in open ground such as in the image below, the UA may search the feature very quickly.



STATIC LINEAR SEARCH

A static linear search is where the UA is held in a stationary position and the linear feature is searched by movement and zoom of the camera. This can be useful when the UA has reached the maximum distance permissible and then searching further just using the zoom.



CREEPING LINE SEARCH

Used when the MISPER has been thought to move off in a certain direction along or near to a linear feature.

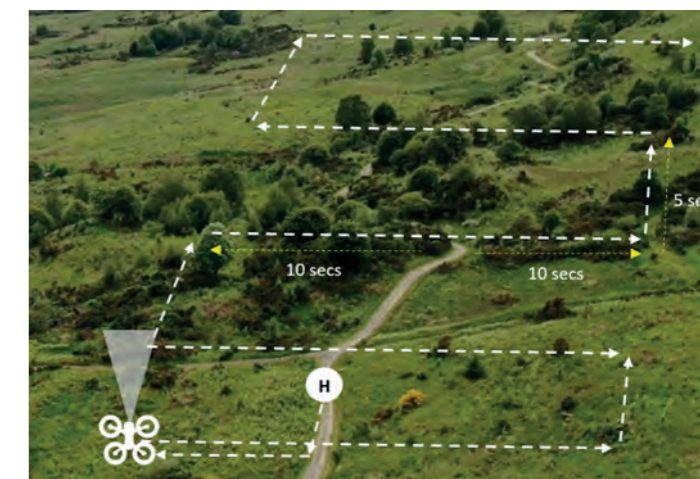
- The search is conducted with the UA always facing forwards (away from the pilot)
- The search will commence from behind the start point
- From the centre point (the track in this case), the UA is moved from one side to the other at a distance appropriate to the search being conducted. Keeping the distance about the same each time can be achieved by counting the number of seconds per side
- 10 seconds provides a reasonable distance to be searched away from the linear feature however, if the casualty/MISPER may have a tendency to wander off a greater distance then additional distance from the track is required
- The distance moved forward will depend on the height of the UA and the camera angle and can be determined by ensuring

on each move forward, that some of the same ground is in view. Five seconds is usually sufficient at a height of 40-60m

- The joystick should have minimal input for left, right and forward movement

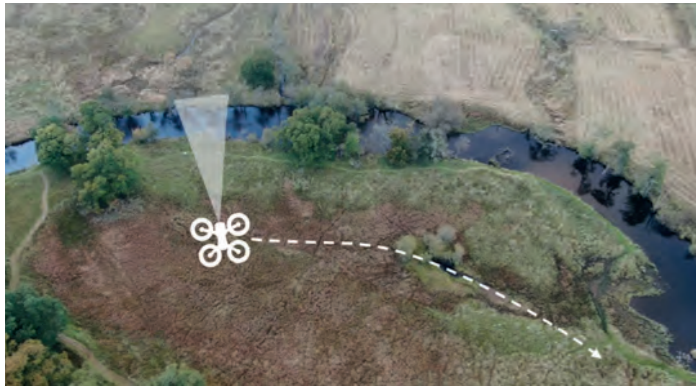
- A repeat search should be carried out with the UA facing backwards (towards the pilot) to ensure that any features are searched from a different direction as they may obscure a casualty because of the camera angle
- This search may also be carried out on non-linear features however, the pilot should have a distant landmark in sight to act as the centre point
- Although using seconds for distance may be unrefined, with practise, accuracy can be gained.

An example Creeping line search can be seen in the below screenshot from an actual flight track. The start point is in the centre of the image. It can be seen that the search track above and below the start point is overlapping.



RIVER SEARCH

The ease upon which a river can be searched is dependent on many factors and not just on the vegetation. Ordinarily, as per a physical search, the river will be searched with the UA positioned above the opposite bank being searched as the opposing bank may be seen more clearly and particularly where it is undercut or where trees are overhanging. It should be considered whether the search is prioritising an above surface search (someone floating), a below surface search or both and of course depending on water clarity.



Shaded areas and even the reflection of the colour of the sky and whether it has cloud cover will affect a search of a river. Consideration should be given when planning the search in relation to the position of the sun, the UA and the time of day. Dawn or dusk may produce better results. The angle of the camera will affect the view and it should be considered to position the UA directly above the water with the camera pointing straight down. In the below image, it can be seen that the tree is causing a shadow and the sky is causing a reflection. Just changing the position of the UA will usually have a positive effect.



When searching a river, the hydrology and any water features should be considered when searching where a casualty may be located. Eddies, strainers and any water that may be holding such as a weir/low head dam may be a possibility.

GULLY SEARCH

A gully may have undercuts at the sides. The undercut can be seen in the below image by having a distinct edge which can be identified easier when the UA is moving as the ground in the gully and the ground on the upper edge of the undercut are seen as moving at different speeds.



If there are numerous undercuts within a gully, it may be preferable to search from one side on the way up and from the other side on the way down. It is preferable to search with the camera pointing forward while ascending/descending. This is so that any undercuts (as highlighted by the yellow arrow in the below image) beneath rock shelves for example can be fully observed as opposed to the camera looking down on the feature and possibly missing areas underneath.

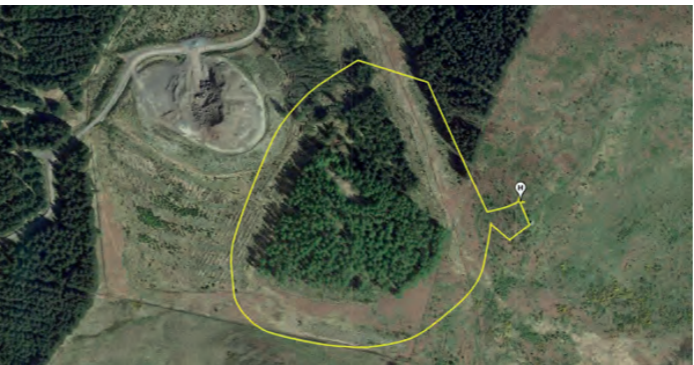


It should always be remembered that when operating in gullies, GPS satellites may be obscured, and so pilots should be very wary and ready to manually fly if GPS stabilisation is lost.

WOODED AREA SEARCH

The search of wooded areas is notoriously difficult for obvious reasons with the foliage and density of the trees having a major effect in being able to see the ground. There are many variables, and it may be prudent to search directly from above and into each edge. When positioned directly above with the camera looking down, at least some of the ground is visible although underneath the tree may not be visible at all.

- Search the perimeter of the wooded area with the UA facing into the treeline as a priority
- Depending on the coverage of the foliage, carry out a rapid/efficient/thorough search at an oblique angle or directly above
- Thermal image search should still be considered as there may be a chance of acquiring a heat source through the foliage which may be undetected by a standard camera
- The search may need to be carried out at a very much slower speed and at a lower height than other searches.



An example tree line search can be seen in the above screenshot from an actual flight track.

RAPID PARALLEL LINE SEARCH

If a rapid search of an area is required, there are various options depending on the type and size of ground requiring search. A principle of a rapid search is that the track flown to search is a grid comprising of a number of squares that makes up the whole search area. As it is a rapid search, it may be suitable for the camera to be facing forward and at a shallow angle downwards as discussed previously.



- The search is conducted with the UA always facing forwards (white line)
- The search will commence from behind the search boundary and should overlap
- The UA is flown sideways until the search boundary is passed
- The UA is then moved forward to a distance dependent on the size of the search area
- The UA is then moved in the opposite direction until the UA reaches past the opposing boundary
- A search should then be carried out but with the search pattern at right angles to the previous (yellow line)
- Repeat search from a different direction to cover any dead ground.

EFFICIENT PARALLEL LINE SEARCH (next pic)

This search is similar to the hasty with similar rules however, as it is an efficient search, the distance in between search sweeps will be less. Once a search has been conducted in one direction, the area will be searched in another direction depending on the



lay of the land to take account of any dead area ground.

POINT OF INTEREST (POI) SEARCH

Another type of rapid area search, this is a search at a specific point(s) where a casualty could be positioned out of view such as behind a tree or large rock for example. A POI search is simply flying from one point of interest to another and searching around it once there. This type of search may save a significant amount of time as opposed to a small team being deployed to physically search the points of interest especially if they are distant from each another.

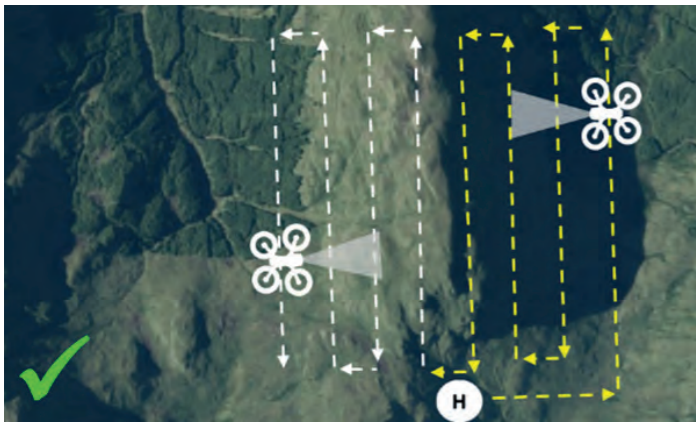
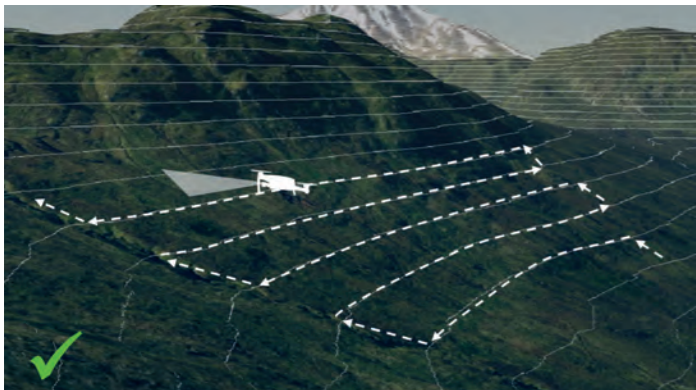


The image above shows an actual flight track of a point of interest search. The flight track shows how the pilot has flown the UA in a circle (with the camera facing the target) at the POI to get an all-round view of each. A full circle may not always be necessary if the feature is easily searched.

SEARCHING ON SLOPED GROUND

When conducting a search, in any given search pattern, the lay of the land should be considered regarding the contours of the ground. It is preferable to search along the contour of the ground rather than across otherwise constant input is required to ascend or descend. An efficient strategy is to plan the search with the long lines of the search pattern in line with the contour of the ground and the short lines across the contour of the ground.

If a ridge line is within the search area, it is preferable to search one side at a time due to the flight path in relation to the camera angle and slope of the ground. If the pilot flew the UA up one side, over the ridge and down the other, the ground would be sloping away from the UA so therefore may have many areas of ground that could be missed due to dead ground.



The pilot should fly the UA using the search pattern previously described (parallel line search) with the UA facing uphill on one side (white line) then repeat the same on the other side again (yellow line), with the UA facing uphill.

MOUNTAIN FACE SEARCH

Mountain face searches can be broken down into two categories, a search on a face that is reasonably uniform and a search on one that is convex or domed shape. The main difference is that if looking directly at the face of a domed shape feature, some areas may be missed at either edge as the face curves round. In the image below, a distinct line can be seen at the edge of the feature indicating that the ground may be hidden (yellow arrows). As per the gully search, the two faces moving at different speeds will give an indication.



When considering the location of the UA pilot, positioning close to the foot and to one side is preferable as the Pilot will be able to observe the UA with the sky in the background as opposed to the face, which would then make judging the distance from



the UA to the face very difficult. A rapid or efficient area search as previously described may be performed on a convex/domed face but taking account of the curved/domed shape. The flight will be flat but curving around the face.



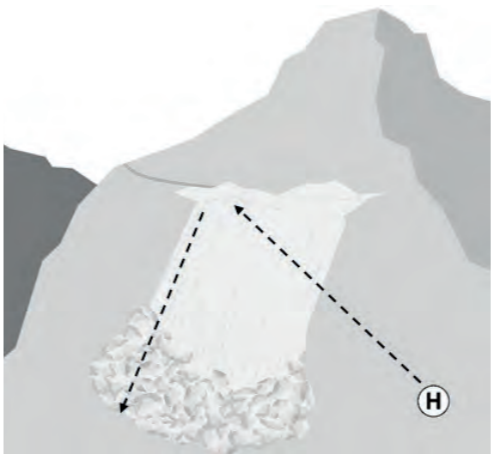
Once a search has been carried out with the camera facing forwards, a search should be conducted with the camera facing directly down. The reason for this is that if a casualty was positioned in a small dip or behind a rock for example, they may not be located due to being obscured from view. Again, it must be remembered to periodically hold the UA and the camera static to observe for movement from the casualty.

AVALANCHE SEARCH

At an avalanche incident, it is highly likely that helicopters may be operating so the pilot must ensure that there is no airspace conflict. A UA may be mobilised for search or checking for hazards above the avalanche such as secondary avalanche, cornices or rockfall for example.

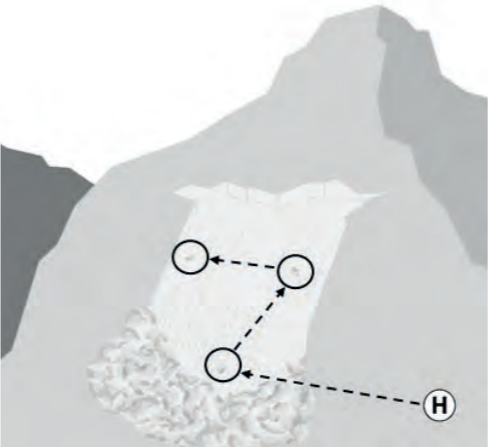
Information required for mobilisation:

- Time of incident
- What happened and how many involved
- Weather conditions at the site
- Safe route in
- Conditions.



- Key search areas:
- Where others were found
 - Along the fall line (where they may have been carried down which may be identified by footprints/ski tracks entering the avalanche from above)
 - Deposit sites
 - Terrain traps.

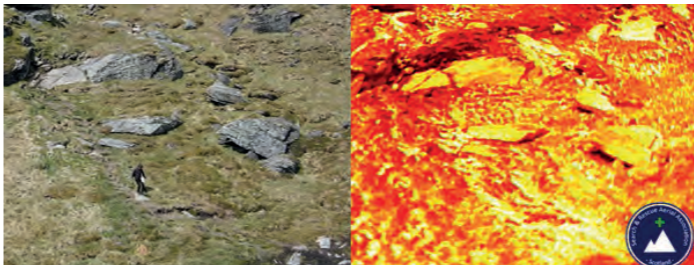
If the casualty location is known at the time of the avalanche, this may be the most suitable search start point. There may be footprints or ski trails still present in the snow breaking off where the avalanche may have been triggered and the casualty swept away. From this start point (black circle), the search should commence in a direction taking the same track as the avalanche. In the image above, walking or ski tracks can be seen in the top left where the casualty may have triggered and become involved in the avalanche.



Another option as an initial rapid search is to carry out a point of interest search to check anything that may stand out from the general avalanche colour/texture.

THERMAL IMAGE CAMERA SPECIFICS

Like any other form of technology, a thermal image capability although very beneficial, is another tool in the box and cannot be relied upon to “see” things we cannot see without considering its limitations. For example, in the below images, a walker on a warm day may be very difficult to see with a thermal image camera (as their temperature may be similar to their surroundings) as compared to a visible camera.



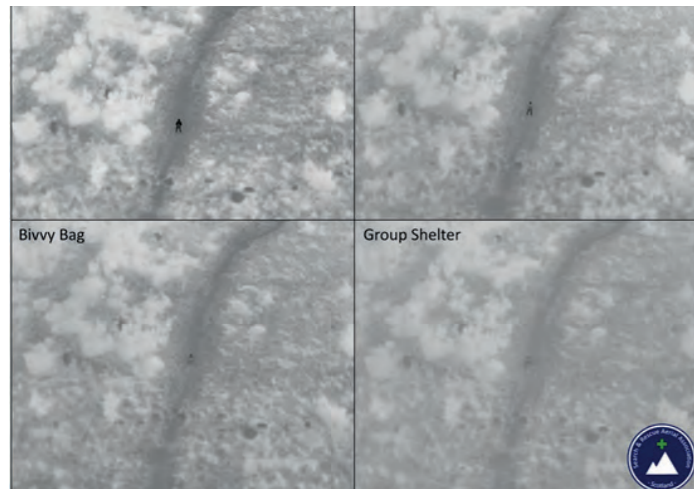
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MOUNTAIN RESCUE

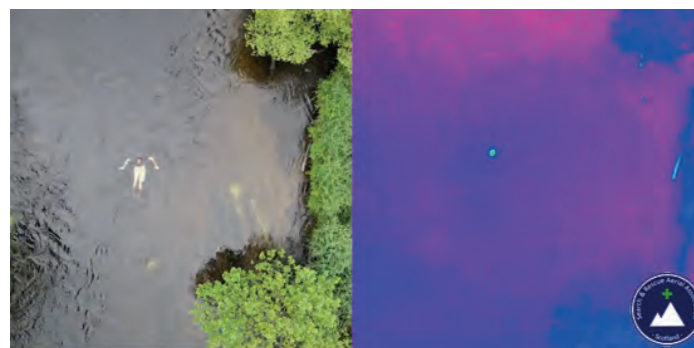
Some drones with a thermal image camera have the facility to change colour schemes by selecting different colour palettes which is very beneficial as one colour scheme may be more suitable than another depending on the target and their surroundings. As in a search with a visible camera, a pre-familiarisation visual check with the camera on similar ground with a similar target profile should be carried out to ascertain which colour scheme works the best. The pilot must constantly



try different palettes as even in the same area, small time differences may mean a different palette is better so never assume what was good last time will be good this time.

The use of such technology in drone search may channel what advice we give to a casualty if we are in communication with them. The image above shows the difference in heat signatures between a casualty wearing summer and winter clothes, in a bivvy bag and a group shelter. Moving from objects of a similar heat (rocks for example) or waving may help in detection.

With regards to casualties in water (pic below), again, the thermal image camera may or may not be better than a



visible camera. If using the thermal image camera, a searcher shouldn't expect to see the full shape of the swimmer as only the heat from the body parts above the water, such as the head, may be detectable.

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POST FLIGHT

It is critical to the overall search plan that adequate information has been exchanged between the pilot and the search manager. The nature of the incident should also be considered as part, or in a separate debrief with regard to trauma incident management as even though the pilot/sensor operator are remote, the camera may pick up on some very graphic detail.



In summary, the search methodology discussed are the very basics and where other systems may not be available for a number of reasons. Some methods may not have complete accuracy, but they may still give a very much more enhanced capability as opposed to not having the UA available at all. Regardless of which system is used, whether using mission planning software is available or not, an effective and efficient search strategy will still have to be formulated.

The team would really like to see industry pushing the Artificial Intelligence effort i.e., colour/change/shape recognition – to assist in the identification of things that just do not 'belong' and then the human can take over for the interrogation of whatever it is.

Also, and more preferred, irrespective of day/night/colours/shape etc., almost everyone carries a mobile phone these days so, working with law enforcement agencies, mobile networks, data security specialists and lawyers we would like to see mobile phone detection readily on-board drones ASAP. Fly a drone in a triangle in an area of suspected location and you have, in effect, created three mobile masts that can be triangulated for a position. This technology is already available on the market, but it is at an unaffordable level for the charitable and humanitarian sector, unless heavily subsidised by industry, governments, or very generous benefactors.

Beyond Visual Line of Sight would be another advantage however, that becomes a very complex aviation operation and goes beyond what can be expected in reality for small charities consisting of volunteers.

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RESCUE STRETCHERS /LITTERS

part 1 RIGID FRAME

We'll start this GUIDE with a quick word about terminology because this can catch us out from the start. Firstly, by 'basket' we are not referring to the square winch baskets used by US helicopter crews in which the casualty sits. This Guide is only for stretchers that allow fully prone casualties. In Europe *all* hand-carry, casualty transportation is called a stretcher whether it is the classic Furley -two poles and a canvas sheet - or a complex assembly of metal tubes fashioned into a basket. In the US, there is a noticeable differentiation between stretchers as simple pole and canvas style designs used for ground-carry and 'litters' as a basket with raised sides. The US military started using a stretcher with raised edges to help keep the casualty more safely secured and these were called 'litters'. These were further differentiated as Stoke's litters because US Navy Surgeon General Charles Stokes invented a specific design in around 1915 that was widely adopted, especially within the US military and it therefore gained a 'Hoover' style right to be a generic name for all basket stretchers/litters. But basically, they're all stretchers and for rescue including heli/rope rescue-use, they're either *basket stretchers* or they're a *platform-style stretcher*. We haven't included the pure sleds or akja/ackja intended ONLY to be used on snow and ice without any true lift-capability or any stretcher with wooden poles held together by canvas.

In the 'modern' rescue era, beginning in the

changed much and has spawned a whole load of similar designs. Meanwhile, for metal baskets, galvanised steel turned to stainless steel which is still the standard but there are now many options in aluminium and latterly in titanium and carbon-fibre. The original mountain rescue designs like *MacInnes* and *Bell* stretchers are still in use now although the 'companies' themselves have gone and that would be the case with many of the models used 40 or 50 years ago – they would still work perfectly well today if you didn't

mind the weight and looked after them. Indeed, *Lyon Equipment* in the UK make and service the *Bell Tangent* (exclusive to Mountain Rescue England & Wales) and updated *MacInnes Mk6* shown above, with a batch having recently been delivered to Scottish Mountain Rescue. The problem with so many of the early designs is that they were invariably 'made-in-the-garage' products, often made to order and most of these have long since disappeared or been swallowed up by a large company. Which can be the best way to ensure not only survival of the product but development or evolution of a design that had stagnated. Think *Cascade* now owned by *Harken Industrial* and *Traverse* now owned by *Ferno*, great products with a more secure future. We had a GUIDE to Stretchers way back in issue 3 of **TECHNICALRESCUE** from 1993/4 and it's amazing to see the similarities, with the metal-frame baskets, *Troll's* (now *SAR Products*) *Alphin* and *Ferno's type 71* and *Paraguard* all in there and looking very similar.

1960s, there was a time when all rescue stretchers were either a steel-framed basket that weighed as much as a battleship or they were the iconic orange plastic *Ferno-Washington* basket type 71. Amazingly that bright orange basket hasn't





BASIC DESIGN

There are five distinct design types with all except rotomoulded frames available as a two piece/split as well as a one-piece:

- Metal frame basket
- Metal frame basket with shell insert
- Metal flat-top/platform
- Plastic-Rotomoulded shell (one-piece only)
- Metal/carbon-fibre combination Sled

This last group is only included if it is also a hand-carry or suspension-capable model and not a dedicated ground-sled – that's a separate GUIDE.

It didn't take long for the traditional rectangular shape of stretchers/litters to be modified to take account of the human shape with a wider upper body tapering to narrower legs – ala coffins! Rectangular is still favoured by many because it maintains symmetry for sliding and offers extra storage space for oxygen etc. Some, like *Junkin*, take body-ergonomics even further and offer rounded dividers for the legs though that hasn't caught on across many other brands. Apart from the *D90* and any rotomoulded stretchers we might have missed, all of the basket stretchers in this GUIDE

have a metal tubular framework-no 100% carbon-fibre frames yet. Even the 'plastic' shell stretchers like the *Ferno71* have their shell supported by at least a top rail if not some cross-members as well. The exposed bottom of an open-weave basket frame is invariably covered by a wire mesh (which can be a literal pain in the ass when strands break) or by a nylon mesh which is softer and more easily removed for cleaning or renewal.

Some may have a PVC-covered thin mattress like the *Spencer Dakar* above. Others, including metal baskets by *Cascade*, *CMC/Traverse* and *Junkin*, also have a kind of short backboard protecting the torso area.



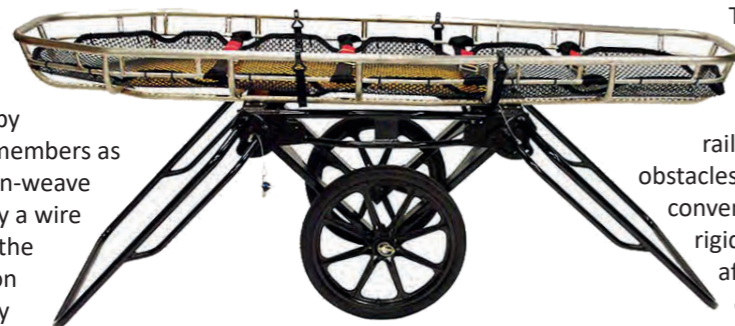
The biggest decision is whether to use a one-piece or two piece frame. Being able to split the frame into two can mean a weak-point which all manufacturers obviously seek to address but in its favour is smaller stowage and transport size. Mil-Spec manufacturer *LifeSafety Corporation* uses a threaded screw-collar to secure the two halves which they claim to be the strongest split coupling in the world. A variation on



this is the *Locsafe* sprung-locking collar (above-left) by *Traverse*. *Tyromont* have taken a different approach with this hinge or release option (above-right) using locking pins originally seen on the *SAR Products Alpine and Lite* (left) shown here with its two hinged parts but these can be divided into two. Most

split stretchers also divide completely into two so that each half can be carried by a different person. A carry-bag, often with rucksack style straps like the *SAR Products* above, is an option offered by most companies and as standard by some. Not all 'split' stretchers divide in half across the waist section – some have stuck to the principles of the old pole and canvas design and break down into longitudinal sections like the *Kong Lecco* where the side rails come apart from transverse support bars.

GROUND-TRANSPORT, CARRYING & SLIDING



The advantage of a full-weave basket frame is that it can be carried at any point along the top rail making passing ground obstacles like boulders more convenient not to mention the rigid support and easy sliding afforded by the bottom rails or skids. Full height plastic shells like the *Spencer*

Dakar (top-left), limit the handholds to specific points though these are numerous. However, these openings are designed to be held from above with the hand around the rounded edge of the top rail so that pushing and pulling over obstacles is not quite as comfortable or even advisable because you will be pulling against a thin shell rather than the supporting tubular frame. The shell on this *Junkin*, sits below the top rail giving full access all along the rail.



Despite being around as long for as long as there have been stretchers, retro-fitted wheels became the new black in Covid times and are often used in conjunction with extension handles. This not only makes transport less arduous, it distances rescuers from possible infection. A number of companies including *Cascade*, *Lyon*, *Kohlbrat* and *Traverse* make a retro-fit wheel system. The *Cascade Advance* and the 'fatter' wheeled *TerraTamer* systems (usefully shown in their ad on page 53), even have an integrated braking system.



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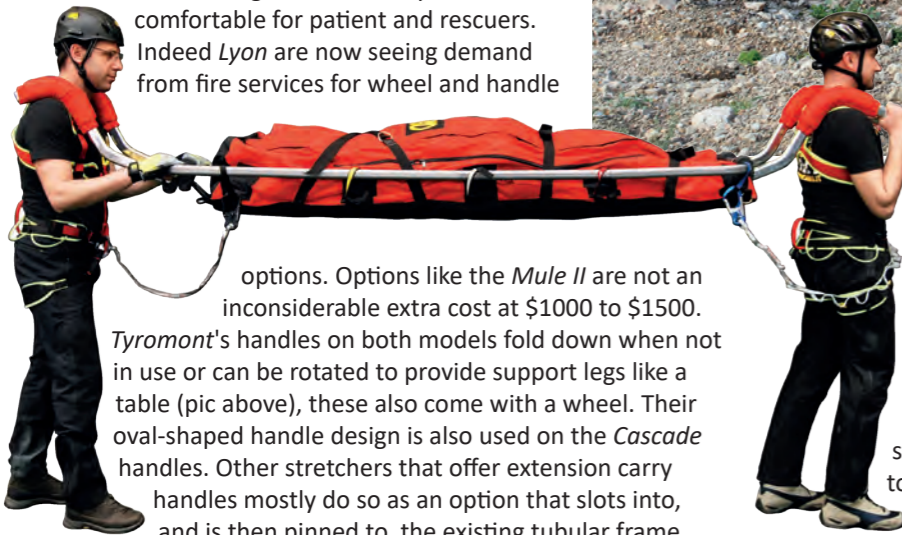
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MARKET GUIDE

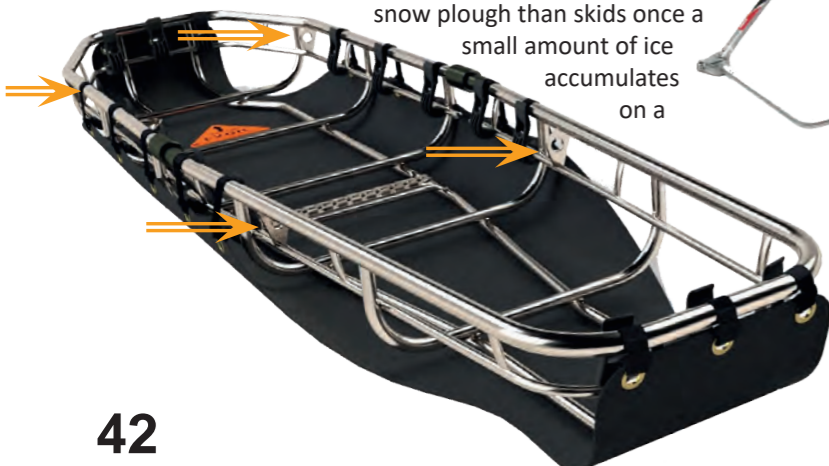
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The *Spencer Dakar* (pic top of p40) has telescoping handles and integral wheels enabling it to be wheeled by one or two persons as well as carried horizontally and/or suspended. Most rigid baskets can utilise systems like *Cascade's Advance* and *Traverse's Tyrol* system (bottom pic) while others like *Traverse's Porter* (pic p40) and *Mule II* which is a fatter, off-road wheel, are specific to the *Traverse* and *CMC* models. Such systems have single and/or twin wheels and optional carry arms that rotate to any position including being able to create a stand which makes tending to the casualty more comfortable for patient and rescuers. Indeed *Lyon* are now seeing demand from fire services for wheel and handle



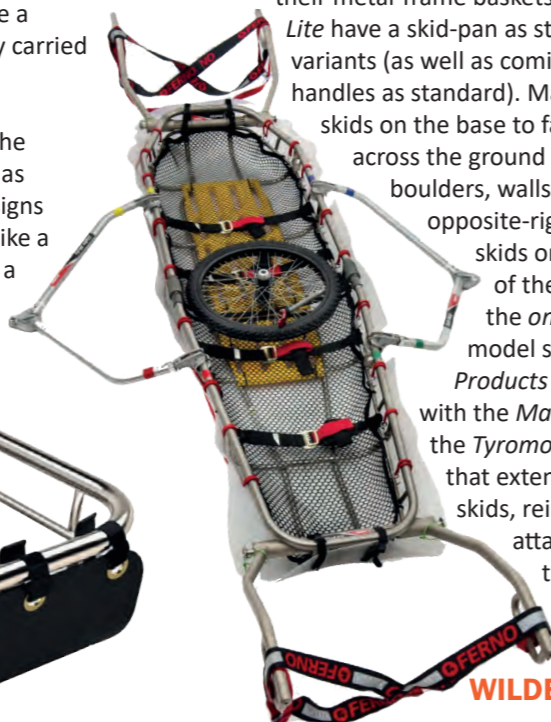
options. Options like the *Mule II* are not an inconsiderable extra cost at \$1000 to \$1500. *Tyromont's* handles on both models fold down when not in use or can be rotated to provide support legs like a table (pic above), these also come with a wheel. Their oval-shaped handle design is also used on the *Cascade* handles. Other stretchers that offer extension carry handles mostly do so as an option that slots into, and is then pinned to, the existing tubular frame like the *Traverse Tyrol* system shown below-right, *Cascade TerraTamer*, *Ferno's Paraguard* and *Kong's Lecco* and *911*. The *Kong* models (pic above) are interesting because their extension handles are standard, not an option and have a padded curved handle to allow them to be comfortably carried on the rescuer's shoulders.

Most metal-frame baskets will be constructed so that the base longitudinal supports protrude enough to double as skids but this doesn't work quite so well in tapered designs and of course, an open weave is prone to acting more like a snow plough than skids once a small amount of ice accumulates on a



cross-member. In the image below left you can see how the base profile is relatively limited with two tubes that are thinner than the top rail and provide relatively inefficient runners. A great many stretchers never get dragged along the ground so this isn't necessarily a problem but for those that want the option, *Lyon Equipment* (below left) and *Traverse* (below) have an ancillary skid-sheet that can be strapped to any basket to facilitate easier sliding and greater casualty protection from below.

Cascade specialise in the ultimate style of sled/pulk or Ackja stretchers but also have a ski-plate available as an option for their metal-frame baskets. *SAR Products Alpine/Lite* have a skid-pan as standard on their MR variants (as well as coming with extension handles as standard). Many stretchers have skids on the base to facilitate easier sliding across the ground and to negotiate boulders, walls etc. The first image opposite-right shows wooden skids on the Mining version of the *Ferno 71*, perhaps the only wooden skidded model still functioning. The *SAR Products* stretchers together with the *MacInnes* stretcher and the *Tyromont Tyral* have side rails that extend to the ground as skids, reinforced by a metal 'ski' attachment in the case of the *MacInnes* and with a flattened profile on the *Tyral*. Similarly,



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RESCUE STRETCHERS/LITTERS

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the third image on the right is the *Kong Lecco* which also has the two side rails extending to the ground as runners and then protects the patient underneath with two aluminium sheets so this slides well, is durable and very protective of the patient. Interestingly, *Spencer's* flat-top *Dragger* can be pulled on its skids or flipped upside-down and hand-carried with the rails acting as side protection like a basket stretcher. The *UT2000* offers actual skate attachments as an option for use on snow and ice. In the image above of Ukrainian rescuers in the Carpathians, a dedicated sled stretcher is being used to transport an injured skier. This type of stretcher, also called an *Ackja*, *Ackja* or *Pulka*, is NOT lift-capable but note that the

common sled handle design has been adopted by some of the hybrid stretchers like the *Tyromont* and *Cascade* models. The second image above shows the moulding detail of the *Traverse Advantage's* shell. This provides protection for the casualty and slides well over all kinds of surfaces but lacks the durability and strength of metal runners or the efficiency of a *Cascade* style smooth-bottom sled. The fourth example above is *Alp Design's Speleo* which isn't dealing with snow and ice so much as rock and grit so it needs to be protective, supportive and durable. They've opted to use a full length sheet of carbon-fibre composite of *Kevlar* and *Bakelite* plastic.



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MARKET GUIDE

SUSPENSION, HORIZONTAL & VERTICAL LIFT

For rope and winching operations you have to be very careful to ONLY use the specified lift points which is NOT the same as using anywhere along the top-rail although the *UT2000* and *Ultramedic's Mining* can specifically be loaded anywhere along the top rail. Others can too like the *Traverse* ranges but they do also have specified tie-in points. Specified load points may be required because of the load angles and may be an isolated section of rail (*Captive Rail Eye* in our tables) or an obvious eye, perhaps with a reinforced grommet or an extra reinforced weld-point. For horizontal lift these will be located at the strongest part of a stretcher to rule out folding or buckling under load; roughly the ¼- ¾ length points at the shoulders to mid torso area and the lower leg to thigh area. Rarely, if ever, will a stretcher have horizontal suspension points at the obvious extremities – head and foot. A number of models have separate load-eyes on the inside of the shell like *Traverse's Stratload* eyes above which are oriented slightly differently on the *Pinnacle* because it is aimed more at vertical extractions. Others have eyes that swivel around the top rail like *Cascade's ALPs* and some *Traverse* tactical variants. This model from China's *EMSS* (left) shows a quite odd addition of a swivelling eye plate right next to the traditional reinforced grommet-eye.

This might be to improve the load angles on the carabiner which can be subjected to some torquing when clipped to rails and through some eyes but backing up via those grommet eyes might not be a bad idea.

ALWAYS FACE CARABINER GATES INWARDS TOWARDS THE CASUALTY

Our definition of 'Vertical' for this article refers to the 90 degree orientation of the stretcher into a complete head-up, feet-down position which is only ever used to negotiate an opening or vertical tube/passage/cave that won't allow the stretcher to be raised in the preferred horizontal orientation. The vertical lift point for a head-up extraction may use the regular head-end attachment eyes or there may be a special, separate attachment above the head to ensure that any straps don't end up being loaded across the casualty's face.

We could fill an entire GUIDE with stretcher bridle options (and probably will at some point) but for the purposes of simplicity we will confine this discussion to the three basic options:

1) **Fixed length wire or webbing straps** Like *Junkin's* quite 'rustic' but robust yellow set (above-right) and *Kong's* more refined *Orion* straps (left). There may be 4,6 or even 10 straps (or wires in the case of this *Tyromont* set on their *Tyroll* stretcher (right),



which is not a rigid-frame so not included in this part). These will be fixed, non-adjustable lengths with two or more being shorter than the rest to allow the stretcher to orientate

level (due to higher upper body weight), slightly head down (preferred for trauma) or slightly head up (preferred for head-injuries). Helicopter litters use their own very specific straps or stainless wire bridles tested and approved as a package. *LSC* has an interesting magnetic-D-rings version (above) where the two D-rings separate for storage and loading and magnetically snap together readily for clipping to the winch cable hook.

A modification of fixed-length straps is *AlpDesigns* cableway or tyrolean rig (right) using a web spacer between two connection points to keep the stretcher on the trajectory of the track-line rope.

2) **Adjustable Length Straps**, again 4, 6 or more but each can be adjusted for length for perfect orientation. Some will allow the orientation of a stretcher to be changed mid-lift to allow negotiation of a narrow section or entrance but this can be difficult with the straps loaded. In the *Alp design* model above the arrow shows the tail of the strap that can be pulled to bring the head upright as in the cave-rescue photo opposite. Some teams will use a mini pulley system to provide this temporary change in orientation.

3) **Vertical 'Yoke' Straps** at the head -end sometimes with a spreader bar but adjustable straps can often be modified for the same purpose. This *Alp Design Speleo* (shown on the right with the casualty's protective cover

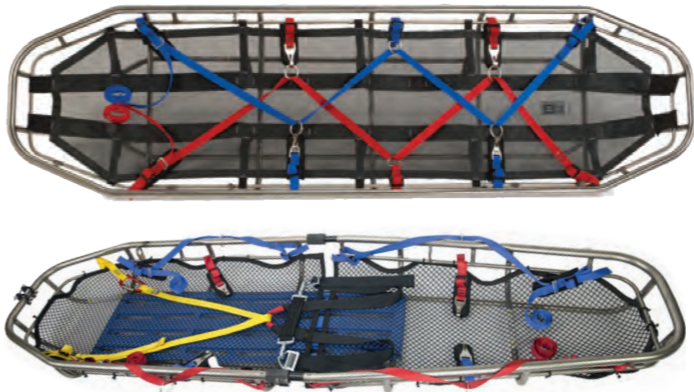


RESCUE STRETCHERS/LITTERS

unfurled) has an ancillary yoke connecting into both the stretcher and the casualty harness (arrowed) but the stretcher does also have its own single point attachment which you can see in red between the two black yoke straps. The *Petzl NEST* (right) has a similar head-end 'yoke' attachment (arrowed). Such straps are also very useful for dragging stretchers through restrictive passageways or along the ground and for many teams are probably more frequently used for that purpose than for a vertical-orientation lift. Before we leave attachment points it's worth mentioning control lines and tag-lines. These are ropes connected to the head and or foot-end of a stretcher to assist in positioning and direction of lift during a raising or winching operation or on a tyrolean. In general a tag-line is for orientation, positioning and obstacle negotiation while a control line maintains a constant lowering speed and/or braking action in a more horizontal plane such as a tensioned diagonal/tyrolean traverse. Where such control or obstacle negotiation is required only temporarily, having ropes attached to the extremities of the stretcher throughout the raise can be a pain, if not a hindrance so consider *Kong's* idea of a remote bomb-release (pic top) running from the tag-line attachment eye via a short length of cord/webbing to the stretcher handler.

PATIENT SECURITY

Most stretchers utilise webbing straps that run to and from each side of the frame. This simple transverse strapping is fine for flat and low-angle ground transport with no exposure of the casualty to a fall other than being tipped too far to one side. Heli-ops and more extreme vertical operations call for something more substantial. Most transverse straps can be crossed to create shoulder and thigh straps or you can use bespoke straps. *CMC* offer two enhanced tie-in systems costing



around \$300 to replace the age-old 'lashing' of casualties using webbing, often a single length, which was tied backwards and forwards, weaving in and out of the frame in a mystical, passed-down-through-the generations method that not only takes hours but can end up being too loose or too tight. The two-strap system bottom-left, replaces the traditional lashing for secure ground transport while below that is a more secure, integrated harness with pelvic and shoulder straps which can be used with a spine board. Any at-height risk to the casualty should ideally be mitigated with a harness style restraint which includes should straps, cross-torso, pelvic and leg-restraints. However, you MUST be sure not to over tighten straps. Wait for the patient to inhale before tightening across the torso, ensure that the brachial and femoral arteries aren't occluded etc.

Casualties in a vertical orientation for extended periods are particularly prone to extreme discomfort and any padding of sensitive areas is welcome. Where time allows, time spent making the casualty more comfortable as well as secure is time well spent. In addition to securing casualties with strapping, some have enhanced safety which doubles as 'environmental' protection in the form of large PVC 'wings' that Velcro right across the casualty's torso and upper legs as seen in the *Paraguard*, *ResQMate*, *Petzl Nest* and *Alp Design Speleo*. When it comes to casualty size, we will deal with bariatrics (oversized) separately except to say that a rigid frame basket will only safely fit a casualty that actually does fit within that basket.

Shorter casualties need to be properly secured so that they don't slide and submarine under standard transverse stretcher straps. This is easily achieved by extending the foot strap(s), creating a figure of 8 and looping this over the feet and firmly securing to the side, preferably to an eye or a transverse frame bar just forward of the feet. Many stretchers have a dedicated foot plate like the *Junkin* and *Spencer* on p40 and some shell frames have additional tie-in points offered by rope that runs in and out for the circumference of the shell.

CAVES & CONFINED SPACES

The *Nest* and *Speleo* on these pages are obviously ideally suited to manoeuvring in very limited space confines of a cave. However, not all 'confined spaces' are small. Except for



MARKET GUIDE



CAVE RESCUE / CON-SPACE

REGULAR

BARIATRIC

mines and the largest cave systems, rigid frame basket stretchers are rarely the first choice for confined space rescue. The Mines Rescue version of the *Ferno 71* isn't a con-space stretcher because mines are often large, spacious areas, it's a regular sized stretcher that has intrinsic safety thanks to wooden runners and no metal fittings that might cause a spark. True confined-space doesn't come more confined than cave rescue which often uses rollup stretchers (featuring in the next issue's GUIDE). However, although probably driven by industry, baskets started striking back against roll-ups a while ago when it was realised that width was often the only problem with a solid frame which otherwise slides well and provides better patient protection in a cave or confined space. So with models like the *Titan Pinnacle*, 'thinner' became the alternative for con-space stretchers to the flexibility of something like the old *Neil-Roberston* style, incidentally still produced today mainly for use in ships. Small-footprint stretchers like *Ferno's Paraguard Exel* which has been around almost as long as the *Neil Robertson*, and the updated *Resqmate* are aimed more at industry and are great for operating in limited space while providing good back support and the ability to slide easily but patient arms and legs are a little more exposed (even with the wraparound 'wings') than the protection afforded by a basket frame and their entire design is a little complex with numerous nooks and crannies that need to be cleaned post-incident. We have not included the half-board 'stretchers' like *FAST*, the *SpecPack* by *Yates*, *UltraMedic's ConRest* (above-right), *Actsfafe's HS Skopan* and the *LSP* because although they have a rigid torso component and are excellent options for confined space rescue they don't offer full length protection for the purposes of this GUIDE so will be included in a separate GUIDE to Con-Space Stretchers in **TECHNICALRESCUE** magazine but some may be in next issue's GUIDE to Flexible/Roll-up stretchers in **WSAR#10** with similar designs like *Tyromont Tyroll's CS*. These models are otherwise well enough equipped to be considered truly capable all-round stretchers though better for rope rescue than for carry-outs! Perhaps the only dedicated cave rescue stretchers designed

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purposely for caves are the *Petzl NEST* and the *AlpDesign Speleo* (red stretchers far-left). Both are low-profile, platforms with integral casualty protection, integrated body harness and, in the case of the *AlpDesign*, a full length-sled style base while the *NEST* uses removable square section alloy tubing to provide extra rigidity, or not if you need to perform a tight manoeuvre around a bend. These are light, narrow and with a height profile limited only by the casualty's nose! In fact, they have all the attributes of a really good mountain rescue and SAR stretcher not much heavier or bulkier than the universally versatile lightweight roll-ups we're looking at next time but sturdier and with significant enhancements. Our teams used *SKEDs* for most types of Technical Rescue but if I was to choose again I'd definitely consider one of these two as my alternate addition to a full rigid basket.

BARIATRICS

At the other end of the spectrum are bariatric stretchers for super-sized casualties. Before they became a manufactured item we had great success using the platform style *Bell Mountain Rescue* stretcher for bariatric 'rescues' which were often no more than 50 feet from a room in a house to an ambulance. But the *Bell* and *Macinnes* were/are solid metal frames well able to carry the kinds of load we were getting – 50 to 70 stone (320kg/700lb to 445kg/980lb) at that time and even higher these days. The 'platform' style enables body fat to be contained by 'soft' measures like blankets and strapping that would otherwise not fit in any standard basket. We were able to have Peter Bell produce a bariatric version – super-wide and flat-topped which suited the great outdoors but was not so great for the urban environment and any doorways that needed to be negotiated. Sadly, most of these types of 'rescue' involved individuals too large to go through the door anyway and taking out a window was the only option. Dedicated wilderness rescuers won't generally be dealing with such large immobile casualties but any casualty still has the potential to be very large, so oversized or wide baskets like the *Traverse Titan 32* top-left and *UltraMedic's 82cm/32" wide XXL* (above) are available. Some regular baskets are wider than others like the *D90* (p50) at 68cm/27" wide so can deal with larger casualties. The *UT200* has an option for frame extensions on the sides and ends which could function to better contain a larger patient in what is otherwise a fairly narrow stretcher but its load-rating would preclude true bariatrics.



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ENVIRONMENTAL PROTECTION

This is often most vital in wilderness rescue where the casualty could be in your charge for several hours and subject to exposure and/or hypothermia, or hyperthermia. All mountain and cave rescue teams use some form of exposure protection in their stretchers, whether it be dedicated like a waterproof/padded bed, thermal blankets, sleeping bags, waterproof covers or incidental such as a vacuum mattress or all of the above. All-encompassing bags are favoured by many, *Tyromont's Injury Protection Bag* (left) for instance adds extra protection to a vacuum mattress which provides thermal protection as well as immobilisation and splinting.

This model is a true 'bag' than can be sealed up around the casualty and can also be carried as kind of 'soft' stretcher separate from the basket. *Kong* have taken this to the next level with an all-encompassing capsule (above) which seals like a drysuit and has a clear face shield with breathing valve. In some instances your protective measures are to stave off heat-stroke and sun burn. In extreme heat you might consider pouring water over a casualty's clothing to cool them down and liberal application of a simple sun-block.

HEAD GUARD / DEBRIS PROTECTION

The *Kong Capsule* is perfect for complete protection from cold-water inundation as might occur in canyon rescue with the very real dangers of negotiating a waterfall but there are simpler options for head-protection like the *Kong Visor* (opposite) which attaches to their optional head-foam/cervical management system. Being strapped to a stretcher face up, partway down a crumbly cliff face is a very scary prospect with very real dangers from falling rock, soil and debris and being poked by branches or thorny twigs. In the old days a pair of glasses or goggles were the real minimalist approach but *CMC* broke the mould when they introduced their comprehensively protective clear Lexan Litter-Shield shown on the left in it's alternative, larger, taller format that will fit most stretchers, not just *CMC's*. This thing is as good today as it was when it was introduced in the 80s able to deflect sizeable chunks of rock that might defeat lighter-weight



counter-measures. Indeed Jim Frank says he knows of at least two saves from rockfall thanks to this Lexan Shield. As you might expect, it's not cheap at \$470 but a lot cheaper than a new face! Similarly this *MacInnes* cover by *Lyon* (right) is a modern, tougher version of the original genius pram-style canvas/PVC cover that folded down and uses adherence to the EN Mountaineering Impact standards as the basis for design. This degree of solid protection might be bulky to store and carry were it not for the fact that both designs can simply flip over the end of the stretcher for patient access and during transport or invert inside the stretcher for storing. The simplest option of a face visor like this *Kong* model, can sit flat in the stretcher for storage. This 'build-your-own' shield from



Kohlbratt also stores flat until formed into a sturdy plastic dome but there's a lot to be said for clear screens like the *Tyromont* in the picture opposite-top-left, giving the casualty insight into what's going on. Not always a good thing!

HELICOPTER-USE

The heli and offshore marine rescue sectors of wilderness search & rescue tend to be differently equipped to mountain and cave rescue teams often with heavier-duty, Mil-Spec systems and components. One of the key players in this is Life Saving Corporation (LSC) of Florida who produce the iconic 406 Medevac II (p50 in its 'F' for Flotation variant discussed shortly) and 402 models (right) in stainless steel or Titanium. Despite its 'slight' appearance the 402 is a true multi-role stretcher that floats, slides and can get into pretty narrow spaces which is why it's favoured by many helicopter crews. The open-weave design of metal baskets



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can disrupt airflow from the downdraught and induce spin just as easily as more enclosed shell structures. The 402 for instance, is a helicopter winch op stalwart and is effectively a solid, flat surface that doesn't allow air through at all so you clearly can't over-simplify aerodynamics. As we'll see next time, Tyromont have designed a kind of air-rudder that sits atop one of their stretchers to counter the spin imparted by the rotors on their design. Any stretcher's aerodynamics can be altered by the way you package your casualty so even those listed in this GUIDE as heli-compatible may become affected by rotor-wash and rotor-spin under certain conditions. What is vitally important is that only the bridles and accessories specifically made for your heli-stretcher are used – **there should be no mix and and matching of slings and components from other manufacturers when it come to heli-ops.** Interestingly Peter Bell's early work with the RAF seemed to indicate that a slight tilt to head up reduced spin as it shed air more readily.



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offshore models are more permanently rigged to orientate the casualty to 'bob' rather than sit like a raft on the top with the risk of waves washing over an upturned face. There are a number of rail attachments around the 406 frame which act as protective buffers but don't increase buoyancy. Nevertheless, this is a feature that many a cliff-rescuer's scraped knuckles would appreciate on ALL basket stretchers.

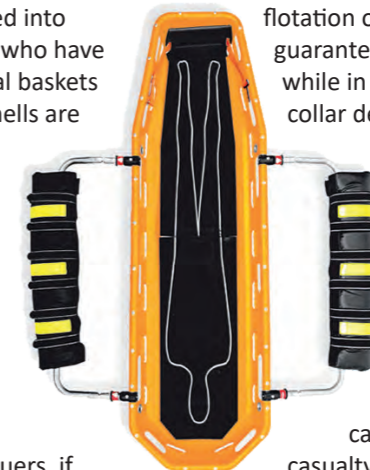
As mentioned in the PATIENT SECURITY section, straps can be a questionable addition in water. The *D90* is designed for in-water loading and while in or over water, no straps are used. There have been instances of patients strapped into metal basket stretchers during watercraft transport who have drowned after the craft has capsized! While all metal baskets are giant colanders that drain freely, some plastic shells are giant drogue anchors that will retain water. High altitude specialists like the *Cascade* range are more concerned with snow than liquid water so that they function better as a sled, able to slide freely on snow and ice. The *UT200* does have drain holes in its plastic shell but these are too small to shed water fast enough in a raising operation out of water – you could initially be lifting hundreds of extra pounds. Better to remove the shell altogether for water ops but this requires tools. For inland rescuers, if

FLOTATION

With just a few exceptions, like the *402*, the *Kong Canyon* and the *D90* (below-left), most stretchers will either sink like a stone or some plastic shells might remain on the edge of being neutrally buoyant so will require additional flotation in order to function safely in inland water. This can be quite a convoluted process to fit so if you're a land-based team, don't expect to rock up and deploy within a couple of minutes like coastal and offshore crews can with pre-rigged systems. Pre-planning is necessary. Most of those that offer some form of flotation use round float tubes that strap around the outside of the frame. The *Junkin* and *Cascade* examples above surround the majority of the frame but some are a horseshoe-shape at the head/torso end only. The *UT200* (below) has a foam-tube option but also offers inflatable supports for those operating in caves and canyons that might not have the space for 6 cubic feet of flotation foam. Priority for placement of floats is the head end, or more particularly, the heaviest part of the body- the upper torso, so most stretchers will orientate slightly or in the case of marine/offshore rescue stretchers having to contend with waves and chop, substantially, feet down. The *UT2000* offers what can only be described as an inflatable upper body lilo for enhanced buoyancy at the vital head-end. (right). One of Heli-rescue's top models, the *Medevac II* & *IIA 406-F* variant shown above left, has a number of flotation aids including a foam torso pad, two lower-profile semi-circular foam tubes on the outer rails and life-jacket style torso pads. Unlike the horse-collar and full circumference flotation offered for stretchers only used for water rescue occasionally in relatively level inland and flood waters, the



you want to combine optional flotation with patient comfort and security, the *Kong Mattress* (right) might be the way to go. It pumps up (by hand/foot pump) and can secure to the bottom of any basket stretcher providing handles and an assortment of securing straps. Of course any rotomoulded spine board will also provide flotation and an easier transition from casualty loading at the site of injury to loading into the stretcher, it just won't be as comfortable. Italian company, Spencer Italia, have taken a leaf out of Polynesian technology and have flotation outriggers (left) which guarantee the stability of the casualty while in the stretcher. In the standard collar designs, if the float profile is too narrow there is always a danger of capsize which this system negates. It also overcomes a patient access problem that may be caused by float add-ons that are too wide – with these outriggers, rescuers can still get direct access to the casualty's airway should a problem occur.





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MARKET GUIDE

IN THE FOLLOWING TABLES.....

Any use, feature, accessory or component that is inherent in the stretcher is shown as a solid coloured square ■■■■■ If it's an option it is shown as an outline square □□□□□

A circle ● in the 'USE' columns indicates that the feature is OK for that purpose but not ideal. We normally use a diamond to indicate this in our GUIDES but felt a diamond ♦ was better used to show which stretchers were tapered. ALL of these stretchers can be used for short-duration carry-out with varying degrees of casualty comfort and rescuer convenience so **Long Range (LR) Gound Carry** is a separate category. Rope rescue in horizontal/prone orientation is a feature of all of these stretchers but load capacity varies.

ORIGIN: The 'manufacturer's country, not necessarily the country of manufacture if they outsource. If we know, we put an inset flag to show where it's made but many are quite cagey about this. As it happens, the vast majority of these stretchers are made in the origin country shown.

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€. Cost is for basic model with included accessories indicated by a solid square in the appropriate column (optional extras being an outline square).

STRETCHER TYPE

BASKET: a basin shaped stretcher with raised sides that help retain the casualty within it. It may be an open weave frame of tubular metal (or carbon-fibre) or it may be a solid shell, usually some form of plastic, supported by a tubular metal frame.

PLATFORM: A more-or-less flat topped stretcher that doesn't have rigid sides but will usually have more complex integrated straps and/or enveloping flexible 'wings' which encapsulate or partially encapsulate the casualty.

SPLIT/BACK CARRY: SPLIT Refers to a two-piece stretcher that either divides into two separate halves which can be carried by one or two people or is hinged in the middle. Some stretchers, may break down longitudinally and be small enough to be carried by one person but are not 'split' in the true sense. ALL split stretchers can be back-carried and most have the provision of a ruck-sack style harness or suitably equipped carry bag which implies it can be carried by one person but some Split steel stretchers are quite heavy and better divided between two if possible. *One half is often longer than the other and our tables generally quote the longer half.*

STRETCHER ATTRIBUTES:

TAPERED ♦ RECTANGULAR ■ The general shape of a basket stretcher. Tapered means it narrows significantly towards the leg end – similar, dare we say, to a traditional coffin shape. Rectangular is more symmetrical with square ends and no defined head or foot other than as determined by internal fixings (integrated head restraint, harness etc).

ANODIZED POWDER COATED the finish on metal stretchers. ■=powder coat. Plastic coating is indicated in the NOTES

INHERENTLY BUOYANT: A solid blue square ■=means that the stretcher will float or be neutrally buoyant WITHOUT additional flotation and will float even with a casualty on board, not necessarily like a raft, keeping the casualty dry but it defiantly won't sink unless damaged. Most that 'float' will be neutrally buoyant sitting at or just beneath the water's surface.

WATER DRAINING: ■ Means that water will not pool in the bottom of the stretcher – clearly, metal baskets will sink immediately but drain nicely through the open weave of the frame. This can be a consideration when performing an in-water recovery where your rigging or anchors DON'T have the ability to hold the considerably heavy weight of a water-filled or slow draining shell-style basket stretcher. An outline square □ indicates that the shell will drain but may be quite slow through

limited size/number of drain holes.

DESIGN LOAD & MBS: Design load is the weight of person that is intended to use the stretcher akin to Working Load Limit. This may be further defined by horizontal and vertical MBS shown as Hz/Vtcl. The Minimum Breaking Strength/Load – **MBS** (in burnt orange) is generally 10 or 15 times higher than the WLL.

SUSPENSION POINTS: See intro text on page 44

USES:

HORIZONTAL LIFT: Can be suspended on rope/winch cable in horizontal/prone orientation. Does NOT refer to hand-carry

VERTICAL LIFT: Stretcher suspends in head-up/standing posture

HELICOPTER: Stretcher is approved for use in/from helicopters in its own country.

SLED / SLIDE: The ability to slide easily on snow, ice, wet grass etc. without digging in or scraping snow/soil/debris inside the stretcher through openings or between frame bars. Some will convert to an Ackja style sled but we have not included dedicated Ackja/pulka sled-stretchers.

LR GROUND-CARRY: Long Range Ground Carry able to be carried for long distances over mixed terrain. Allows multi-rescuer carry. Has wide, comfortable handles. Supports and protects the casualty when slid over rocks/railings etc.

WATER-CAPABLE ■=Inherently buoyant stretcher.

□=Option to attach flotation (from the same manufacturer.)

CONFINED SPACE: Narrow enough to be used for small spaces

BARIATRIC: Wide & strong enough for very large casualties

FEATURES

INTEGRAL C-COLLAR: Cervical protection that will fit to stretcher

INTEGRAL SPINE BOARD: Usually a half-board covering the spine area from head to waist as an integral component

HEAD GUARD: Again, every stretcher in this guide can be fitted with a fits-all head guard so this refers to the manufacturer's supplied head-guard.

WEATHER PROTECTION: waterproof and/or heat-retaining cover

ADJUSTABLE FIXED LENGTH BRIDLE: A set of 2, 4 or 6 straps connecting harness lift points to a central collection point known as a stretcher bridle. **Adjustable** straps shown as a burnt orange square ■ or □ Fixed length straps = □ or ■

INTEGRAL BODY HARNESS: is an addition to regular stretcher straps. Improves casualty safety and positioning by restraining/wrapping the foot, shoulders/chest and waist to the stretcher. These may be quite simple enhancements of regular transverse straps or a complete full body harness with padded femoral and shoulder straps.

EXTENSION HANDLES: are carry handles that fix to the frame

WHEELS: technically, every tubular frame basket in this GUIDE can take one of the 'Fits-All' wheels like the Mule II but this column is for wheels offered by the same manufacturer.

■= single wheel or □ option. ■=2 wheels or □ option.

FOOT-PLATE/SUPPORT: a rigid foot plate or separate web-support as provided by a full body harness.

PADDED BASE MAT: between the casualty and the stretcher base-always a waterproof to allow easy cleaning of body-fluids

CARRY BAG/RUCKSACK: A protective cover for the stretcher often with back-carry straps

COLOUR: Primary colour of shell if it has one or of the frame. Where there is a significant, uniform second colour-usually of a protection bag we've shown a smaller square inside the main colour. Some frames are offered with a coloured coating or anodizing but most are bare metal and shown as □

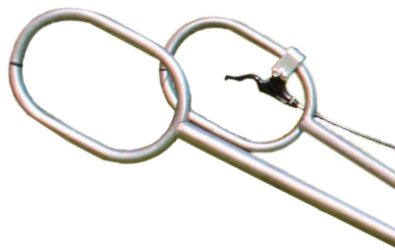
TAME THE BACKCOUNTRY











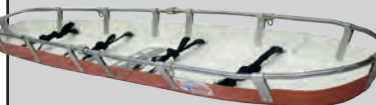















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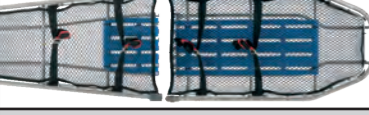











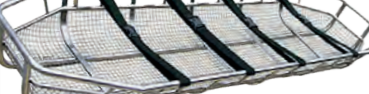

Equalizer handles attach to all Cascade Professional and Advance Series litters. The unique 24-position system allows operators to quickly adjust handle positions for terrain changes or differences in operator height. Available in titanium or stainless steel, these handles are incredibly light and stow easily in a Tamer Transport Pack and ready to deliver a hand.



| IMAGES NOT TO SCALE | MODEL | COMPANY | ORIGIN | COST inc tax/VAT | BASKET | FLAT/PLATFORM | SPLIT / TWO-PIECE | TAPERED RECTANGULAR | ANODIZED POWDER-COAT | INHERENTLY BUOYANT WATER DRAINING | WEIGHT | DESIGN LOAD MBS Hz/Vtcl | DIMENSIONS L x Wx H/D SPLIT LENGTH (longest section) | MATERIALS: FRAME BASE/LINER SUSPENSION POINTS | HORIZONTAL LIFT | VERTICAL LIFT | HELICOPTER | SLED / SLIDE | LR GROUND-CARRY | WATER-CAPABLE | CONFINED SPACE | BARIATRIC | INTEGRAL G-COLLAR | INTEGRAL SPINE BOARD | HEAD GUARD | WEATHER PROTECTION | BRIDLE ADJ USTABLE | BRIDLE FIXED LENGTH | BODY HARNESS | EXTENSION HANDLES | WHEEL / 2-WHEELS | FOOT-PLATE / SUPPORT | PADDED BASE / MAT | CARRY BAG/RUCKSACK | COLOUR OPTIONS | NOTES | WWW. | |
|--|--|-------------------|---|---------------------|--------|---------------|-------------------|---------------------|----------------------|--------------------------------------|-------------------|----------------------------------|---|---|-----------------|---------------|------------|--------------|-----------------|---------------|----------------|-----------|-------------------|----------------------|------------|--------------------|--------------------|---------------------|--------------|-------------------|------------------|----------------------|-------------------|--------------------|----------------|---|--------------------|--------------------|
|  | Barella Speleo | ALP DESIGN |  | n/a | - | ■ | - | ■ | - | ■ | 13kg 28.7 lb | 150kg 331 lb | 183x42x10cm 72x16.5x4" | Carbon Fibre/ Kevlar/Bakelite Nylon/Cordura 7x Webbing | ■ | ■ | ■ | ■ | ● | - | ■ | ● | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Rope handholds run the circumference of the stretcher | alpdesign.it | |
|  | Advance 200 CRC-RSL-M200-1 | CASCADE RESCUE |  | \$995 | ■ | - | - | ◆ | - | - | 7.94kg 17.5 lb | >1134kg >2500 lb | 208x54.6x14cm 82x21.5x5.5" | Stainless Steel Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 TT 1-piece CRC-RSL-M200-1T | CASCADE RESCUE |  | \$1800 | ■ | - | - | ◆ | - | - | 6.1kg 16.5 lb | >1134kg >2500 lb | 208x54.6x14cm 82x21.5x5.5" | Titanium Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 MAX CRC-RSL-M200M-1 | CASCADE RESCUE |  | \$995 | ■ | - | - | ■ | - | - | 10.9kg 24 lb | >1134kg >2500 lb | 208x63.5.6x16cm 82x25x6.25" | Stainless Steel Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 MAX TT CRC-RSL-M200M-1T | CASCADE RESCUE |  | \$1800 | ■ | - | - | ■ | - | - | 8.16kg 18 lb | >1134kg >2500 lb | 208x63.5.6x16cm 82x25x6.25" | Titanium Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 2-piece CRC-RSL-M200-2 | CASCADE RESCUE |  | \$1300 | ■ | - | ■ | ◆ | - | - | 8.61kg 19 lb | >1134kg >2500 lb | 208x54.6x14cm 82x21.5x5.5" 106.7cm / 40" | Stainless Steel Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 TT 2-piece CRC-RSL-M200-2T | CASCADE RESCUE |  | \$1950 | ■ | - | ■ | ◆ | - | - | 7kg 15.5 lb | >1134kg >2500 lb | 208x54.6x14cm 82x21.5x5.5" 106.7cm / 40" | Titanium Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 MAX Split CRC-RSL-M200M-2 | CASCADE RESCUE |  | \$1300 | ■ | - | ■ | ■ | - | - | 11.8kg 26 lb | >1134kg >2500 lb | 208x63.5.6x16cm 82x25x6.25" 106.7cm / 40" | Stainless Steel Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 MAX TT Split CRC-RSL-M200M-2T | CASCADE RESCUE |  | \$1950 | ■ | - | ■ | ■ | - | - | 8.85kg 19.5 lb | >1134kg >2500 lb | 208x63.5.6x16cm 82x25x6.25" 106.7cm / 40" | Titanium Glass Composite 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 Carbon TT 2-piece CRC-RSL-M200-2TC | CASCADE RESCUE |  | \$2900 | ■ | - | ■ | ◆ | - | - | 7.5kg 14 lb | >1134kg >2500 lb | 208x63.5.6x14cm 82x25x5.5" 106.7cm / 40" | Titanium Carbon-Fiber 4x articulating | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Advance 200 MAX Carbon TT Split CRC-RSL-M200M-2TC | CASCADE RESCUE |  | \$2900 | ■ | - | ■ | ■ | - | - | 6.1kg 16.5 lb | >1134kg >2500 lb | 208x63.5.6x16cm 82x25x6.25" 106.7cm / 40" | Titanium Carbon-Fiber 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Also optional Snowmobile tow-bar | cascade-rescue.com | |
|  | Professional Steel Litter CRC-RSL-PS/PSR | CASCADE RESCUE |  | \$495 | ■ | - | - | ◆ | ■ | ■ | 14kg 31 lb | >1134kg >2500 lb | 211x64.8x16cm 83x25.5x6.25" | 19mm/¾" top rail Coated Steel HDPE mesh 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cascade-rescue.com |
|  | Professional Stainless Litter CRC-RSL-PSS1/PSSR1 | CASCADE RESCUE |  | \$975 | ■ | - | - | ◆ | ■ | ■ | 11.5kg 25.5 lb | >1134kg >2500 lb | 211x64x16cm 83x25x6.25" | Stainless Steel HDPE mesh 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cascade-rescue.com |

NOTES: N/A = info Not Available/not given COST: Approx & includes local tax/VAT USES: ● = OK BUT NOT IDEAL

USES & FEATURES: ■ = Option

| IMAGES NOT TO SCALE | MODEL | COMPANY | ORIGIN | COST inc tax/VAT | BASKET | FLAT/PLATFORM | SPLIT / TWO-PIECE | TAPERED RECTANGULAR | ANODIZED POWDER-COAT | INHERENTLY BUOYANT WATER DRAINING | WEIGHT | DESIGN LOAD MBS Hz/Vtcl | DIMENSIONS L x Wx H/D SPLIT LENGTH (longest section) | MATERIALS: FRAME BASE/LINER SUSPENSION POINTS | HORIZONTAL LIFT | VERTICAL LIFT | HELICOPTER | SLED / SLIDE | LR GROUND-CARRY | WATER-CAPABLE | CONFINED SPACE | BARIATRIC | INTEGRAL C-COLLAR INTEGRAL SPINE BOARD | HEAD GUARD WEATHER PROTECTION | BRIDLE ADJUSTABLE BRIDLE FIXED LENGTH | BODY HARNESS EXTENSION HANDLES | WHEEL / 2-WHEELS | FOOT-PLATE / SUPPORT | PADDED BASE /MATT CARRY BAG/RUCKSACK | COLOUR OPTIONS | NOTES | WWW. | |
|--|---|-------------------|---|---------------------|--------|---------------|-------------------|---------------------|----------------------|--------------------------------------|-------------------|--|---|--|-----------------|---------------|------------|--------------|-----------------|---------------|----------------|-----------|---|----------------------------------|--|-----------------------------------|------------------|----------------------|---|---|---|-------------|--------------------|
|  | Professional Stainless Split Litter CRC-RSL-PSS2/PSSR2 | CASCADE RESCUE |  | \$1365 | ■ | - | ■ | ◆ | ■ | ■ | 12.5kg 27.5 lb | 1134kg 2500 lb | 211x64x16cm 83x25x6.25" 109cm / 43" | Stainless Steel HDPE mesh 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cascade-rescue.com |
|  | Professional Titanium Litter CRC-RSL-PT1/PTR1 | CASCADE RESCUE |  | \$2350 | ■ | - | - | ◆ | ■ | ■ | 7.9kg 17.5 lb | 1134kg 2500 lb | 211x64.8x16cm 83x25.5x6.25" | 19mm/3/4" Top Rail Titanium HDPE mesh 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cascade-rescue.com |
|  | Professional Titanium Split Litter CRC-RSL-PT2/PTR2 | CASCADE RESCUE |  | \$2950 | ■ | - | ■ | ◆ | ■ | ■ | 8.4kg 18.5 lb | 1134kg 2500 lb | 211x64.8x16cm 83x25.5x6.25" 109cm / 43" | 19mm/3/4" Top Rail Titanium HDPE mesh 4x Swivel Eyes | ■ | ■ | ■ | ■ | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cascade-rescue.com |
|  | Disaster Response 726300/1 | CMC PRO |  | \$419 | ■ | - | - | ◆ | ■ | ■ | 15kg 33 lb | 408kg 900 lb | 210x62x17cm 82.7x24.4x6.7" | Carbon-Steel Durethane mesh 8 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cmcpro.com |
|  | Disaster Response Con-Space 726305 | CMC PRO |  | \$419 | ■ | - | - | ■ | ■ | ■ | 14kg 31 lb | 408kg 900 lb | 210x46x17cm 82.7x18.1x6.7" | Carbon-Steel Durethane mesh 8Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cmcpro.com |
|  | Stainless Steel Rescue Litter 726100/1 | CMC PRO |  | \$999 | ■ | - | - | ◆ | ■ | ■ | 14.1kg 31 lb | >11kN >2473 lbf 14/30kN 3147/6744 lbf | 211x58x18.5cm 83x23x7.25" | 25mm/1" top-rail Stainless Steel Durathane Net 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cmcpro.com |
|  | Stainless Steel Split Litter 726103/4 | CMC PRO |  | \$1390 | ■ | - | ■ | ◆ | ■ | ■ | 16.3kg 36 lb | >11kN >2473 lbf 14/30kN 3147/6744 lbf | 211x58x18.5cm 83x23x7.25" 116cm/45.7" | 25mm/1" top-rail Stainless Steel Durathane Net 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cmcpro.com |
|  | Titanium Rescue Litter 726112 | CMC PRO |  | \$2350 | ■ | - | - | ◆ | ■ | ■ | 5.9kg 13 lb | >11kN >2473 lbf 14/30kN 3147/6744 lbf | 211x58x18.5cm 83x23x7.25" | 25mm/1" top-rail Titanium Durathane Net 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cmcpro.com |
|  | Titanium Split Litter 726117 | CMC PRO |  | \$2950 | ■ | - | ■ | ◆ | ■ | ■ | 7.3kg 16 lb | >11kN >2473 lbf 14/30kN 3147/6744 lbf | 211x58x18.5cm 83x23x7.25" 116cm/45.7" | 25mm/1" top-rail Titanium Durathane Net 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | cmcpro.com |
|  | Field Rescue Stretcher EDJ-016A | EMSS |  | n/a | ■ | - | - | ■ | - | - | 18kg 39.7 lb | 159kg 350 lb | 216x61x19cm 85x24x7.5" | Stainless Steel Polyethylene 4x Swivel Eyes 4 Grommet Eyes | ■ | - | ■ | ● | ■ | ■ | - | - | - | - | ■ | - | ■ | ■ | ■ | ■ | Same or similar Chinese models made by Flower Medical, Ruixen Medical etc | emssabc.com | |
|  | Field Rescue Split Stretcher EDJ-016B | EMSS |  | n/a | ■ | - | ■ | ■ | - | - | 20.5kg 45.2 lb | 159kg 350 lb | 216x61x19cm 85x24x7.5" 130cm/51" | Stainless Steel Polyethylene 4 Swivel Eyes 4 Grommet Eyes | ■ | - | ■ | ● | ■ | ■ | - | - | - | - | ■ | - | ■ | ■ | ■ | ■ | Same or similar Chinese models made by Flower Medical, Ruixen Medical etc | emssabc.com | |
|  | RESCUE STRETCHER EDJ-016F | EMSS |  | n/a | ■ | - | ■ | ■ | - | - | 14kg 31 lb | 159kg 350 lb | 220x55x15cm 86.6x21.6x6" 115cm/45.2" | Alumium Alloy HDPE Shell 4 Captive Rail Eyes | ■ | - | ■ | ■ | ■ | ■ | ● | - | - | - | ■ | ■ | - | ■ | ■ | Appears to be a direct copy of the UT2000 | emssabc.com | | |
|  | Stainless Steel Stretcher EDJ-016C | EMSS |  | €1364 | ■ | - | - | ■ | - | ■ | 13kg 28.7 lb | 350kg 772 lb | 212x62x18cm 83.5x24.4x7.1" | Stainless Steel Steel wire mesh 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | - | ■ | - | - | ■ | ■ | Same or similar Chinese models made by Flower Medical, Ruixen Medical etc | emssabc.com | | |

NOTES: N/A = info Not Available/not given COST: Approx & includes local tax/VAT USES: ● = OK BUT NOT IDEAL

USES & FEATURES: ■ = Option

**singing
rock®**

BABY RESCUE BAG













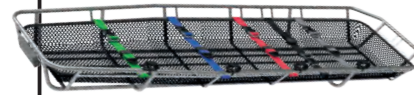



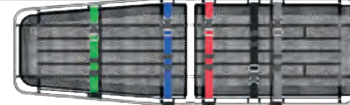



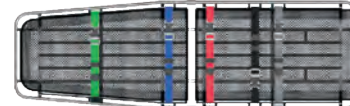





Designed for rescue transportation of the children
with a height 40-110 cm, max. weight 25 kg

Size: 80x45x35 cm
Weight: 3300 g

www.singingrock.com

**SAFETY
FIRST**







USES & FEATURES: ☒ ☐ = Option

| IMAGES NOT TO SCALE | MODEL | COMPANY | ORIGIN | COST inc tax/VAT | BASKET | FLAT/PLATFORM | SPLIT / TWO-PIECE | TAPERED RECTANGULAR | ANODIZED POWDER-COAT | INHERENTLY BUOYANT WATER DRAINING | WEIGHT | DESIGN LOAD MBS Hz/Vtcl | DIMENSIONS L x Wx H/D SPLIT LENGTH (longest section) | MATERIALS: FRAME BASE/LINER SUSPENSION POINTS | HORIZONTAL LIFT | VERTICAL LIFT | USES | | | | | | | | | | NOTES | WWW. | | | | | |
|---|-----------------------|----------------|---|---------------------|--------|---------------|-------------------|---------------------|----------------------|-----------------------------------|-------------------|--|---|--|-----------------|---------------|------------|--------------|-----------------|---------------|----------------|-----------|-------------------|----------------------|------------|--------------------|-------|------|-------------------|---------------------|--------------|--|-----------------------|
| | | | | | | | | | | | | | | | | | HELICOPTER | SLED / SLIDE | LR GROUND-CARRY | WATER-CAPABLE | CONFINED SPACE | BARIATRIC | INTEGRAL C-COLLAR | INTEGRAL SPINE BOARD | HEAD GUARD | WEATHER PROTECTION | | | BRIDLE ADJUSTABLE | BRIDLE FIXED LENGTH | BODY HARNESS | EXTENSION HANDLES | WHEEL / 2-WHEELS |
|  | 911 Net Full | KONG |  | \$1890 €1660 | ■ | - | ■ | ■ | - | ■ | 18kg* 39.7 lb* | 1500kg 3300 lb (450kg* 990 lb*) | 218-320*x60x22cm 85-126*x24x8.7" 117cm/46" | Aluminium HDPE Mesh 8 Reinforced Eyes | ■ | ■ | ■ | - | ■ | - | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | * Length with extension handles * Weight and load with detachable handles | kong.it |
|  | 911 Shell 880.03 | KONG |  | \$4950 | ■ | - | ■ | ■ | - | - | 18kg* 39.7 lb* | 1500kg 3300 lb (450kg* 990 lb*) | 218-350*x60x22cm 85-138*x24x8.7" 117cm/46" | Aluminium Fibre-Glass 8 Reinforced Eyes | ■ | ■ | - | ■ | ■ | - | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | * Length with extension handles * Weight and load with detachable handles | kong.it |
|  | Lecco 2.0 | KONG |  | \$4510 €3200 | - | ■ | - | ■ | - | ■ | 16kg* 35.3 lb* | 200kg 440 lb 2100kg 4620 lb | 198-310*x47x11cm 78-122*x18.5x4" | Aluminium Nylon 8 Reinforced Eyes | ■ | ■ | ■ | ■ | ■ | - | - | ● | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | * Weight with detachable handles | kong.it |
|  | Lecco XL | KONG |  | \$7625 | - | ■ | - | ■ | - | ■ | 16kg 35.3 lb | 400kg 880 lb | 198-310*x75x11cm 78-122*x30.5x4" | Aluminium Nylon 8 Reinforced Eyes | ■ | ■ | - | ■ | ■ | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | kong.it |
|  | 402 | LSC |  | \$1801 | - | ■ | ■ | ■ | - | ■ | 14.5kg 32 lb | 272kg 598 lb | 203x42x19cm 80x16.5x7.5" 16.1cm/41" | Stainless Steel Nylon/Cordura 4 Fixed Eyes | ■ | ■ | ■ | - | - | ■ | ■ | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Integral foot plate | lifesavingsystems.com |
|  | 402TI | LSC |  | \$2856 | - | ■ | ■ | ■ | - | ■ | 10.8kg 24 lb | 272kg 598 lb | 203x42x19cm 80x16.5x7.5" 16.1cm/41" | Titanium Nylon/Cordura 4 Fixed Eyes | ■ | ■ | ■ | - | - | ■ | ■ | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Integral foot plate | lifesavingsystems.com |
|  | 404 Medevac II | LSC |  | \$1137 | ■ | - | - | ■ | - | ■ | 14.5kg 32 lb | >1134kg >2500 lb | 213x61x18cm 84x24x7" | Stainless Steel HDPE mesh 10 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | lifesavingsystems.com |
|  | 406 Medvac IIA | LSC |  | \$1330 | ■ | - | ■ | ◆ | - | ■ | 15.4kg 34lb | >1134kg >2500 lb | 213x61x18cm 84x24x7" 109cm/43" | Stainless Steel HDPE mesh 10 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | lifesavingsystems.com |
|  | 406 D Medevac IIA | LSC |  | \$1291 | ■ | - | ■ | ◆ | - | ■ | 14.3kg 31.6 lb | >1134kg >2500 lb | 198x61x18cm 78x24x7" 102cm/40" | Stainless Steel HDPE mesh 10Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | lifesavingsystems.com |
|  | 406 TI Medevac IIA | LSC |  | \$3594 | ■ | - | ■ | ◆ | - | ■ | 9.98kg 22 lb | >1134kg >2500 lb | 213x61x18cm 84x24x7" 109cm/43" | Titanium HDPE mesh 10 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | lifesavingsystems.com |
|  | 406 D TI Medevac IIA | LSC |  | \$3668 | ■ | - | ■ | ◆ | - | ■ | 9.25kg 20.4lb | >1134kg >2500 lb | 198x61x18cm 78x24x7" 102cm/40" | Titanium HDPE mesh 10 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ■ | - | - | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | lifesavingsystems.com |
|  | MacInnes Mk6 LMK6-ST | LYON EQUIPMENT |  | £3300 | - | ■ | ■ | ■ | - | ■ | 25kg 55.1 lb | 136*-272kg 300*-600 lb | 219x64x32cm 86.2x25.2x12.6" 118cm/46.5" | Aluminium PVC 6 Fixed Eyes | ■ | ■ | ■ | ■ | ■ | - | - | ● | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | * WLL if using 4 instead of 6 lift eyes. Mk7 discontinued | lyonequipment.co.uk |
|  | Bell Tangent Split MR | LYON EQUIPMENT |  | n/a* | - | ■ | ■ | ■ | - | ■ | 25kg 55.1 lb | 130kg 286.6 lb 272kg 600 lb | 208x58x28cm 82x22.8x11" 108cm/42.5" | Stainless Steel Nylon 6 Fixed Eyes | ■ | ■ | ■ | ■ | ■ | - | - | ● | - | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | *Only available via MR England & Wales but cost is similar to MacInnes | lyonequipment.co.uk |

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USES & FEATURES: ■ □ = Option













| IMAGES NOT TO SCALE | MODEL | COMPANY | ORIGIN | COST inc tax/VAT | BASKET | FLAT/PLATFORM | SPLIT / TWO-PIECE | TAPERED RECTANGULAR | ANODIZED POWDER-COAT | INHERENTLY BUOYANT WATER DRAINING | WEIGHT | DESIGN LOAD MBS Hz/Vtcl | | DIMENSIONS L x Wx H/D SPLIT LENGTH (longest section) | MATERIALS: FRAME BASE/LINER SUSPENSION POINTS | HORIZONTAL LIFT | | USES | | LR GROUND-CARRY | WATER-CAPABLE | CONFINED SPACE | BARIATRIC | INTEGRAL C-COLLAR | INTEGRAL SPINE BOARD | HEAD GUARD | WEATHER PROTECTION | BRIDLE ADJUSTABLE | BRIDLE FIXED LENGTH | BODY HARNESS | EXTENSION HANDLES | WHEEL / 2-WHEELS | FOOT-PLATE /SUPPORT | PADDED BASE /MAT | CARRY BAG/RUCKSACK | COLOUR OPTIONS | NOTES | WWW. |
|--|------------------------------------|---------------------------|---|--------------------------|--------|---------------|-------------------|---------------------|----------------------|-----------------------------------|----------------------|-------------------------------|--|---|--|-----------------|---|------------|--------------|-----------------|---------------|----------------|-----------|-------------------|----------------------|------------|--------------------|-------------------|---------------------|--------------|-------------------|------------------|---------------------|---|---|------------------|-------|------|
| | | | | | | | | | | | | | | | | | | HELICOPTER | SLED / SLIDE | | | | | | | | | | | | | | | | | | | |
|  | Keswick | PERFORMANCE MANUFACTURING |  | \$4500 €3200 | - | ■ | ■ | ■ | ■ | ■ | 19.9kg 44 lb | 1000kg 2200 lb | | 208.5x61x28cm 82x24x11.8" 104cm/41" | Aluminium Nylon 4 Captive Rail Eyes | ■ | ■ | ■ | ■ | ■ | - | - | - | - | □ | - | ■ | □ | - | ■ | □ | - | ■ | * Partially anodized | perf-mfg.ca | | | |
|  | Nest | PETZL |  | £2174 \$2870 €2050 | - | ■ | * | ■ | - | ■ | 13.1kg 28.8 lb | 150kg 331 lb | | 200x50x5cm 78.7x19.7x2" | Nylon/Aluminium Polyethylene 4 Web Extensions | ■ | ■ | - | ● | ● | - | ■ | - | - | ■ | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | *not split but packs to a long tube. Optional STEFF straps to incline the stretcher | petzl.com | | | |
|  | DX030/032 | PROTEKT |  | £998 €836 | ■ | - | ■ | ■ | - | ■ | 16kg 35.3 lb | 1000kg 2200 lb | | 212.5x58.5x18.5cm 84x23x7.3" 106cm/42" | Stainless Steel Polyester mesh 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | - | - | - | - | ■ | - | - | - | - | - | - | - | - | | protekt.pl | | | |
|  | DX031G | PROTEKT |  | €912 | ■ | - | - | ■ | - | ■ | 17kg 37.5 lb | 1000kg 2200 lb | | 212.5x58.5x18.5cm 84x23x7.3" | Stainless Steel Aluminium Bed 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | - | - | - | - | ■ | - | - | - | - | - | - | - | - | | protekt.pl | | | |
|  | DX031/033 | PROTEKT |  | €813 | ■ | - | - | ■ | - | ■ | 15kg 33 lb | 1000kg 2200 lb | | 210x41.5x18.5 cm 83x16.3x7.3" | Stainless Steel Polyester mesh 4 Fixed Eyes | ■ | ■ | ■ | - | ■ | - | - | - | - | ■ | - | - | - | - | - | - | - | - | | protekt.pl | | | |
|  | RSBSA01 RSBSS01 | ROYAX |  | €557 €532 | ■ | - | - | ■ | ■ | ■ | 7.7-14kg 17-31 lb | 700kg 1543 lb | | 215x66x20cm 84.6x26x8" | Aluminium Stainless Steel PVC Netting 5 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | □ | - | - | ■ | □ | □ | ■ | ■ | - | - | - | - | - | ■ | Also available in Steel cost €472 weight 16kg/35.2 lb | royax.eu | | |
|  | Alpine CR Civil Rescue | SAR PRODUCTS |  | £1477 | - | ■ | ■ | ■ | ■ | ■ | 13.45kg 29.7 lb | 300kg 661 lb | | 210x60x12cm 83x23.6x4.7" 105cm/41.3" | Steel Polyethylene bed 4 Fixed Eyes | ■ | ■ | ■ | □ | ● | - | ● | ● | - | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | sar-products.com | | |
|  | Alpine Light CR Civil Rescue | SAR PRODUCTS |  | £2013 | - | ■ | ■ | ■ | ■ | ■ | 11kg 24.25 lb | 300kg 661 lb | | 210x60x12cm 83x23.6x4.7" 105cm/41.3" | Steel Polyethylene bed 4 Fixed Eyes | ■ | ■ | ■ | □ | ● | - | ● | ● | - | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | sar-products.com | | |
|  | Alpine MR Mountain Rescue | SAR PRODUCTS |  | £1785 | - | ■ | ■ | ■ | ■ | ■ | 18.42kg 40.6 lb | 300kg 661 lb | | 210x60x12cm 83x23.6x4.7" 105cm/41.3" | Aluminium Polyethylene bed 4 Fixed Eyes | ■ | ■ | ■ | ■ | ● | - | ● | ● | - | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Mountain Rescue version is with Handles and skid-pan. | sar-products.com | | |
|  | Alpine Light MR Mountain Rescue | SAR PRODUCTS |  | £2275 | - | ■ | ■ | ■ | ■ | ■ | 14.95kg 32.95 lb | 300kg 661 lb | | 210x60x12cm 83x23.6x4.7" 105cm/41.3" | Aluminium Polyethylene bed 4 Fixed Eyes | ■ | ■ | ■ | ■ | ● | - | ● | ● | - | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Mountain Rescue version is with Handles and skid-pan | sar-products.com | | |
|  | Boston Pro ST04302B | SPENCER |  | €1050 | ■ | - | - | ■ | □ | ■ | 17kg 37.5 lb | 360kg 794 lb | | 211x65x25cm 83x25.6x9.8" | 30mm top rail Aluminium or Steel Polyethylene Board 4 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ● | □ | * | - | ■ | - | - | - | - | - | - | - | - | ■ | Titanium version of Pro weighing 9kg available to order | spencer.it | | |
|  | Boston Pro ST04303B | SPENCER |  | €722 | ■ | - | - | ■ | □ | ■ | 26kg 57.3 lb | 360kg 794 lb | | 211x65x25cm 83x25.6x9.8" | 30mm top rail Stainless Steel Polyethylene Board 4 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | ● | □ | * | - | ■ | - | - | - | - | - | - | - | - | ■ | *The integral Rock Spine board offers buoyancy but float tubes available as an option | spencer.it | | |
|  | Boston Tec ST04310B ST04311B | SPENCER |  | €687 €709 | ■ | - | - | ■ | □ | ■ | 14-23kg 31-51 lb | 360kg 794 lb | | 211x65x18.5cm 83x25.6x7.3" | Aluminium or Steel Polyethylene Bed 4 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | □ | - | - | ■ | - | - | - | - | - | - | - | - | - | ■ | Back board has a lever to maintain adjustment angle. Titanium version of this weighing 8kg available to order | spencer.it | | |

NOTES: N/A = info Not Available/not given COST: Approx & includes local tax/VAT USES: ● = OK BUT NOT IDEAL USES & FEATURES: ■ □ = Option

| IMAGES NOT TO SCALE | MODEL | COMPANY | ORIGIN | COST inc tax/VAT | BASKET | FLAT/PLATFORM | SPLIT / TWO-PIECE | TAPERED RECTANGULAR | ANODIZED POWDER-COAT | INHERENTLY BUOYANT WATER DRAINING | WEIGHT | DESIGN LOAD MBS Hz/Vtcl | DIMENSIONS L x Wx H/D SPLIT LENGTH (longest section) | MATERIALS: FRAME BASE/LINER SUSPENSION POINTS | USES | | | | | | | | | | | | | | | | NOTES | WWW. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------------------------------|---------|---|---------------------|--------|---------------|-------------------|---------------------|----------------------|--------------------------------------|---------------------|----------------------------------|---|---|-----------------|---------------|------------|--------------|-----------------|---------------|----------------|-----------|-------------------|----------------------|------------|--------------------|----------------------|---------------------|-----------------------------------|------------------|-------|------|---------------------|------------------|--------------------|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | HORIZONTAL LIFT | VERTICAL LIFT | HELICOPTER | SLED / SLIDE | LR GROUND-CARRY | WATER-CAPABLE | CONFINED SPACE | BARIATRIC | INTEGRAL C-COLLAR | INTEGRAL SPINE BOARD | HEAD GUARD | WEATHER PROTECTION | BRIDLE ADJ. UNSTABLE | BRIDLE FIXED LENGTH | BODY HARNESS EXTENSION HANDLES | WHEEL / 2-WHEELS | | | FOOT-PLATE /SUPPORT | PADDED BASE /MAT | CARRY BAG/RUCKSACK | COLOUR OPTIONS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | Boston Light ST04320B ST04321B | SPENCER |  | €676 €698 | ■ | - | - | ■ | □ | ■ | 12-22kg 27-49 lb | 360kg 794 lb | 211x55x18.5cm 83x21.6x7.3" | Aluminium or Steel Polyethylene Bed 4 Captive Rail Eyes | ■ | ■ | ■ | - | ■ | □ | ■ | - | ■ | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

NOTES: N/A = info Not Available/not given COST: Approx & includes local tax/VAT USES: ● = OK BUT NOT IDEAL

USES & FEATURES: □ = Option

| IMAGES NOT TO SCALE | MODEL | COMPANY | ORIGIN | COST inc tax/VAT | BASKET | FLAT/PLATFORM | SPLIT / TWO-PIECE | TAPERED RECTANGULAR | ANODIZED POWDER-COAT | INHERENTLY BUOYANT WATER DRAINING | WEIGHT | DESIGN LOAD MBS Hz/Vtcl | | DIMENSIONS L x Wx H/D SPLIT LENGTH (longest section) | MATERIALS: FRAME BASE/LINER SUSPENSION POINTS | HORIZONTAL LIFT | USES | | | | | | | | | | NOTES | WWW. | | | | | | | | |
|--|--|------------|---|--------------------------|--------|---------------|-------------------|---------------------|----------------------|--------------------------------------|-------------------|----------------------------------|--|---|--|-----------------|---------------|------------|--------------|-----------------|---------------|----------------|-----------|-------------------|----------------------|------------|-------|------|--------------------|--------------------|---------------------|--------------|-------------------|--|--|------------------|
| | | | | | | | | | | | | | | | | | VERTICAL LIFT | HELICOPTER | SLED / SLIDE | LR GROUND-CARRY | WATER-CAPABLE | CONFINED SPACE | BARIATRIC | INTEGRAL C-COLLAR | INTEGRAL SPINE BOARD | HEAD GUARD | | | WEATHER PROTECTION | BRIDLE ADJ USTABLE | BRIDLE FIXED LENGTH | BODY HARNESS | EXTENSION HANDLES | WHEEL / WHEELS | FOOT-PLATE/SUPPORT | PADDED BASE /MAT |
|  | Titan Split 2070S / 2070ST | TRAVERSE |  | £1766 \$1390 €2821 | ■ | - | ■ | ■ | □ | ■ | 15kg 33 lb | 1136kg 2500 lb | | 212x60x19cm 83.5x23.5x7.7" 116cm/45.7" | 25mm/1" top rail Stainless Steel HDPE mesh 4 Strat-points | ■ | ■ | ■ | □ | ■ | ■ | ■ | - | - | ■ | □ | □ | ■ | ■ | □ | ■ | ■ | ■ | | traverserescue.ca | |
|  | Titan 32 Wide | TRAVERSE |  | £1550 \$1011 €2527 | ■ | - | - | ■ | □ | ■ | 19.2kg 42.4 lb | 1136kg 2500 lb | | 212x81x18cm 83.5x32x7.25" | 25mm/1" top rail Stainless Steel HDPE mesh 4 Strat-points | ■ | ■ | ■ | □ | ■ | ■ | ■ | ■ | - | ■ | - | □ | □ | ■ | ■ | □ | - | ■ | | traverserescue.ca | |
|  | Titan Titanium 2072 / 2072T | TRAVERSE |  | £2000 \$2350 €4277 | ■ | - | - | ■ | □ | ■ | 6.3kg 13.9 lb | 1136kg 2500 lb | | 212x58x18cm 83.5x23x7.25" | 25mm/1" top rail Titanium HDPE mesh 4 Strat-points | ■ | ■ | ■ | □ | ■ | ■ | ■ | ■ | - | - | ■ | □ | □ | ■ | ■ | □ | ■ | ■ | | traverserescue.ca | |
|  | Titan Titanium Split 2072S / 2072ST | TRAVERSE |  | £3255 \$2950 €5277 | ■ | - | ■ | ■ | □ | ■ | 7.5kg 16.5 lb | 1136kg 2500 lb | | 212x60x19cm 83.5x23.5x7.7" 116cm/45.7" | 25mm/1" top rail Titanium HDPE mesh 4 Strat-points | ■ | ■ | ■ | □ | ■ | ■ | ■ | ■ | - | - | ■ | □ | □ | ■ | ■ | □ | ■ | ■ | | traverserescue.ca | |
|  | Titan Pinnacle Con-Space 0153254 | TRAVERSE |  | £1135 \$750 | ■ | - | - | ■ | □ | ■ | 6.5kg 14.3 lb | 1136kg 2500 lb | | 209.5x48.3x18cm 83.5x19x7.25" | 25mm/1" top rail Titanium HDPE mesh 4 Strat-points | ■ | ■ | ■ | □ | ■ | ■ | - | ■ | - | ■ | □ | - | ■ | □ | ■ | ■ | ■ | ■ | | traverserescue.ca | |
|  | Titan Pinnacle Split Con-Space 0153255 | TRAVERSE |  | £2130 \$1335 | ■ | - | ■ | ■ | □ | ■ | 7.5kg 16.5 lb | 1136kg 2500 lb | | 209.5x49.5x19cm 83.5x19.5 x7.7" 106.7cm/42" | 25mm/1" top rail Titanium HDPE mesh 4 Strat-points | ■ | ■ | ■ | □ | ■ | ■ | - | ■ | - | ■ | □ | - | ■ | □ | ■ | ■ | ■ | ■ | | traverserescue.ca | |
|  | Tyral | TYROMONT |  | €3800 | ■ | - | ■ | ■ | ■ | ■ | 15kg* 33 lb | 250kg 550lb | | 215x56x25cm 84.6x22x9.8" 108cm/42.5" | Aluminium Troclyen Bed 8 Fixed Eyes | ■ | ■ | ■ | ■ | ■ | - | - | - | ■ | □ | □ | □ | ■ | ■ | ■ | ■ | ■ | ■ | *Includes Integral ext handles | tyromont.com | |
|  | Light* | TYROMONT |  | €2600 | ■ | - | ■ | ■ | ■ | ■ | 21kg* 46.3 lb | 250kg 550lb | | 200x53x25cm 78.7x20.9x9.8" 100cm/39" | Steel Troclyen Bed All of Top Rail | ■ | ■ | ■ | ■ | ■ | - | ■ | - | ■ | □ | □ | □ | ■ | ■ | ■ | ■ | ■ | ■ | *inc integral ext handles weighing 5kg. *'Light' refers to the simpler frame structure NOT the weight. | tyromont.com | |
|  | UltraBasket SAN-0087 | ULTRAMEDIC |  | €899 | ■ | - | - | ■ | - | - | 12.5kg 27.5 lb | 315kg 695 lb | | 214x62x19cm 84.25x24.4x7.7" | Aluminium ASA/ABS Plastic 4 Grommet Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | □ | □ | □ | - | ■ | ■ | ■ | ■ | ■ | | ultramedic.de |
|  | UltraBasket Twin SAN-0087-2 | ULTRAMEDIC |  | €1242 | ■ | - | ■ | ■ | - | - | 15.5kg 34 lb | 315kg 695 lb | | 214x61.5x18.5cm 84.25x24x7.3" 116cm/45.7" | Aluminium ASA/ABS Plastic 4 Grommet Eyes | ■ | ■ | ■ | ■ | ■ | ■ | ■ | - | - | - | □ | □ | □ | - | ■ | ■ | ■ | ■ | ■ | | ultramedic.de |
|  | UltraBasket XXL SAN-0087-2-XXL | ULTRAMEDIC |  | €1815 | ■ | - | ■ | ■ | - | ■ | 36kg 80 lb | 400kg 882 lb | | 214X81.8X19cm 84.25x32.2x7.7" | Aluminium ASA/ABS Plastic 6 Grommet Eyes | ■ | ■ | * | ■ | ● | ■ | - | - | ■ | - | - | □ | □ | □ | - | ■ | ■ | ■ | ■ | * Load limit is reduced to 200kg in fully vertical orientation | ultramedic.de |
|  | UltraBasket-M SAN-0087-1-M | ULTRAMEDIC |  | €1720 | ■ | - | - | ■ | - | - | 12kg 26.5 lb | 300kg 661 lb | | 218x59x20cm 85.8x23.2x7.9" | Aluminium ASA/ABS Plastic All of Top Rail | ■ | ■ | ■ | ■ | ■ | - | - | - | - | □ | □ | □ | - | ■ | ■ | ■ | ■ | ■ | ■ | | ultramedic.de |
|  | UltraMining SAN-0090 | ULTRAMEDIC |  | €1887 | ■ | - | - | ■ | - | □ | 20kg 44 lb | 200kg 441 lb | | 200x55x30cm 78.7x21.6x11.8" | V2A Stainless Steel 6 Handle/Rail Eyes | ■ | ■ | ■ | ■ | ● | - | ■ | - | - | □ | □ | □ | - | ■ | ■ | ■ | ■ | ■ | ■ | | ultramedic.de |

NOTES: N/A = info Not Available/not given COST: Approx & includes local tax/VAT USES: ● = OK BUT NOT IDEAL USES & FEATURES: □ = Option

SAR PACK

Packing for the Weather pt2

by **Roland Curll**
NSW Police Rescue – Australia



Roland is a 19 year veteran of Police Rescue in NSW Australia responsible for rope rescue, extrication, SAR, trauma and swiftwater rescue in the Illawarra region south of Sydney. This huge region incorporates significant coastal cliffs and the Upper Nepean river basin with remote bush, forest, canyons and waterways.

In issue 8, we considered how a 24 hour SAR Pack (Search and Rescue Pack) is an important tool for all SAR Teams operating in remote areas and that there is no such thing as the perfect SAR Pack because different teams work in different environments and have different levels of response. Budget, the rules and regulations of the team, and knowledge can also cause limitations.

Working together as a team will help put together a strong check list of what equipment needs to be carried, but it also comes down to the individual. Each person needs to put together their own setup and to test their own equipment. Gathering information from the experienced members of the team will help you understand what equipment needs to be carried, but testing the backpack by carrying it out into the type of environment that you and your team responds to will allow you to make your personal corrections now, instead of during an actual rescue. Carry the pack over different terrain and in pouring rain and searing heat – this will tell you what rubs in the heat, what leaks in the wet etc. Pull out all the gear and train yourself on each piece of equipment. Focus on *how* you pack your equipment in priority order for when you're in the field, bearing mind that small items migrate south and large items bring everything else out with them when you unload. Specialist SAR packs are a great option because they often provide a modular or capsule design that compartmentalises all your kit like *Coaxsher's SR1 Endeavour* opposite and *Traverse Kigali* above. However, bear in mind that the downside to this efficiency is that every pouch and zip and buckle adds bulk, weight and cost to what, in its simplest, lightest and cheapest form would be a pillow case!

Being prepared is the reason that a SAR Pack exists. Not only prepared for what you know is going to happen but also what *could* happen. The urban-rescue tendency to simply go back to the vehicle if you need anything may not be an option. How far into the field you plan on moving may be another consideration to influence what equipment you carry. For example, no matter how

far you plan on travelling into the field you always have a knife, a fire starter and a light source even if the patient is only a couple of metres into the bush. If you plan on travelling more than a couple of hundred metres, then carry your SAR Pack. This is based on the idea that you obviously plan on being back before night fall but just in case things don't go as planned, you are prepared. What was planned to be only a several hundred metres away prompting you to travel light could change due to poor initial information, weather change or a change in patient circumstances, there can be any number of reasons that stop you returning to the vehicle to retrieve kit you should have taken in the first place. Carrying a full SAR Pack so that you are properly prepared for all eventualities can sometimes make you question whether you need quite so much, perhaps just some water and a light rain jacket instead? Experience will assist in figuring out what is needed and what is not needed, but you must factor in Murphy's Law. It's often the case that such a high percentage of calls don't call for the pack to be unzipped that you question the need. Even when it does get used, some team members may continually attend call outs/ missions and never use the majority of items in their pack. They will think about ditching certain unused items. Then a call will come in that ends up using virtually everything in their pack and their understanding of the term 'necessity' will be restored.

CLOTHING

Things often don't go as planned and this is when proper preparation is necessary so that the SAR member can still be effective and complete their task without being a hindrance to colleagues. Changes and upgrades to clothing allows SAR team members to be effective come snow, rain or shine. Choice of clothing prepares the user for the elements, provides personal protection when performing tasks, and adds uniformity. Uniformity is important in search & rescue because team members can often be separated by significant distances and searchers need to be sure who is in the distance. It promotes teamwork and provides a professional appearance that can help bring relief to

a patient because it can inspire more confidence than seeing a mish-mash of different colours and types of clothing. Some search and rescue teams are provided with clothing as part of their uniform, while other teams require members to buy their own clothing and/or PPE but specify what to buy or what colour. For instance, all jackets must be red or all helmets must be white. For teams that co-opt local climbers or other expertise for assistance or simply for team members who turn up without their team kit, a few high-viz tabards might be an idea? Lightweight and compact clothing makes it easier for the SAR member to carry these items if they're not needed at the outset but lightweight also needs to translate to highly functional. A *Pac-a-Mac* is fantastically small and easy to carry but it's not going to help much in a blizzard. The answer is the age-old layer system.

This needs no introduction but just in case, a layer system is made up of different layers of clothing which can be added or removed depending on conditions and are easily carried. This can entail duplication of layers especially if you're insisting on taking that *Pac-a-Mac*, but the basic components are:

- Base layer (next to the skin)
- Insulation layer (creating/maintaining warmth)
- Shell layer (keeping out wind, rain, dust, sand and debris)

Currently, Merino is a popular choice for a base layer. The reason we say 'currently' is because clothing companies are always coming out with new types of materials so it is not known if a better base layer will come on the market tomorrow and change everything. Merino wool items, such as the clothing produced by *Ice Breaker* or *Woolpower* has the ability to help keep the wearer warm when it is cold out, but it also has the ability to help keep them cool when it is hot. Sheep aren't daft.

The insulation layer adds extra warmth to the body. This can be a fleece material, or a quilted (also known as a puffer) jacket which is a compact yet warm solution because it has sections filled with a synthetic fibre or down trapping an insulating layer of air around each fiber or down-filament. Down loses this ability to trap air when wet while synthetic fibres are unaffected but are not usually as light, or as compact as a down jacket which will squash

down small for transport and then literally suck in air when opened and expand to many times it's packed size. The *Arc'teryx Cerium SL* (above) for instance could be deemed a shell layer in dryer climates but as a layer it is incredibly lightweight because it is insulated with 'ethically-sourced' goose down but crucially, has durable water repellent treatment to keep the down dry. Down is not a feather, it's a soft mass of filaments beneath the feathers and quality is even more important in your performance jacket than it is in your pillow – goose down is better than duck down and if you're offered chicken down, run a mile. The *Arc'teryx Cerium SL* is not the most compact jacket on the market, but it is very functional. And as mentioned before functionality is all-important when considering what lightweight equipment to carry. You may want to consider vacuum packing to get the most clothing into the smallest space – the type that require a vacuum cleaner to suck out the air will be a one time deal because you won't be able to repack them into your SAR Pack once you've broken the vacuum seal.

There are however some one-way valve storage bags like the ones above that create a vacuum as you roll the air out of the bag with the clothing inside and this type *can* be used in the field.

The shell layer is basically the layer that protects everything inside from rain, sleet, snow, hail, dust, sand and whatever it is you're rolling in on that mountainside. Materials like *Gore-Tex* and *SympaTex* are popular because they don't allow large water/ rain molecules in but they do let smaller sweat molecules out. Some cheap materials, including that bright blue *Pac-a-Mac* your mum insists on wearing may keep the rain out, but they become wet on the inside as condensation from your sweaty exertions build up and you end up as wet as if you had worn no jacket. Consider also having a pair of overtrousers or rain pants. A rain jacket is often worn without rain pants which results in the wearer getting soaking wet legs which can cause problems as this is a large area from which to lose heat. It is a good idea to stop and put on your rain gear when it starts to rain, telling yourself that you want to reach a certain location before pulling out your gear can result in wet clothing before reaching that location. A shell layer is important in stopping a cold wind from stripping heat from your thermally efficient layers which are far less efficient when wet (apart from a neoprene wetsuit but that's a different article). Keeping out the rain and snow will help prevent or slow hypothermia but these things are often also worn in warm or tropical climates. Here, staying dry may be of no concern at all

because temperatures remain high day or night but if daytime temperatures are high while night-time temperatures plummet this can be a huge test for your clothing choices. Hyperthermia may be a consideration and even in cold weather it is easy to become overheated so vents and venting zips are a good idea allowing maximum circulation of air while still wearing your foul weather clothing. It can be the case that in the midst of a mission that initially required your cold weather rain-jacket but has now turned sunny, you're stuck carrying a heavy pack or managing the stretcher and don't get time to get rid of the coat and over-trousers. Vents at such a time are a miracle invention.

The head, hands and feet should also come into consideration when choosing clothing for the elements. A beanie / warm hat is a requirement for cold climates because a high percentage of heat is lost through the head. A hood on the jacket can help keep the head warm and protect from wind but which layer has a hood or not depends on the individual. In search and rescue a helmet is commonly used so how a beanie or hoods work with the helmet is something that the individual needs to test to find a solution that works for them. Most of this clothing focuses on keeping the individual warm and dry, but as we've already mentioned, some teams operate in warmer locations and there is a need to keep cool. Long sleeve clothing to protect from the sun, wick away sweat, and prevent overheating is important. There may even be consideration given to using cooling vests but despite their efficiency, these tend to be too heavy and bulky for SAR use. Wearing a hat that shades the wearer from the sun also has the benefit of improving visibility for searching as even sunglasses can suffer from light ingress from the top and sides (hence blinkered mountaineering glasses). Some special clothing may also be considered to deter mosquitoes but whatever its specialist uses, the clothing has to first and foremost be efficient for your tasks – wearing a complete mosquito next bag with cut-outs for your feet may do a grand job of keeping mosquitoes out but it will hinder most rope or stretcher handling operations.

OVERNIGHTING

The functionality of the clothing allows the SAR member to be able to effectively operate in the field for an extended period of time, but if the SAR member has to stay overnight in the field, they will require some form of shelter or sleep system. A sleep system is basically a shelter and a sleeping bag or similar. Some teams operate in areas where it is warm enough that a sleep system is not required, but when it comes to a sleep system for search and rescue operations there are basically two types. One is an expected or PLANNED system that will allow the SAR member to actually get some sleep. This may be during an extended search where the team has stopped searching for the day, and instead of hiking all the way back to the command post they set up camp so they can get some sleep and then continue searching the next day. The other type of sleep system is impromptu or UNPLANNED where you are unexpectedly stuck out in the wilderness overnight and you just need something, not to help you sleep, but to prevent you from becoming hypothermic so that you can make it through

the night. In one such instance I remember, the casualty had been reached, treated and packaged for helicopter evacuation but conditions and light don't allow it until the next day forcing an impromptu overnight stay in the canyon. This type of sleep system may be something as simple as a space blanket (also known as a Mylar blanket or an emergency blanket); a bivvy bag made from the same material may help reflect and trap body heat but because of this material condensation can build up. In other parts of the world just to get through the night may require a snow tent and a sub-zero sleeping bag. Again, this is where experience helps because you can gain an understanding of what works in the areas that you respond to and what is necessary in a worst-case-scenario – something that should always be planned for.

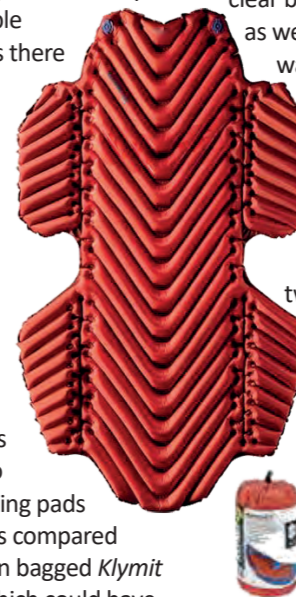
Equipment that is carried as part of a sleep system may have to be shared with the patient. Depending on the environment, a good example of low-bulk, quick and easy setup kit that doesn't take up much room in the pack is the 240g/8.5oz SOL (*Survive Outdoors Longer*) *Escape Bivvy* (right) and their *All-Season Blanket* (above). Also known as an *All-Weather Blanket*, this All-Season Blanket is basically a strong tarp-like material where one side is reflective like a space blanket, but it will last a lot longer. This can be used as a ground sheet or as a tarp, while you sleep in the SOL *Escape Bivvy*, which also has reflective material on the inside to reflect body heat but it is made of a special material which does not allow condensation to build up on the inside. The side zip also makes it easier to get out should you have to get up to check on the patient. If you have to share this system with the patient, you could use the *All-Season Blanket* to wrap up the patient while you use the *Escape Bivvy* or vice versa.

There are so many other sleep systems that could work as part of your SAR Pack setup but in basic terms you need something to sleep under, something to sleep in, and something to sleep on. For example, you sleep under a tarp, you sleep in a sleeping bag, and you sleep on a foam mat. It is a good idea to think about all three, but experience will dictate which is needed or more to the point, which is small and light enough to be carried in your SAR pack. A tarp is a lightweight solution that has various uses and is often considered instead of carrying a tent in the SAR Pack. Over the years there has been various ideas about how to set up a tarp, one idea is to have an A-frame design which is low to the ground so that it reflects heat, or raising it high so that cool air can circulate if it is too hot. With search and rescue response the tarp may be used with the patient in mind. There may need to be enough room under the tarp so that patient can be treated. The tarp may need to be rigged so that getting in and out from under it is easy for patient access.



Instead of a sleeping bag, a lightweight bivvy bag may be a solution if it is warm enough, a thermal sleeping bag liner could be added to add a little bit of warmth as well as wearing extra clothing. This may work in some locations if it is warm enough, but a sleeping bag will provide a lot more warmth. A bivvy bag can be used with a sleeping bag to provide a more waterproof cover, or a tarp may provide enough waterproof protection. Different set ups work for different people. As with a quilted/puffer jacket, sleeping bags can be filled with down or synthetic fibre. There are the same pros and cons as there were with jackets. Sleeping bags have always been capable of being compressed; they often come in a compression bag, but while this takes up less room in your pack, if it's intended to be used for patient care and your casualty is hypothermic on arrival, a compressed bag takes a while to regain its loft and thermal efficiency. When speaking to the ultralight backpacking community, it seems the sleeping bag is not as popular as a quilt (which is basically an open sleeping bag). A quilt works well when you have a designated campsite, are in a tent and have an inflatable sleeping pad, but in a search and rescue wilderness you may not be able to choose a flat designated campsite. You may have to stay overnight at whichever uncomfortable location the patient decided to be injured in, plus there are less concerns about unwanted drafts with a sleeping bag. A sleeping bag seems more suited for search and rescue, but a quilt may also be useful. If the location or injuries of the patient make it difficult to get them into a sleeping bag, a quilt may be more beneficial.

Using something to sleep on, is not only for comfort but also to prevent the body from being in contact with the ground resulting in heat loss. *Cascade Design's ThermaRest* has been the market leader in 'self'-inflating mats since the 80s and continues to evolve but there are one or two other options worth a mention. The *Klymit* Sleeping pads can be inflated by mouth in relatively few breaths compared to their inflated size. They are very compact when bagged *Klymit* also has a hammock version (right) with wings which could have applications in SAR because it provides lateral protection, both thermal and physical. Because you can add or remove air as required, the *Klymit* can be used between the patient and a spine board, and inflated quite specifically to fill any gaps to help reduce discomfort for the patient. Unfortunately, if this sleeping pad gets a puncture it will need to be repaired in the field. With a foam pad there is no need to worry about deflation, but it will take up more room in the pack. Solid foam pads can also be easily cut up for improvised splints. Many backpacks come with a foam pad as part of their frame structure which can be removed to use as an improvised pad. Most of these are too small but you may be able to gerry-rig your backpack with a doubled section of foam so that when removed, it opens up to cover a larger area to lie on. Before clothing and shelter comes water and after all three comes food. Many of you will routinely carry high-energy bars and drinks but for protracted calls you will need something more substantial to maintain your energy and general well-being for



continuing to perform your search and rescue task. Food that requires little or no preparation can be eaten during short breaks without holding up the rest of the team. Chemical cookers are an easy option because they only need a small amount of water to heat up a meal and nothing restores flagging energy and spirit on a cold day better than hot food and hot drink. Whatever food the SAR member chooses to carry in their pack should be tried when not on a mission in case that specific type of food causes digestion problems which could cause even more problems while responding. Food and chemical cookers unfortunately do expire, which is something to be aware of when storing these items in a SAR Pack because you never know when they might be needed. Carrying a stove, even if it is just one for the team, not only helps the team with hot drinks and meals it is equally important for the casualty. Carrying a *Nalgene* bottle, instead of just using a store-bought disposable water bottle, enables hot water to be poured into it and place inside the patient's sleeping bag like an old fashion hot water bottle. *Nalgene*-style rather than a *Sig* or *KleanKanteen* because the contents and quantity are fully visible through the clear bottle and wide-mouth versions mean it can be used for food as well as liquids. Experience will help to figure out how much water needs to be carried in the pack, but as a precautionary measure a *Sawyer Squeeze* or *Katadyn Befree* or some other type of water filtering method should be carried in case extra water is collected in the field.

Some stoves come with a built-in igniter, but even if it does it is still a good idea to have a fire starter, preferably two, and know how to use them. A butane gas type stove is one option, such as one small enough which can fit inside a small pot like the *Toaks Titanium Pot* along with the small canister, this makes a lightweight stove setup. But because the Pot is sitting on top of the stove the ground needs to be stable to ensure the pot does not tip over. The *Jetboil* (right) has the pot connected to the stove instead of just sitting on top and when not in use stores inside the pot. If it does tip over during cooking, the pot is covered in a neoprene type material so you can grab it without burning fingers. There are a number of stoves like the *Jetboil* which have additional parts allowing the stove to be hung from something if there is not stable ground for it to sit on. These types of stoves do not perform as well at higher altitudes, and the pressurised gas canisters may not be allowed on some aircraft. If your SAR team works with helicopters, the pilot or crew should be consulted first about ANY compressed gas that you may be carrying.

The SAR Pack is essential for any SAR member needing to remain in a remote area for an extended period of time. The contents of the pack; the clothing, the sleep system, the food and water; all need to be items which are well thought out and properly tested. Next comes some actual rescue components of the SAR pack but that's a whole 'nuther article.





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