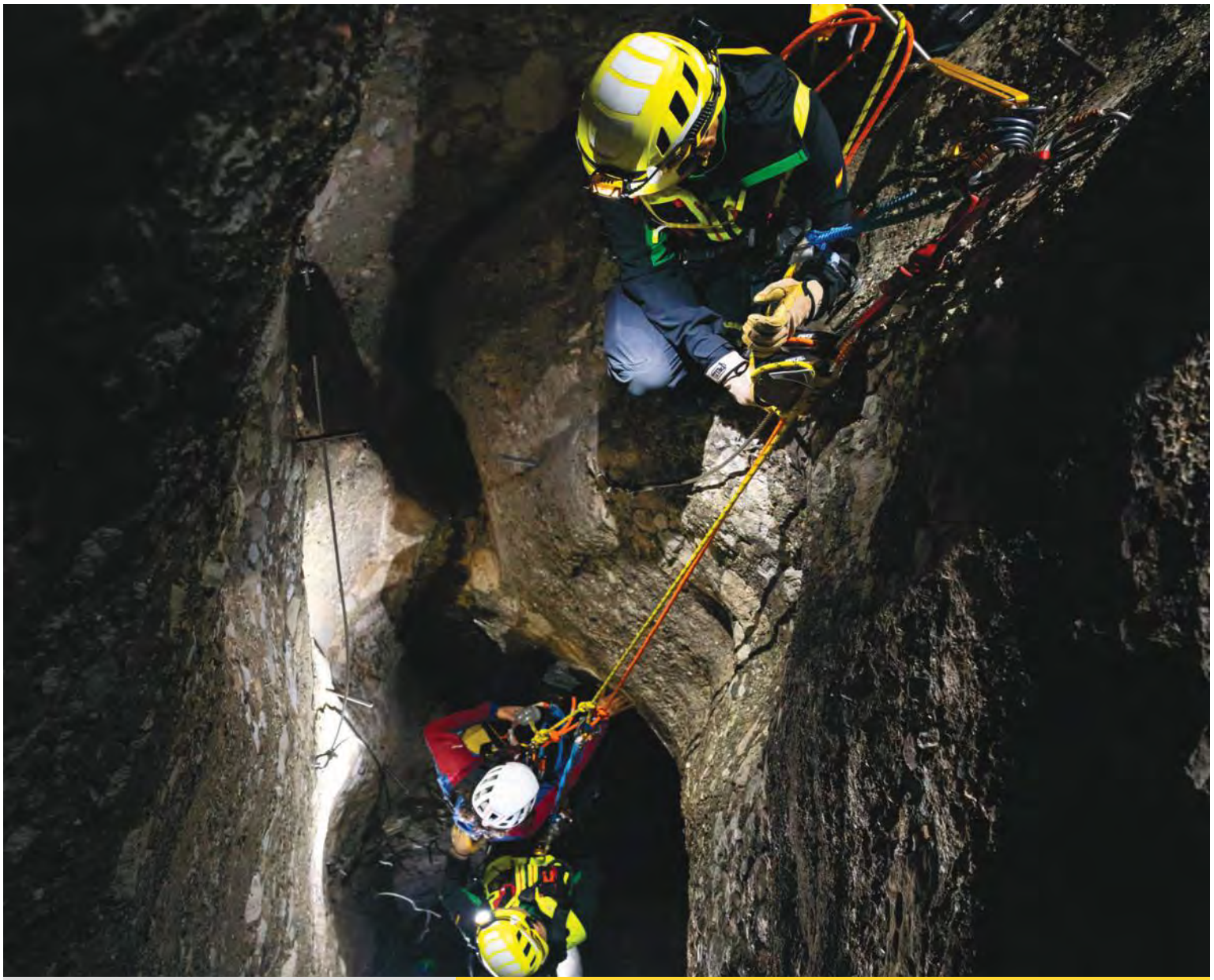
TECHNICAL RESCUE

USAR/EXTRICATION·CON-SPACE·ROPE & WATER RESCUE EMS·TACTICAL

ISSUE 85
www.rescuemagazines.com



A technical rescue solution including the new XENA® headlamp, FALCON harness, MAESTRO® Descender with integrated progress capture pulley and STRATO® VENT helmet. petzl.com

PETZL RESCUE SOLUTIONS

Whether day or night, on a rock face, or at the bottom of a cave, rescuers don't stop.

When facing these critical situations rescue workers know that powerful and robust lighting and high performance gear are an absolute necessity. Petzl brings its expertise with products that are completely adapted to the demands of your work.

PETZL®

Access the inaccessible®

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Dr Michael Croslin and the [Water] Rescue Drone Project posse continue to push the operational envelope with affordable water rescue drones. p54

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FRONT COVER
Skylotec's Actsafe RCX Power Ascender in use at this year's GRIMP Rescue competition in Belgium . See p2&3

ICX SPECIFICATIONS

COST exc battery:	£5000 $8850 €6000 (exc battery)
WEIGHT inc B220X battery:	7.5 kg / 16.4lb
BATTERY WEIGHT:	1.42kg / 3lb
BATTERY TYPE:	HUSQVARNA 36V LITHIUM ION
BATTERY POWER	Optimum=5.2 to 9Ah B220X=6Ah
BATTERY RECHARGE:	80/90min
BATTERY DIMENSIONS:	11.6 x 13.2 x 9.8cm 4.6 x 5.2 x 3.8"
ICX DIMENSIONS:	25.5 x 24.9 x 21.7cm 10 x 9.8 x 8.5"
WORKING LOAD LIMIT:	185kg / 407lb
OPERATING ROPE Ø:	11mm / 7/16"
RANGE on 1x BLi200:	230m /754ft @ 100kg /220lb @20°C
ASCENT SPEED:	0-24m/min 0-78ft/min
DESCENT SPEED:	0-24m/min 3.3-78ft/min
OPERATING TEMP:	-10to40°C / 14to104°F
IP RATING:	55
WARRANTY:	12 months (varies by market/country)

RCX POA-017 SPECIFICATIONS

COST exc battery:	£26500 $32500 €30625 (inc 2 batteries)
WEIGHT inc B220X battery:	30 kg / 66lb
BATTERY WEIGHT:	14kg / 30.8lb
BATTERY TYPE:	ACTSAFE LITHIUM ION
BATTERY POWER	n/a
BATTERY RECHARGE:	90min
BATTERY DIMENSIONS:	11.6 x 13.2 x 9.8cm 4.6 x 5.2 x 3.8"
RCX DIMENSIONS:	33 x 28 x 27cm 13 x 11 x 11"
WORKING LOAD LIMIT:	250kg / 550lb
OPERATING ROPE Ø:	11mm / 7/16"
RANGE on 1 charge:	200m /1800ft @ 100kg /220lb @20°C
ASCENT SPEED:	0-24m/min 0-78ft/min
DESCENT SPEED:	0-25m/min 3.5-78ft/min
OPERATING TEMP:	-10to40°C / 14to104°F
IP RATING:	67
WARRANTY:	12 months (but varies by market & country)

HUSQVARNA x SKYLOTEC

ACTSAFE ICX

Husqvarna x *Skylotec's Actsafe ICX* power ascender is the most compact model yet and benefits from 'off-the-shelf' 36v Husqvarna batteries rather than the usual bespoke batteries that are often used in high-end power ascenders.

- *Fast and secure rope loading - mid-line attachable*
- *Ultralight, compact personal power ascender with LED battery charge status*
- *Easy control with an intuitively operated thumb wheel or remote control*
- *WLL 185kg or max. 1 person - not rated for two-person rescue but can use remote control to retrieve climber*

www.arbclimbers.com

Skylotec's Actsafe RCX **is specifically designed for rescue - whether as a powered ascender, an anchored winch or a helicopter winch.**

- ***Fast and secure rope loading - mid-line attachable***
- ***Ultralight, compact personal power ascender with LED battery charge status***
- ***Throttle style controlWLL 250kg rated for two-person rescue***

ON THE COVER

SKYLOTEC

ACTSAFE RCX

RESCUE ASCENDER

The cover shot and this page are taken from GRIMP 2024 held in Belgium every year. This has become the premier event for rope rescuers in particular and this year was able to make use of the impressive Atomium building in Brussels thus saving themselves the usual entrance fee of €14.

LX SWANGUARD EXTRICATION VEST

The *Lukas LX Swanguard* made by *S-Guard/ Hubert Schmitz GmbH* in Germany is designed to assist in the safe extraction of a seated vehicle occupant with suspected spinal injuries. It enables a safer transition from a seated position to spineboard extrication.

The instructions on the right make clear the procedure but users must ensure adequate training and pre-incident practice with the LX *Swanguard* before deployment. This device differs from previous extraction devices in having integrated straps to ease upright securing and rearward extraction as well as being slimmer and lighter than most. Two red loop-straps are housed in the front shoulder straps and two white straps clip to the from and to the steering wheel to keep the casualty upright while the seat back is removed.

COSt is approx €700 inc VAT
($750/£600 excVAT)

www.lukas.com/rescue

STEP 1:

Open up the vest.

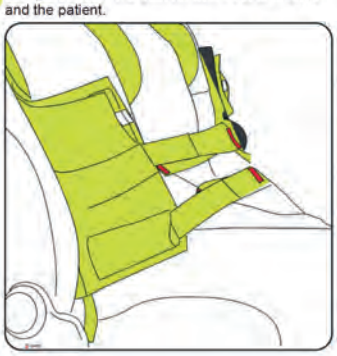
Place the vest between the seat back and the patient in line with the patient's shoulders. Hold the patient's upper body slightly forward while doing so.

Use the blue tapes to pull the vest down to the sitting surface of the seat between the seat back and the patient.

STEP 2:

Use the red tapes to pass the shoulder straps under the armpits towards the back. Pull the red tapes out of the shoulder straps and allow them to hang down over the seat back.

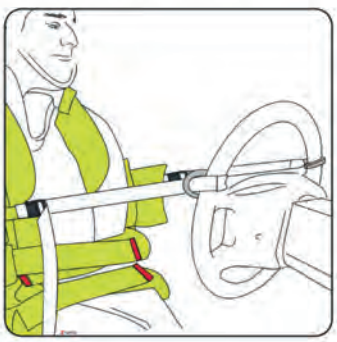
Place the forearms on the patient's lap and wrap the sides of the vest around the patient in such a way that the arms are under the vest.



STEP 3:

Close the vest with the four Velcro® fasteners incorporated in the front of the vest.

ATTENTION!
Do not close the straps too tightly.
Prevent breathing problems for the patient.

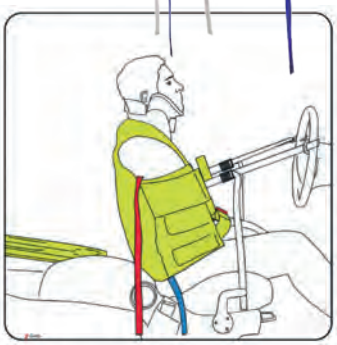


STEP 4:

Take the two straps with hooks from the pockets attached to the vest and hook them in.

The pockets can be removed, so that the straps can be attached to the vest at any desired angle.

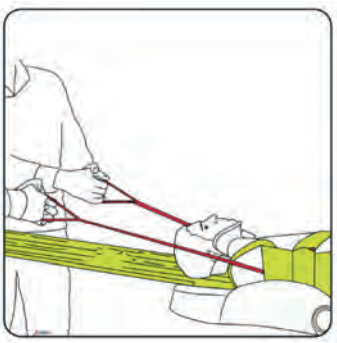
Now tighten the straps, so that the patient is pulled slightly off the seat back.



STEP 5:

Move the seat back into the reclined position or remove the seat back if this is no longer possible.

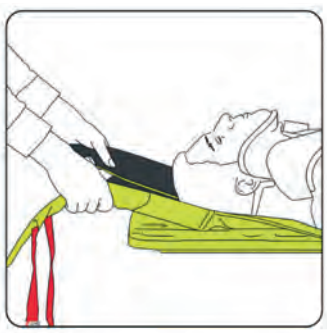
Place the spineboard in position, support the patient, release the straps by pressing the fasteners and lay the patient on the spineboard.



STEP 6:

Use the red straps to pull the patient on the spineboard.

Place the head end of the spineboard with the patient on the foot of a stretcher with a vacuum mattress and pull the patient over the spineboard onto the vacuum mattress.



STEP 7:

Open the vest, remove the shoulder straps under the armpits and use the red straps to pull the vest out from under the patient.

NEW US Helmets for work around electrical hazards

KASK, the premium designer and manufacturer of head protection, announces the launch of the Utilities Collection created to protect U.S. utility workers from electrical hazards, heat, and flames.

This new collection combines advanced helmet features with safety accessories, focusing on fire-resistant, fire-retardant, and arc-rated equipment. It is specifically designed to meet the demanding safety requirements of U.S. professionals particularly when working around electrical utilities. The *KASK Utilities* Collection has been tested against multiple arc flash safety standards that evaluate a product's resistance to burns caused by electric arcs.

At the heart of the new collection is the ***ZENITH X2 FR*** helmet, which meets ANSI Z89.1 Type I and Type II standards, providing all around protection against impacts and penetration from the front, rear and sides. Although no formal arc rating exists for helmets, *KASK* subjected ***Zenith X2 FR*** to the ASTM F2621 test to ensure that it did not melt, drip, or ignite when exposed to high levels of thermal energy. Zenith X2 FR passed the test, ensuring protection at energy levels of up to 19 cal/cm2.

To further enhance worker safety in fire-prone and high-risk environments, the helmet can be easily equipped with:

- FR Sun shield: flame and fire-resistant brim to provide sun protection on the back of the neck, ears, and face (According to ASTM F1959).
- FR Neck protector: flame and fire-resistant neck protection designed to shield the wearer from heat and chemicals. Front hook-and-loop closure ensures protection of exposed skin and neck area (According to ASTM F1959).
- Arc Visors ATPV10: arc-rated face protection that allows the wearer to work near live electrical components with protection up to 10.0 cal/cm2 (According to ASTM F2178-12).
- Arc Visor ATPV 27 Ergo: ergonomic arc-rated face protection that allows the wearer to work near live electrical components with protection up to 27.0 cal/cm2 (According to ASTM F2178-12).
- FR padding: self-extinguishing high-comfort padding resistant to catching fire. Does not melt or drip when exposed directly to extreme heat, preventing injuries in applications near flames (According to ASTM F1959).

www.kask-safety.com

Obelisk

for Technical Rescue teams

Designed and manufactured by Lyon Equipment specifically for emergency service work. Adjustable width cross-head with max height of 2200mm for a large, clear working area below the anchor points.

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WORK & RESCUE

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PELI INTRODUCES NEW VAULT HARD-CASES

[ED: There hasn't been much to shout about in hard cases for a while other than a plethora of drone-model-specific internals so an entirely new range of eleven lower priced cases from our favourite case-meisters PELI is interesting and a pain because we now have to add all these to our **USAR BUYERSGUIDE***!]*

- Peli Products, renowned for its premium high-performance cases including the Peli™ Air, classic Protector Case™ and Storm Case™ lines, proudly announces the launch of the new VAULT by Peli collection. This innovative series of rugged cases fills a critical gap in the market by offering protection, without compromising on quality.

The VAULT by Peli collection offers premium protection at an affordable price for avid outdoor enthusiasts, with the reputation for durability that comes from the Peli name" said Ebru Doyuran, Product Marketing Manager of Peli Products. "Our goal is to establish loyalty with a new group of consumers who will come to rely on Peli as a lifetime source for products that are built to protect.

The VAULT by Peli series introduces 11 new cases meticulously crafted to be crush-proof, dustproof, and weather-resistant, ensuring exceptional protection in any environment. Vault cases are available in black only and in a single configuration – with foam.

Key Features of the VAULT by Peli Cases:

- **Crushproof, Dustproof and Watertight** Construction: Designed to withstand the harshest conditions, providing ultimate protection for your valuable equipment.
- **High-Impact Polymer**: Tested and proven tough, offering an optimal blend of rigidity and flexibility to guard against impacts and cracking.
- **Push-Button Latches**: Engineered to lock automatically yet open with ease, ensuring secure and convenient access.
- **Heavy-Duty Handles**: Built extra tough for reliable performance, day in and day out.
- **Stainless Steel Lock Hasps**: Provide added security for peace of mind in any situation.
- **Solid Foam Interior**: Customisable interior to secure and protect your gear effectively.
-

The VAULT by Peli cases range will be available on Peli.com and is backed by a 3-year guarantee. This new series promises to set a new standard in affordable protective solutions, offering the trusted Peli quality that professionals and outdoor enthusiasts have relied on for years.

www.peli.com/vault

Introducing the new BlueWater Ropes

11mm Tech-G

CUT/ABRASION RESISTANT

The newest addition to BlueWater' ArmorTech rope series! Tech-G features a Technora® Aramid sheath with a core rope of polyester and nylon for the ultimate ease and predictability of handling. Tech-G remains round in mechanical devices even under extreme circumstances.

Dual Sheath for the ultimate in safety

UL Classified Life Safety Rope, NFPA 2500 (1983) - General Use

Minimum Breaking Strength:	8,992 lbf. (40.0 kN)
Certified Diameter:	11.0mm
Elongation @ 300 lbf.	4.3%
Elongation @ 600 lbf.	7.1%
Elongation @ 1000 lbf.	9.3%

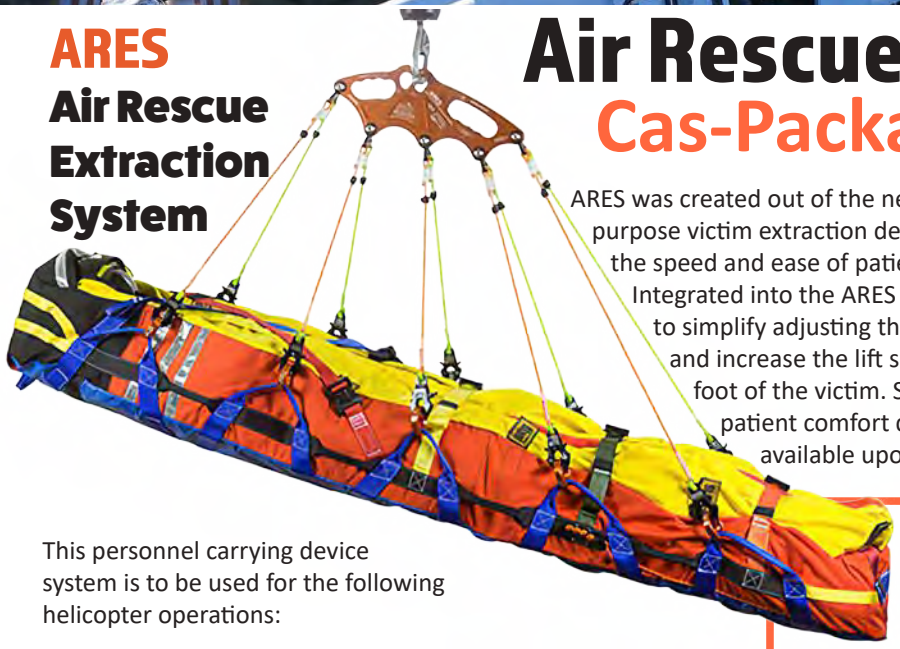
BlueWater Ropes
209 Lovvorn Road, Carrollton Georgia 30117
Tel: (770) 834-7515 > (800) 533-7673
www.BlueWaterRopes.com
email: info@BlueWaterRopes.com

Air Rescue Systems

Cas-Packaging

The latest in rescue technology from Air Rescue Systems, the new Patent Pending Air Rescue Extraction System or ARES was created out of the need for a lightweight, safe, intuitive and multi-purpose victim extraction device. The system's modular design helps increase the speed and ease of patient packaging during helicopter rescue operations. Integrated into the ARES is the Stabilization Lift System flight bar designed to simplify adjusting the bag position into two easy attachment options and increase the lift support angle to reduce tension on the head and foot of the victim. System includes basic spine board for increasing patient comfort during "bag-only" flights. Optional leg board available upon request.

ARES
Air Rescue Extraction System



This personnel carrying device system is to be used for the following helicopter operations:

Short-Haul – Human External Cargo (HEC)
Hoist / Winch Operations

KEY FEATURES

Shaped and padded head-box won't collapse in flight or under rotor wash
Integrated tagline/litter drag chute quick release ring
SOLAS grade high reflective tape
Mil-Spec structural 1-3/4" webbing and heavy duty coated nylon tarp
Structural external carrying handles
Deployment bag with concealable shoulder straps and rated lift handles
Low profile system allows for easy cabin entry during hoist operations
SLS suspension Kong Frogs with safety lock-off design
Modular design speeds packaging and reduces chances of entanglement
Full structural head and foot capture eliminates possibility of patient jettison
Side zippers provide Medics with patient access without removing them from the system
Available options: SKU: ARES-R3 (TAN)

Air Rescue Extraction System - R3 Complete System - Tan Color
SKU: ARES-R3 (BRT)

Air Rescue Extraction System - R3 Complete System - Bright Color Pattern

Technical Specs
Adjustable one size fits all: 35-400 lbs (15-181 kgs) and up to 78 in (198 cm) tall
Complete system 22 lbs (10 kg) and 32 in (81 cm) long

www.airrescuesystems.com

APED
PEDIATRIC VERSION

The Advanced Pediatric Extraction Device or A.P.E.D. is the first of it's kind. Children are not small adults and utilizing adult systems for pediatric helicopter rescue is unsafe. Designed as the only full support and immobilization pediatric helicopter extraction system, the APED is the solution for the demanding missions of rescuing of our small victims. The APED excels in short haul and hoist rescue operations and provides for rapid application, stability and the highest level of safety. The robust structural design provides full victim encapsulation in an intuitive configuration for the new-born to 50-pound toddler. An internal support harness system cradles the child with a head neutral position and is completely adjustable to the full victim weight range.
The ARS Patent Pending SLS (Stabilized Lift System) utilized in the ARS ARES Bag was miniaturized for the APED to gain the maximum control and ease of cabin entry for hoist operations. The stout deployment bag provides rapid out the door capabilities with rated attachment points and built-in messenger bag style, stowable shoulder strap and reflective SOLAS marking.

Victim Size- 0-50 lbs. Up to 42" (0-23kg/106cm)
Padded, protective "Head-Box"
0:1 Static System Safety Factor (rated to 1000 lbs)
Stabilizes Life System with 1800 lb. MBS bridle legs
Rapid on, self locking "Quick-Lift Connections"
One size, internal "Pediatric Cradle Harness"
Integrated Structural Lift HandlesRapid Deployment Bag
Adjustable, ten-degree foot down angle reduces potential of spin during hoist operations

FOR THOSE WHO EXPECT THE BEST,

EQUIPMENT THAT EXCEEDS

YOUR EXPECTATION.

CASCADE RESCUE
BY HARKEN

Cascade Rescue litters are purpose-built to function as a patient packaging and patient movement system that exceeds the expectations of rescue professionals. Our NFPA Steel Litters, CE Certified Titanium and Stainless Steel Professional Series Litters and UL Certified Litters are ideal for difficult access and confined space rescues. Built in the USA, competitively priced, and manufactured by a company that has been in business since 1962. Our Professional Series Litters are what rescue professionals require in demanding technical rescues.

Rescues can be dangerous. ***It's best to get gear from a company who understands that.***

844.414.RESQ
CASCADE-RESCUE.COM

New Stuff from PMI-ROPE

12.5mm PMI® Extreme Plus™ (G) Rope

A New Standard in Rescue Gear

the 12.5 mm PMI® Extreme Plus™ (G) Rope with UNICORE® technology isn't your ordinary rope; it's a groundbreaking leap in rescue gear innovation.

Featherlight Precision: At just 113 g/m, maneuvering this rope is a breeze.
Mighty Strength: With an MBS of 46.4kN (10,431 lbf), it's strong enough to handle the unexpected.
Customizable Lengths: Choose from 183 m (600 ft), 46 m (150 ft), 61 m (200 ft), or 92 m (300 ft) – because one size doesn't fit all when it comes to rescues.
Elongation: 1.3% at 300 lbf, 2.4% at 600 lbf, and 4.6% at 1000 lbf – it stretches to support, not to stress.
Standards: Compliance (pending): ANSI Z359.15 (2014), NFPA 12500 (2022), G – because being up-to-code means being up-to-task.
The Power of UNICORE®
Sheath slippage? Not on our watch. The sheath and core of our rope are inseparably bonded, offering unmatched integrity and safety – even if the sheath takes a hit, you can count on the core. Unicore® technology creates the ultimate bond between sheath and core. This bond ensures sheath slippage is nearly zero, even when the sheath is entirely cut circumferentially. This rope allows the firefighter to pass either a cut or torn sheath area, whether descending/ascending or raising/lowering a load since the sheath cannot bunch to create an impasse.
Ease and Dependability in Your Hands: Durable yet supple, our rope promises a handling experience that's second to none, ensuring you can perform at your best with gear that does the same.
Tailor-Made for Rescue: Ideal for Fire Rescue, Technical Rescue, Confined Space, and Tower Rescue.
Material Mastery: A top-grade Polyester/Nylon blend that's tough as nails and ready for action.

COST: $178.02 - 46 m (150 ft)
Other Lengths: 61 m (200 ft), 92 m (300 ft), 183 m (600 ft)

KEY FEATURES:
Unicore® technology
Nearly zero sheath slippage
Sheath - 100% Polyester
Core - 100% Nylon 6.6
High Strength: weight ratio
Easy to handle

PMI® Gear Bucket

Key features:
Store gloves, pulleys, cord, even snacks in the outside mesh pockets with Velcro closures
Holds up to 70 m (230 ft) of 11 mm; 46 m (150 ft) of 12.5 mm; or 30 m (100 ft) of 16 mm rope

The PMI® Gear Bucket can hold all of your gear and literally stand up to the test. Plastic reinforced stays keep the bucket upright while stacking your rope inside. Semi-rigid sides make it great for feeding line throwing devices right from the bag with minimal drag on the line.

COST: $42.00
SKU: RB44049
Weight: 1.4 lbs (658 g)
Dimensions: 11" x 14"
Colors: Red
Material: Cordura

PMI® Rope Rescue Seat Harness

a rescue harness that is light enough to be easily stowed but packed with storage options. 6x CariTool holders, 4x reinforced gear loops in signature vivid green so they quick easy to locate and place gear. 2x additional sewn loops on the rear sit either side of a rear belay loop (or chest harness attachment point) and above a high-viz reflective panel. Mesh fronted padding maintains breathability in an otherwise lighter weight belt and leg loops.

Cost: $249.00
code: SG51300
weight 2.43 lbs
Waist 81-137 cm (32"-54")
Leg 56-79 cm (22"-31")
Compliant CE0598, EN358:99, EN813:08
Max Rated Load 100kg/220lb

www.pmirope.com

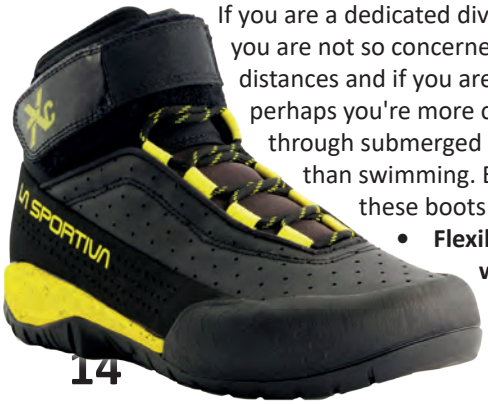
EDER Ascender EPC-240

With 36m/minute and a permissible payload of 240kg, the EDER Ascender is ready for any rescue job. The Ascender is powered by a powerful STIHL battery or 2-stroke engine.

www.eder-maschinenbau.de

WATER RESCUE BOOTS

Water rescue boots are great for canyon and cave rescue but are a dilemma for multi-role agencies because the tasks they are expected to perform can be contradictory - lightweight, heavy duty, robust tread able to provide grip on slippery, wet surfaces- thin-and flexible enough for swimming fins, quick draining but don't let in too much sand/mud/grit, swim in them, walk on rocks, don't damage the inflatable rescue craft but be able to hike in to the incident scene, possibly from a very long distance. *Palm Equipment*'s useful diagram on the right shows the general construction where the insole is always removable and usually cushioned and the midsole is the protective layer above the outsole which is the sole and any connected rand which we have listed as 'sole' and 'reinforcement' in our tables.



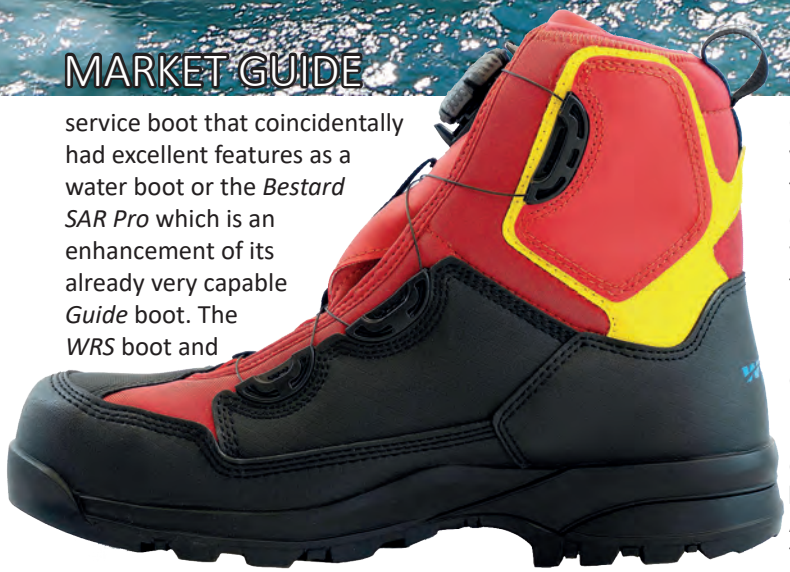
If you are a dedicated dive team or boat crew you are not so concerned about walking long distances and if you are a flood response team perhaps you're more concerned about walking through submerged debris and broken glass than swimming. Either way, we can divide these boots into four distinct types:

- **Flexible, enhanced rock/ wet boots** which are a variation on dive 'rock' boots and watersport booties. **We have included some with the more robust soles** eg. *TDS & DUI* but *Apeks, Mares etc.*are in the updated version of this article in the **Water Rescue BUYERS GUIDE** which includes more dive and rock boots.
- **Military or mountain style high-leg service, walking or climbing boots** which are stripped down from the usual full leather and stiffened insoles to become quick draining, ankle hugging and often quick-donning. One or two of the specialist water boots like *WRS* and *Bestard* are high leg but are closer in design to the next category than the military style boots...
- Modified approach boots - usually low cut boots or shoes with good soles for walking longer distances but without the usual *Goretex* or similar membrane designed to keep water out and let your foot breathe - instead, as with the high leg boots, they are the opposite of waterproof and have drain holes and fast draining materials and mesh that shed water once you're out of water. These tend not to be quick donning as they they lack zip=entry and are usually worn for the duration rather than be a shoe/boot you change into. Water sport companies like *Palm* and *Northern Diver* have such boots primarily aimed at boarders, rafters but entirely capable as general water rescue boots and there are many watersport and yachting boots from the likes of *Gul* but they are not included here. Canyoning with its mix of in water, hiking and climbing has been fertile ground for water rescue boot development because it is a

mass-market driver to what would otherwise be a very small commercial market, that's why climbing legends *La Sportiva* have perhaps the coolest boot design with their *TX Canyon* (left) and *NorthernDiver* have their *Freestyle* renamed from *Canyon v2*. Further testament to this larger market driver is *Adidas* as worn by rescuers in our title picture opposite, which is a very unusual brand for us to see in professional emergency service footwear though sport canyoneers and cavers will be familiar. Aside from their robust build (unusually non-draining), there is one very good reason why you might consider this boot above all other brands and that is the sizing. The majority of boots go up to UK14/US15/EU48 some to EU50 but *Adidas* goes up to a whopping size UK18/US19/EU54⅔. I can tell you from personal experience that your chances of finding any size over EU**48** on the shelf are minuscule but there is at least a chance you might get a size **49** or **50** and you know you can order a pair without incurring a custom-built charge.

• In its own category is the '*Mudder*' which is more of an adjunct to your water rescue boot than a boot by itself but it can be used (as we can attest) in conjunction with your regular service boot to enable you to perform the small miracle of walking on mud rather than knee deep in it. Mud is a regular occurrence at a water rescue incident whether it be tidal, river bank or imported by flood water and the only difference then between a water rescue boot and a high-leg firefighting boot or even a pair of wellies is the speed with which they will drain and clean off once you're out of the mud. Surface mud is the great leveller; no boot or shoe will do anything more than sink into mud without assistance from a load-spreader, in this case Mudders, but the swim style booties are unquestionably better for mixed mud and water environments as they are lighter within the *Mudder,* keep out fine particles and those tiny scratchy snails and quick to rinse off - something like the *NRS ATB Wetshoe* or the *OTB Abyss* (above) . The *Mudder* shown below was first produced in the US by *AMAK* in the **50**s for hunters and bait diggers but *Lyon Eqpt* in the UK quickly saw their rescue applications and their usage increased in rescue but still not what they deserve.

Specially designed water rescue boots that we have mostly included here, are designed from the ground up to be a water rescue boot. The *WRS, Ionic* and *Freestyle* as distinct from the *Haix Eagle* for instance that is more of an athletic



service boot that coincidentally had excellent features as a water boot or the *Bestard SAR Pro* which is an enhancement of its already very capable *Guide* boot. The *WRS* boot and

Italian *Cosmos Water Pro* probably exemplifies best the design thought process when starting from scratch - they picked a sole that was coarse enough to give protection from ingress of broken glass and sharp stones/rock etc. and good grip on wet rock or a boat hull but made it more flexible than a stiffened midsole safety or mountain boot. It retained a protective toe cap in case of rock movement or entrapment under water and added protective reinforcement to the toe, the heel and the lower mid area in between like a shaped rand. They made the upper out of thermally cushioning neoprene with a gaiter-style cuff at the top that inhibits ingress of debris, grit and those pesky snails. Instead of laces the *WRS* adopted the modern *BOA* concept of fast-ratcheting lace/cord tightening while the Cosmos has a full length frontal zip which, together with a very wide opening tongue and flexible neoprene cuff make these a fast entry donning/doffing boots. The insoles were quick to remove to allow for the different foot sizes whether wearing hiking socks or a drysuit's wet-sock. Finally, since these are for rescuers they are high vis colours, more visible underwater when looking to place your feet carefully as well as being a visible addition to the rest of your high visibility rescue ensemble. In this aspect the WRS just about trumps all others!

IN THE FOLLOWING TABLES.....

Guide to Water Rescue Boots in the **WATER RESCUE BUYERSGUIDE** for regular updates to this article.
Any use, feature, accessory or component that is inherent in the tool is shown as a solid coloured square ■■■■■
If it's an option it is shown as an outline square □□□□□
A circle ●●●●● in the 'USE' row indicates that this feature is only partially present and/or is OK for that purpose but not ideal.
A model variant is shown in cyan blue and any features or specifications that differ from the standard are also in cyan or will have a cyan outline to a black or orange square ■■.
.

USES: refers to the range of activities that the boot can be used for. Hardcore water rescue boots like the *WRS* and *Freestyle* are so specifically designed towards water rescue that they are of less use in activities like hiking in or working on a rubble pile. Conversely, those that are more utilitarian are probably not quite as proficient for pure water rescue but for cross-discipline teams - good enough!
■=**Dive** - for use with drysuits and fins underwater - fast draining
■=**In/Around Water /Boat**- for use walking through or swimming in water and on the bank or in a watercraft- eg. boat crew, swiftwater & canyoning, Fast draining.
■=**On Land** - walking or hiking longer distances
■=**USAR** - more rugged boots with safety toe and capable of withstanding work in and around concrete and building debris such as urban flooding or tsunamis.
■=**Tactical** - suitable for military use - able to walk longer distances and will be low viz/black.
ORIGIN: The company's home country, not necessarily the country of manufacture which is indicated by an inset flag or two equally sized flags if the tool is made in both countries.
COST: *Prices in burnt orange colour* ***£$€ are a currency conversion only*** *and may not include bulk shipping, import duty and taxes etc.* Prices are a guide only & include local taxes/VAT. They vary with exchange rates, extra taxes etc. Usually rounded up to the nearest Pound£/US Dollar$/Euro€. Cost is usually for a basic model.
WEIGHT: Is for ONE BOOT size EU 43/44 UK 9/10 USA10/11 this is therefore only a rough guide as te smallest size would be considerably lighter than the largest size.
SOLE: ALL WATER RESCUE BOOTS HAVE ANTI-SLIP SOLES (**SRC**) so we have not included that as a feature - it's a given!
SOLE MATERIAL: Usually a nitrile rubber but there are some variations on this, a better indication can be the.....
STYLE/BRAND: because there is no doubt that certain designs within well known brands like Vibram and Skywalk can be relied upon. They are not necessarily better than some of the in-house mouldings but until you have bought and used those own-brands you don't have much of an idea whereas the known brands will already be used on other boots that will have chosen that sole for a reason.
ANTI- OIL CHEMICAL STATIC: The sole will not decompose in

the prescence of hydrocarbons (oil/ petrol) or chemicals and/or will not generate static electricity

ANKLE INGRESS SEAL: The Collar is the top of the boot and neoprene collars provide reasonable protection against ingress but a cuff is a closer fitting option and usually an addition to the boots collar.

PADDED ANKLE COLLAR: this refers to genuine auxillary padding such that the collar is noticeably 'puffy' not simpler a fatter section of neoprene or leather!

SHOCK ABSORBING: indicates an active shock absorbing element built into the sole of the boot (not simply the insole as this can be supplemented with off-the-shelf options).This can be a sorbothane or EVA insert, sometimes air bubbles.

METAL ■/ COMPOSITE■ TOE: a protective toe cap that withstands impact to some degree - 200joules for alloy or 100joules for composite (see standards). Most also have a rubber or reinforced cover to a protective cap and some with no certified protection simply have extra rubber.

PULL ON TAB/ LOOP: A leather flap or a sewn-in loop to assist in pulling the boot on.

HI-VIS REFLECTIVE: Boots designed for rescue will have sections of trim that are highly coloured for visibility by others and for the wearer to spot foot placement in murky water. Some will have reflective panels for visibility to other searchers at night or in low light.

ENHANCED DRAINAGE: All of these boots will drain to some extent as the materials are porous not waterproof but most have additional holes, mesh or material placement that accelerates draining of water so that each foot lift does not weigh many times more than it has to. Neoprene or similar foot hugging materials 'booty' do this by restricting the available space for the water to collect. However, it is worth remembering that draining water is akin to draining body (foot) heat so not necessarily what you want in all conditions.

LACING/FASTENING/ZIP: Lacing systems are conventional or speed lacing where you pull on just the ends to tighten the entire stack rather than having to do each row individually. Straps are virtually all Velcro/hook&loop but some are buckles. As always, Velcro with a capital 'V' is the proper brand. Non-branded hook & loop has a lower case 'v'. Becoming more common is the BOA system where thin 'laces' or cord runs into a ratchet hub that tightens the cord when rotated.

Zips are shown as a pink square ■ With boots that are designed to be submerged there is no need for a zip to the watertight but the better zips have large teeth that are not so prone to jamming up or 'de-railing' and should be backed by a neoprene or similar material strip that resists the ingress of sand/grit/mud.

STANDARDS / PROTECTION: The European norm most applied to water rescue footwear is **EN ISO 20345:2011** which is for safety footwear and nothing directly to do with being a water rescue boot.

SB: This would have a protective toe cap that withstands a 200joule impact or for a lesser figure of 110 joules/Newtons the label is **SBP S1 S2 & S3** are anti-static where the number is irrelevant for water rescue boots as it is the degree of water resistance/repllency! **SRC** indicates slip-resistance on a ceramic and steel surface with soap and glycerol.

IMAGES NOT TO SCALE

OTHER TOOLS IN RANGE:
- = DIVE
- = IN/AROUND WATER/BOAT
- = LAND/WALKING-APPROACH
- = TACTICAL
- = USAR

= OK but not ideal

= Option

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Sizing =





	MODEL	Terrex Hydro Lace	Rassler 2.0	Hyak
	COMPANY	ADIDAS 2.0	ASTRAL	ASTRAL
	USES	■ ●	■ ■	■
	ORIGIN			
	COST inc tax / VAT	£130 $169 €124	£150 $150 €140	£150 $150 €140
	WEIGHT - 1 boot med-size	680g / 1.5lb	273g / 9.6oz	275g / 9.6oz
MATERIALS	UPPER	HD Nylon laminate	Canvas	Canvas/1060D Cordura
MATERIALS	UPPER REINFORCEMENTS	Heel, Toe, Lower-mid, Ankle	Heel, Toe	Heel, Toe, Lower-mid
MATERIALS	MEMBRANE/LINING	Neoprene	3D Airmesh	3mm quilted spacer-mesh
MATERIALS	MIDSOLE/RESIST PENETRATION	-	flat-no arch EVA -	flat-no arch EVA -
	INSOLE REMOVABLE	AdiPrene Eva foam ■	7mm EVA ■	7mm EVA ■
SOLE	SOLE			
SOLE	SOLE MATERIAL	no-mark Rubber	No Mark G-Rubber	No Mark G-Rubber
SOLE	STYLE/BRAND	'Stealth' Marathon	Astral GraniteGrip*	Astral Flexgrip
SOLE	ANTI- OIL CHEMICAL STATIC	-	-	-
COMFORT	SIZES UK US EU	4-18 5-19 36-54⅔	4-13 5-14* 36-49¾	4-13 5-14* 36-49¾
COMFORT	ANKLE INGRESS SEAL	Neoprene cuff	-	-
COMFORT	PADDED ANKLE COLLAR	■	■	■
COMFORT	SHOCK ABSORBING	■	●	●
	METAL / COMPOSITE TOE	Toe cap only	-	-
FEATURES	PULL ON TAB/ LOOP	■	■	■
FEATURES	HI-VIS REFLECTIVE	■ ■	-	-
FEATURES	ENHANCED DRAINAGE	No	4 holes, mesh tongue/gusset	mesh tongue/gusset
FEATURES	LACING/FASTENING ZIP	Speed Lace + velcro strap	Laces	Laces + Velcro strap
	STANDARDS/PROTECTION	-	-	-
	OTHER COLOURS	■	■ ■	■
	NOTES	New version 2025 Orange colour shown.	* Womans' sizes from W6 to W15. Men's=wider toe box *Granite-Grip = less flex more wear-resistance	* Womans' sizes from W6 to W15 Protective cover for laces. *Flex-Grip = more flex/grip less wear-resistance
	WEBSITE	adidas-group.com	astraldesigns.com	astraldesigns.com

WATER RESCUE BOOTS

	Rescue 01	Aqua Pro	Wildwater Pro	Canyon Guide SAR (Pro)
				
				
	BAIZHOU/POSSESS SEA*	BESTARD	BESTARD	BESTARD
	■ ■ ■ ■	■ ■	■ ■	■ ■
	£204 $00 €230	£167 $217 €212	£167 $217 €209	£191 $248 €228
	770g / 1.7lb	440g / 15.5lb	535g / 1.17lb	600g / 1.3lb
	Synthetic leather	H20 Microtech / Cordura	H20 Microtech / Cordura	H20 Microtech / Cordura
	Toe, Heel	Rubber toe, TPU Heel	Rubber toe, TPU Heel	TPU heel, toe, lower mid
	4.5mm CR Neoprene	Hydro-mesh	Hydro-mesh	Hydro-mesh
	Kevlar ■	Thermoplastic -	Thermoplastic -	Thermoplastic/Ceramic ■
	■	EVA/Cambrelle ■	EVA/Cambrelle ■	EVA/Cambrelle ■
				
	RUBBER	no-mark RUBBER + EVA	no-mark RUBBER + EVA	no-mark RUBBER + EVA
	In-House	Vibram Best IdroGrip	Vibram Best IdroGrip	Vibram Best IdroGrip
		-	-	-
	*3-12 4-13 37-46	4-13 5-14 37-49¾*	3.5-14 4.5-15 36-48	3.5-14 4.5-15 36-48
	Neoprene cuff	-	-	drawcord gaiter
	-	■	■	■
	-	■	■	■
	Rubber	-	-	Liquid Thermo Plastic
	■		■	■
	■ or ■	■ ■	■ ■	■ ■
	2x Mesh panels	4 holes + mesh	4 holes + mesh	4 holes + mesh
	BOA	Laces & stow pouch	Locking Laces & stow pouch	Locking Laces & stow pouch
	-	-	-	-
	■	-	-	■*
	*Possess Sea Ind.Co & Jiangsu-Baizhou co-produce this, Baizhou version has a metal grip cleat in the sole. Fin retaining heel.	*Including half sizes. Latin last (narrow fit). Stainless Steel eyes. Bulk order Customisation	*Including half sizes. Wide last/fit. Stainless steel eyes. Bulk order Customisation	Extra wide last. Stainless steel lace eyes. *Black-Canyon Guide (not SAR) *Including half sizes
	jsbaizhoucn.com en.drysuit.cn	bestard.com	bestard.com	bestard.com

IMAGES NOT TO SCALE

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- = IN/AROUND WATER
- = LAND/WALKING-APPROACH
- = TACTICAL
- = USAR

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COST: Including VAT/Local Tax
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	MODEL	Rockboot	Black Eagle Athletic 2.0 T Zip	Pro 3/4 Water
	COMPANY	DUI	HAIX	JOLLY SCARPE/COSMAS
	USES			
	ORIGIN			
	COST inc tax / VAT	£152 $140 €145	£160 $210 €190	£105 $136 €125
	WEIGHT - 1 boot med-size	600g / 1.3lb	615g / 1.35lb	710g / 1.56lb
MATERIALS	UPPER	HD Nylon laminate	Micro-fibre/textile	Cordura, Neoprene
MATERIALS	UPPER REINFORCEMENTS	Toe, heel	Heel, Toe, Ankle	Heel, Toe, Lower-mid
MATERIALS	MEMBRANE/LINING	1.5mm Hyper-Compressed Neoprene	Mesh	Lycra/Neoprene
MATERIALS	MIDSOLE/RESIST PENETRATION	Flat, minimal arch	Texon Polymer	Cushioned PU
	INSOLE REMOVABLE	EVA/Cambrelle		
SOLE	SOLE			
SOLE	SOLE MATERIAL	RUBBER + EVA	non marking RUBBER	NITRILE RUBBER
SOLE	STYLE/BRAND	in-house	Haix	In-House
SOLE	ANTI- OIL CHEMICAL STATIC	-		
COMFORT	SIZES UK US EU	3-14 4-15 36-48	3-15 m/w 4-16 m/w* 36-49m/w	5-14 6-15 40-47
COMFORT	ANKLE INGRESS SEAL	-	-	Neoprene Cuff
COMFORT	PADDED ANKLE COLLAR			
COMFORT	SHOCK ABSORBING			EVA heel
	METAL / COMPOSITE TOE	Rubber		
FEATURES	PULL ON TAB/ LOOP	*		-
FEATURES	HI-VIS REFLECTIVE	-	-	
FEATURES	ENHANCED DRAINAGE	4 holes in Rand	mesh upper	Perforated lower-mid
FEATURES	LACING/FASTENING ZIP	Laces & stow pouch	Laces +	Speed laces, hook/elastic loop
	STANDARDS/PROTECTION	-	EN ISO 20347	EN ISO 20347 O1 P HI CI HRO FO AN SRC
	OTHER COLOURS	-		-
	NOTES	*Velcro loop designed to stow lace-ends. Wear with wet sock	*Medium or Wide fit. Not to be confused with the GTX version with no zip-not for water rescue!	Laces & padded ankle inside outer gaiter. Inc extra pr of laces. 21cm high inc sole
	WEBSITE	divedui.com	haix.com Haixusa.com	jollyscarpe.com

	TX Canyon	Mudders
	LA SPORTIVA	MUDDER BOOT CO
		* MUD
	£180 $234 €144	£236 $158 €250
	470g / 1lb	1.1kg / 2.4lb
	Ariaprene TPU/foam laminate	Vulcanised rubber
	Heel	-
		-
	EVA -	-
		-
	RUBBER + EVA	VULCANISED RUBBER
	Vibram IdroGrip	In-House
	6-12 7-13 39-46	One Size Fits All
	'Spyral' Neoprene Cuff	-
	-	-
		-
	Rubber	-
		-
		-
	2 holes + upper perforation	fully drains on incline
	Speed Lace + velcro Strap	2x buckled Straps
	-	-
	-	-
		Fits any boot and *allows progress on mud as the top flares like a webbed foot to provide large surface area
	lasportiva.com	mudderboots.com

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	MODEL	Freestyle/Canyon v2	Prosafe v2	Rock-Swim
	COMPANY	NORTHERN DIVER	NORTHERN DIVER	NORTHERN DIVER
	USES	■ ■ ●	■ ■ ●	■ ■ ■ ■
	ORIGIN	UK	UK CN	UK
	COST inc tax / VAT	£94 $122 €114	£101 $132 €122	£68 $89 €82
	WEIGHT - 1 boot med-size	740kg / 1.6lb	730kg / 1.6lb	650kg / 1.4lb
MATERIALS	UPPER	Micro-Fibre	Micro-Fibre/Cordura	Synthetic Leather & Nylon
MATERIALS	UPPER REINFORCEMENTS	Heel, Toe, Lower-mid	Heel	Heel, Toe
MATERIALS	MEMBRANE/LINING	Mesh	Mesh	Neoprene & mesh
MATERIALS	MIDSOLE/RESIST PENETRATION	Composite	Composite	Flexi -
	INSOLE REMOVABLE	Neoprene ■	PU foam ■	- Neoprene
SOLE	SOLE			
SOLE	SOLE MATERIAL	RUBBER + EVA	RUBBER + EVA	RUBBER
SOLE	STYLE/BRAND	In-House	In-House	In-House
SOLE	ANTI- OIL CHEMICAL STATIC	■	■ ■	■ ■
COMFORT	SIZES UK US EU	3-14 4-15 36-48	3-14 4-15 36-48	6-12 7-13 39-46
COMFORT	ANKLE INGRESS SEAL	-	-	Gusseted neoprene gaiter
COMFORT	PADDED ANKLE COLLAR	■	■	-
COMFORT	SHOCK ABSORBING	■ EVA heel	■ EVA heel	■ EVA heel
	METAL / COMPOSITE TOE	■	■	-
FEATURES	PULL ON TAB/ LOOP	■	■	■
FEATURES	HI-VIS REFLECTIVE	■	■	-
FEATURES	ENHANCED DRAINAGE	2 holes with mesh backing	4 holes with mesh backing	2 lg holes with mesh backing
FEATURES	LACING/FASTENING ZIP	2x velcro Straps + ■	BOA	Laces + velcro strap
	STANDARDS/PROTECTION	EN ISO 20345 SB S1 S2 S3 SRC	EN ISO 20345 SBP S1 S2 S3 SRC	-
	OTHER COLOURS	-	-	-
	NOTES			
	WEBSITE	ndiver-rescue.com	ndiver-rescue.com	ndiver-rescue.com

				
				
Rock-Swim Safety	**Storm**	**Workboot Wetshoe**	**ATB Wetshoe**	
NORTHERN DIVER	**NRS**	**NRS**	**NRS**	
■ ■ ■ ■ ■	■ ■ ■	■ ■ ● ■	■ ■ ● ■	
£76 $98 €92	£150 $150 €165	£85 $95 €79	£70 $75 €70	
800kg / 1.76lb	680g / 1.5lb	500g / 1.1lb	500g / 1.1lb	
Synthetic Leather & Nylon	Polyuretane/Synth rubber	5mm Neoprene.Synth Leather	Micro-Fibre/Cordura	
Heel, Toe, Lower-mid	Heel, Toe, Lower-mid upper ankle	Heel, Toe, Lower-mid	Heel	
Neoprene & mesh	Polyester mesh	Micro-fibre/Mesh	Mesh	
Composite ■	EVA	Polymer ■	Composite -	
- Neoprene	Perforated 5mm ■	- 7mm Neoprene	- PU foam	
				
RUBBER	non-mark RUBBER	RUBBER EVA	RUBBER EVA	
In-House	'Hypergrip'	In-House	In-House	
■ ■	-	■	■ ■	
6-13 7-14 39-47	4-14 5.5-15 38.5-48.5	3-14 4-15 36-48	3-14 4-15 36-48	
Gusseted neoprene gaiter	-	-	-	
-	■	■	■	
■ EVA heel	■ EVA heel	■ EVA heel	■ EVA heel	
- ■	Rubber -	-	-	
■	■	■	■	
-	-	-	-	
2 lg holes with mesh backing	Mesh uppers	2 holes with mesh backing	4 holes with mesh backing	
3x velcro Straps + ■	Laces + ■	Laces, velcro Strap + ■	velcro Strap + ■	
EN ISO 20345	-	-	-	
-	-	-	-	
	Swim fin 'lip' on the heel. Zip=YKK Aquaguard	Swim fin 'lip' on the heel. Zip=YKK Aquaguard	Swim fin 'lip' on the heel. Zip=YKK Aquaguard	
ndiver-rescue.com	nrs.com/rescue	nrs.com/rescue	nrs.com/rescue	

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		Abyss	Gradient 3.0	Ionic Rocka
	MODEL			
	COMPANY	OTB	PALM EQUIPMENT	SAFEQUIP
	USES	■ ■ ● ■	■ ●	■ ■
	ORIGIN	US	UK	UK
	COST inc tax / VAT	£154 $200 €186	£150 $195 €181	£107 $190 €175
	WEIGHT - 1 boot size 43/44 9/10	630g / 1.4lb	413g / 14.6oz	1kg / 2.2lb
MATERIALS	UPPER	Ballistic nylon,Thermo-polyurethane	3mm CR limestone neoprene/mesh	Synthetic Leather/Nylon
MATERIALS	UPPER REINFORCEMENTS	Heel, Toe	Heel, Toe, Lower-mid	Heel, Toe
MATERIALS	MEMBRANE/LINING	Ballistic nylon mesh	Mesh	Mesh
MATERIALS	MIDSOLE/RESIST PENETRATION	- -	Cushioned - EVA -	Kevlar ■
	INSOLE REMOVABLE	'SEAL' Composite ■	cushioned ■	■
SOLE	SOLE			
SOLE	SOLE MATERIAL	RUBBER	HYDRO GRIP RUBBER	RUBBER Compound
SOLE	STYLE/BRAND	Tactical Sole Tech	Vibram IdroGrip	Vibram
SOLE	ANTI- OIL CHEMICAL STATIC	■ ■	■	■
COMFORT	SIZES UK US EU	4-13 5-14 36-46	5-14 6-15 40-47	3-13 4-14 36-48
COMFORT	ANKLE INGRESS SEAL	Neoprene Cuff	Neoprene Cuff	Neoprene Collar
COMFORT	PADDED ANKLE COLLAR	-	-	-
COMFORT	SHOCK ABSORBING	■	■ EVA heel	■
	METAL / COMPOSITE TOE	-	■	PU
FEATURES	PULL ON TAB/ LOOP	■	■	■
FEATURES	HI-VIS REFLECTIVE	-	□	■
FEATURES	ENHANCED DRAINAGE	2 lg mesh holes + perf Sole	-	Mesh upper & 6 panels
FEATURES	LACING/FASTENING ZIP	Laces + closed neoprene cuff	Lace	BOA
	STANDARDS/PROTECTION	EN ISO 20345	-	EN ISO 20345:2011
	OTHER COLOURS	-	■	-
	NOTES		 Lace storage pouch in tongue. Inc extra pr of laces.	 Alternate Vibram sole
	WEBSITE	OTBboots.com	palm.equipment	ionicrescue.com

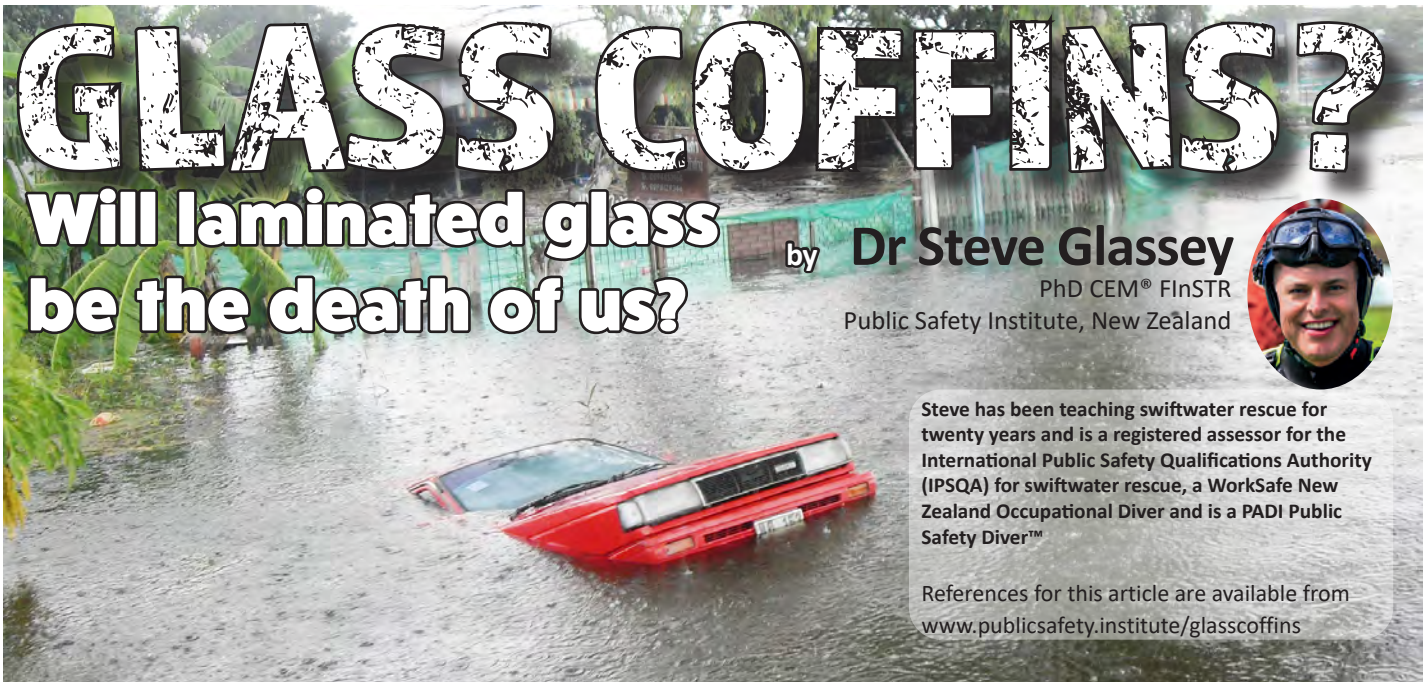
WATER RESCUE BOOTS

	Omaha Xtrem 2.1	Strong	Aquasafe	Water Rescue Boot
				
				
	TDS Technical Dive System	TDS Technical Dive System	VOLKL	WRS/ROCKFALL
	£74 $94 €89	£57 $75 €64	£142 $184 €170	£170 $265 €205
	n/a	n/a	550g / 1.2lb	750g / 1.6lb
	Synthetic/Nylon mesh	6.5mm neoprene	1.8-2mm PU/Leather/Cordura	Synth Leather/Neoprene
	Heel, Toe	Heel, Toe	Heel, Toe	Heel, Toe, Lower-mid, Ankle
	Mesh	-	Textile mesh	-
	-	-	Kevlar-composite	Kevlar-composite
				EVA
				
	Perforated PU	Perforated PU	Injected RUBBER/PU	NITRILE RUBBER
	In-house	In-house	non-mark	Rockfall
	-	-		
	6-13 7-14 39-47*	3-14 4-15 36-48	4-15 5-16 38-50	3-15 4-16 36-50
	Neoprene Collar	Neoprene Collar	-	Neoprene Cuff
	-	-		-
	Rubber	Rubber	200j	
		-		
	-	-		
	Reinforced Mesh upper	-	-	4+ Mesh Gusset in Tongue
	toggled Lace + velcro strap	velcro flap +	Strap with cam-lock buckle	BOA
	-	-	EN ISO 20345:2007 S1P SRC	EN ISO 20345 S1P SRC
	-	-	-	-
	* sizing in two-size increments eg. 40/41, 46/47 etc. Fin restraint 'lip'	Heavier duty version of 6mm Strong	Quick release buckles.	
	tdsdive.com	tdsdive.com	voelkl-professional.com	wrsinternational.com

GLASS COFFINS?

Will laminated glass be the death of us?

by Dr Steve Glassey
PhD CEM® FInSTR
Public Safety Institute, New Zealand



Steve has been teaching swiftwater rescue for twenty years and is a registered assessor for the International Public Safety Qualifications Authority (IPSQA) for swiftwater rescue, a WorkSafe New Zealand Occupational Diver and is a PADI Public Safety Diver™

References for this article are available from www.publicsafety.institute/glasscoffins

INTRODUCTION

The automotive industry is witnessing a growing trend towards the use of laminated glass in side and rear windows of vehicles. While this shift is driven by new safety standards aimed at reducing ejection injuries in crashes, it may have unintended consequences for occupant rescue and escape in submerged vehicle incidents. As more vehicles adopt laminated glass, there are concerns that they could become "glass coffins" in water, making it harder for occupants to exit or be rescued.

THE SHIFT TOWARDS LAMINATED GLASS

Laminated glass, which consists of two or more glass layers bonded together with a plastic interlayer, has long been used in vehicle windshields for its safety benefits. In recent years, however, its use has been expanding to side windows as well. In 2021, around 25-30% of all vehicles sold in North America already had laminated sidelites on the front doors[1]. Some European automakers like Mercedes and BMW are standardizing side glazing in their top-selling models[2].

Looking forward, the laminated glass segment is anticipated to witness rapid growth at a compound annual growth rate (CAGR) of 7.3% in coming years[3].

The passenger cars segment, which primarily utilizes laminated glass for safety, captured approximately 67% revenue share of the automotive glass market in 2022[4]. If current trends continue, it is plausible that 40-50% or more of new vehicles sold could have laminated side glass by 2030 [1][2][4].

DRIVEN BY SAFETY STANDARDS

This shift towards laminated glass is largely driven by the introduction of (US) Federal Motor Vehicle Safety Standard 226 (FMVSS 226) for ejection mitigation. Aimed at preventing occupant ejection through side windows in a crash, FMVSS 226 has made laminated glass a key countermeasure for compliance [5]. The standard was introduced to address the high fatality risk associated with ejection. In roll-over crashes, the ejection fatality rate is over 4 times higher for unrestrained occupants[6]. Side window ejections account for 62% of all fatal occupant ejections in crashes[7]. Seatbelt use was found to virtually eliminate the risk of complete ejection, but for unbelted occupants, the risk is significantly increased[8].

THE DROWNING DILEMMA

While FMVSS 226 may reduce ejection injuries and fatalities, it does not address the issue of vehicle submersion and occupant drowning. Drowning is a significant cause of vehicle-related fatalities, with some studies finding vehicle-related incidents accounting for up to 63% of flood deaths[9].

The use of laminated glass in side windows can make escape or rescue from a submerged vehicle significantly more difficult, as the glass cannot be easily broken. This raises the question - why has ejection mitigation been prioritized over drowning prevention in vehicle safety standards? Especially when considering that increased seatbelt use is a highly effective ejection countermeasure, with only 1% of ejected occupants wearing a seatbelt compared to over 30% of non-ejected occupants[10].

THE NEED FOR DROWNING PREVENTION

As more vehicles adopt laminated glass to meet FMVSS 226, there is a growing need for drowning prevention measures. One promising solution is the Automatic Window Opening System (AWOS) developed by AWOS Tech[11]. This system can detect when a vehicle is submerged and automatically open the electric windows to allow escape. Such systems could be a lifesaving feature if widely adopted by vehicle manufacturers. Estimates of total flood fatalities in the U.S. range from 60-

100 deaths per year on average[12]. While exact numbers for vehicle-related drownings are not always specified, applying the 63% proportion from some studies would estimate around 38-63 annual vehicle-related flood deaths[9][12]. More research is needed to determine precise averages, but the available data suggests vehicle-related drownings account for a significant portion of flood fatalities.

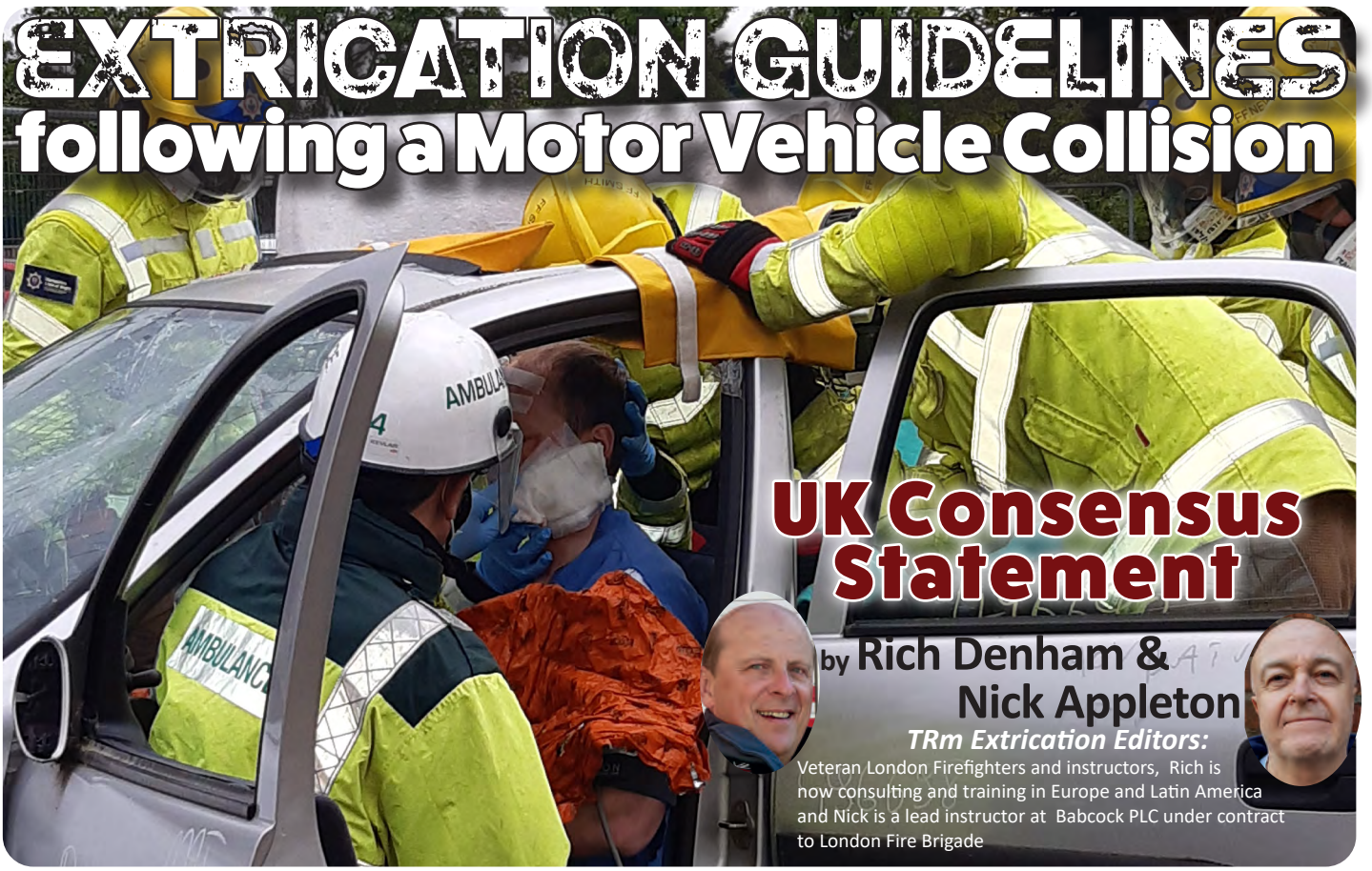
BUT WHAT ABOUT NOW?

Even if there are changes to standards at some point in the future, the challenge for first responders to gain access through laminated glass is an issue and will continue as a legacy problem for some time. What we do know is the centre-punch and hammer type window breaking tools (i.e. *Res-Q-Me*) are not effective in breaching laminated glass. Though there are tools to slide down to derail side windows from their internal mounting, once windows are up and water force laterally applied, they are difficult to impossible to be lowered. Though further research is needed in the context of effectiveness in shallow water, existing tools such as the *Glass Master* (manual saw), *Nemo* waterproof reciprocating saw (battery powered), waterproof battery-powered forcible entry (RIT) and wedge tools from *Holmatro, Weber, Genesis* and *Lukas* plus hand powered options from Holmatro and *Weber*, and *BreachPen* (thermal cutting wand) could all be viable options for use in swiftwater.

CONCLUSION

In conclusion, while laminated glass offers important safety benefits in crashes, its growing use in vehicles also creates new challenges for occupant escape and rescue in submersion incidents. As we strive to reduce ejection fatalities, we must not neglect the significant risk of drowning in vehicles. Innovative safety features like automatic window opening systems may help mitigate this risk and prevent vehicles from becoming "glass coffins" in water. Ultimately, a comprehensive approach that addresses both ejection and submersion dangers is needed to maximize occupant protection. By raising awareness of this issue among automakers, policymakers, and the public, we can work towards solutions that will save lives on and off the road.

EXTRICATION GUIDELINES following a Motor Vehicle Collision



UK Consensus Statement

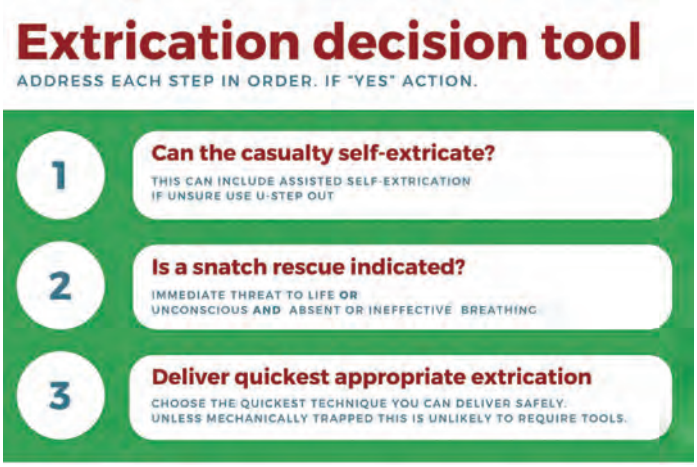
by Rich Denham & Nick Appleton

TRm Extrication Editors:

Veteran London Firefighters and instructors, Rich is now consulting and training in Europe and Latin America and Nick is a lead instructor at Babcock PLC under contract to London Fire Brigade

INTRODUCTION

Following on from the recent articles '*Evidence Based Extrication*' (TR 83) and '*Patient Centred Rescue and the Hierarchy of Extrication*' (TR 84) , this patient rescue theme accelerates with a review of the recently released '*Extrication following a Motor Vehicle Collision*' consensus statement (CS), published by the Faculty of Pre-Hospital Care (FPHC), of the Royal College of Surgeons, Edinburgh. While this is clearly a UK-document, the principles may well be considered by other countries and services. The FPHC is an independent body, and while it worked closely with Dr. Tim Nutbeam and his colleagues within the '*EXtrication In Trauma (EXIT)*' Project on the production of this CS (see TR issues above), it is their recommendation.



CONTEXT

Because of its origin and authority, this document is a major step forward in upgrading and standardising the national UK rescue response in patient extrication. This is because traditionally, the National Fire Chief's Council (NFCC) have incorporated FPHC guidance into their National Operational Guidance (NOG), and it would be reasonable to expect that both the Joint Royal College Ambulance Liaison Committee (JRCALC – who develop clinical guidelines for UK NHS ambulance service paramedics) and the National Police Chief's Council (NPCC) to make similar adoptions, and in doing so effectively create a contemporary and multidisciplinary national protocol.

REVIEWING THE CONSENSUS STATEMENT

The CS is wide ranging, but for the purpose of this article we will only comment on its fourteen recommendations. However, for definitive reference – this article is essentially the authors' observations - you must read the CS document itself, especially for the evidence that underpins various statements, and there is a link at the end of this article for that purpose:

THE RECOMMENDATIONS

The evidence based recommendations are highlighted in **green** and in full below, followed by commentary in each case, and with further contextual information being available in TR 82 (see link at the end of this article).

1 All patients with injury should be considered time dependent. Operational and clinical team members should work together to rapidly develop a bespoke patient centred extrication plan with the primary focus of minimising entrapment time.
It is difficult to accurately diagnose and treat time dependant and critical injuries in entrapped patients, and so early extrication is necessary to facilitate full assessment and onward treatment.

However, absolute movement minimisation (AMM) - extrication where the focus is on minimising spinal movement – delays extrication and increases the time until this assessment and treatment can take place.

So in order to minimise entrapment time, the wider CS advocates Gentle Patient Handling: careful and purposeful handling (or assistance) of patients, but with a focus on progressing patient care in a timely manner, rather than AMM.
2 Non-clinicians should be empowered to decide on the extrication mode and deliver this before the arrival of the clinical team.
Perhaps controversial, the reasoning here is that non-medical rescuers often arrive before ambulance clinicians and as extrication should ideally not be delayed awaiting their arrival, the initial responders could use the extrication decision tool opposite to decide on the most appropriate method of physical release. This is an enabling step, which means on arrival a more timely and detailed clinical assessment can be undertaken on those who have self-extricated whilst additionally meaning it is possible to accurately identify those who are truly entrapped (with potential resource implications). For detail on self -extrication, see subsequent recommendations 3 and 4.

There is the issue of where to temporarily locate the patient and a lack of viable relocation options and /or poor weather conditions could mean that the patient should remain in the crashed vehicle until an ambulance arrives, if this is the only safe alternative.
However, in urban environments there may be somewhere appropriate – perhaps a shop, house or even a bus-shelter. In more remote conditions and if environmental conditions are poor, then another vehicle would be acceptable. A Police (or Highways agency) vehicle could be used for this purpose, as the climb up into a fire truck may preclude its use.

For the purpose of this article, recommendations 3 and 4 can be taken together :

3 Self-extrication or minimally assisted extrication should be the standard 'first line' extrication for all patients who do not have contraindications.

4 Self-extrication decision making for non-clinicians should use an appropriate tool, such as U-STEP OUT.
Self extrication reduces extrication time and so enables earlier assessment and (definitive) treatment, which is associated with

better patient outcomes.
In addition, research has shown that self-extrication is also associated with the least spinal movement of all methods.
There are of course contraindications, and the recommendations state that these include:

- An inability to understand or follow instructions
- Or have a condition/ injury which prevents standing on at least one leg

The U-STEP out tool has been developed and tested to support non-clinical decision making in relation to self-extrication and so is suitable for fire, police and highways agency use.

5 Patients who cannot independently self-extricate may benefit from assisted self-extrication

Research has shown that depending on injury, the ability to self-extricate is similar across all age-groups. However, in some cases, assisted self-extrication may be necessary, and involves simple steps like providing gentle support and /or guidance, see recommendation 1. This might include a static rescuer arm offered to a patient, on which to pull themselves into a standing posture, or additional stability or traction through rescuer support via a belt at the patient's waist.

6 In fully conscious patients who do not have neurology it is not necessary to provide manual inline stabilisation in the vehicle.

Patients who are fully conscious and can maintain their neck in a position of comfort will not require Manual In-Line Stabilisation (MILS), which not only ties-up a rescuer, but further by preventing self-extrication, will extend the patient's time on scene and delay their access to definitive care.

7 If hard neurological signs (a level on the body below which there is no movement or feeling) are present on initial assessment, the patient should have a rapid extrication with GENTLE PATIENT HANDLING

Because such signs are associated with the simultaneous presence of other serious injury which could compromise the nervous system, and further given that related and sufficient intervention is less-likely to be able to be made in-car, the recommendations state that the clinical requirement here is for the rapid removal of the patient to definitive medical care.

8 Collars reduce neck movement. They should be applied prior to extrication when indicated and removal considered when the extrication phase is complete.

The context here is that recent studies have not conclusively demonstrated the clinical benefit of cervical collars, so in the interim the recommendations state:

- Patients with a suspected serious neck injury or with a GCS of <15 and evidence of significant body compartment injury should have a collar applied in-car.
- In this context the collar should be considered an extrication device and in the absence of evidence of neurological injury, the collar should be removed following extrication.

9 Vehicle relocation, including vehicles in which patients are trapped, should be implemented if this will reduce entrapment time

NFCC National Operational Guidance supports vehicle relocation where it will safely reduce entrapment time, is safer for the patient, or safer for the rescuers. This can take a number of forms including moving vehicles on their sides utilising spreaders and rams. Or utilising winches to move vehicles to a safer position in order to facilitate the extrication.

For the purpose of this article, recommendations 10 and 11 can be taken together:

10 Rescuers should be aware that clinical observations may prolong entrapment time and as such should be kept to a minimum.

11 Clinical care during entrapment should be limited to necessary critical interventions to expedite safe extrication.

In the restricted space within a vehicle it can be extremely difficult to accurately monitor a patient and constantly assess them for observations and treatments which might not be necessary for the purpose of safe and timely extrication, as this will hinder rescue operations and delay the extrication of the casualty.

In the setting of road trauma, clinical observations are poor at predicting serious injury and the need for further intervention when in hospital. Therefore, they may be falsely reassuring to rescuers when expedited transfer to definitive care is the priority.

12 If a pelvic binder is indicated this should be applied after the process of extrication is complete.

The recommendations observe that correctly fitting a binder to a patient in car is both difficult and imprecise and will inevitably extend entrapment time.

13 The psychological impact of extrication should be considered and support mechanisms implemented.
The mental welfare benefit to an entrapped patient of an assigned 'extrication buddy' cannot be overestimated. Previously this would incidentally be provided by a rescuer, usually a firefighter, who was positioned behind the patient and stabilised their head as a part of AMM. Whilst this latter function is no longer necessary in a fully conscious patient who can maintain their own neck stability (see recommendation 6), the dedicated support role of explaining the process, and providing companionship, reassurance and advocacy, is a must rather than a nice to have.

Communication with the patient should establish and use their name, together with clear and easy to understand language. And any repositioning of the buddy to facilitate space creation and extrication should ideally be explained to the patient beforehand, together with a reassurance that they are not leaving them.

Note that while patients found onlookers taking photos to be intrusive and distressing – and the Police attendance should prevent this - they did not object to the capture of content by rescuers for internal training purposes.

14 Fire & Rescue Services/Brigades and Ambulance Trusts should ensure regular joint multidisciplinary learning, sharing and case review opportunities.
With many UK fire and rescue services now operating a medical rescue component under the direct clinical governance of their local ambulance service, this multidisciplinary approach would facilitate joint learning activities. However, whilst this allows for a valuable exchange of information and the development of policy at managerial level, at practitioner level the need for planned and regular training events, as well as the significant funding of scrap cars to facilitate them, will need to be formally addressed.

BENEFITS OF THE FPHC RECOMMENDATIONS

To help identify the main benefits of the CS Recommendations, we can compare them with the two general consensuses that preceded them:

HISTORICALLY: SCOOP AND RUN

Prior to the advent of advanced medical training for ambulance personnel, they weren't able to greatly assist a trauma patient, and so they robustly removed them from the vehicle and rapidly transported them to the clinicians that could help them. The 'Scoop' component of this approach is identified as the dragging or uncontrolled lifting of a patient, which is associated with poor patient outcomes and is remediated in the fifth recommendation. The 'Run' principle however, (rapidly transporting the patient to an appropriate medical centre) is endorsed throughout the CS and by contrast is associated with better patient outcomes.

SUBSEQUENTLY: STAY AND 'PLAY'

The exact opposite of the previous approach and variations can still be observed operationally. This concept was brought about in part by a belief in the never proven theory of AMM and an associated need to 'Stay' and facilitate this (see recommendations **1** and **7**) - and also because extended skills were beginning to be taught to medical rescuers around the time of its adoption, and at an incident they were unsurprisingly keen to 'Play', to fully use these skills. A similar approach was also adopted by firefighters at the time, perhaps creating more space than was necessary, with the advent of more capable hydraulic tools and better space creation training. Anyway, this combination resulted in significantly extending a (critically ill) patient's time on scene and this contributing factor to poor patient outcome is remediated by the **10**th and **11**th recommendations.

THE FUTURE: '*GENTLE BUT GO*' ?

This interpretation focusses on the FPHC recommendation requirements for Gentle Patient Handling during extrication, but in a timely way (including the creation of minimum safe space by the fire service), so that the patient is released to Go to definitive medical care as soon as possible. As such it can be seen as a positive evolution of Scoop and Run.

CONCLUSION

The Consensus Statement recommendations support the delivery of an evidence-based, patient-focused extrication on both clinical and operational levels. As such, the Statement represents a major step-forward in improving patient outcomes after a motor vehicle collision, and to echo what we said at the end of the article in TR82, is an opportunity that should be enthusiastically embraced by all stakeholders concerned, in the very best interests of the public that we all serve.

FPHC CONSENSUS STATEMENT LINK:
https://fphc.rcsed.ac.uk/media/3649/extrication-following-a-motor-vehicle-collision.pdf

IMPACT: Centre for Post-Collision Research, Innovation & Translation
www.post-collision.com

Technical Rescue#82:
https://accessandrescue.hflip.co/TechRescue82.html

Technical Rescue#84:
https://accessandrescue.hflip.co/TechRescue84.html

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A ~~PIRATE'S~~ ~~YOUNG PERSON'S~~ GUIDE TO....

ANCHORS & ANCHOR SYSTEMS..

part3

by Reed Thorne
Ropes that Rescue AZ, USA

Our resident rope genius, Capt'n 'GreyBeard' Thorne started a new series in TR83 on anchoring. Refer to part 1 for definitions.

This series includes:

- ANCHOR LOADING
- BOMBPROOF ANCHORS
- FLOATING ANCHORS
- LINEAR ANCHORS
- MULTI-POINT ANCHORS

BOMBPROOF ANCHORS

Definition:

A single anchor or anchor system viewed as substantially capable of supporting both halves of a two rope system (main & belay or both halves of a TTRS)

So called "bombproof" anchors are a special terminology reserved specifically for those anchors which withstand all forces delivered from both the main and belay line with a good safety factor (10:1 in most locations). So, if in the wilderness you are looking for the BFR or BFT, which is to say the "rock" or the "tree", it must be so substantial that there can be no doubt that it can be relied upon for this task.

The acronym for a "bombproof" anchor is:

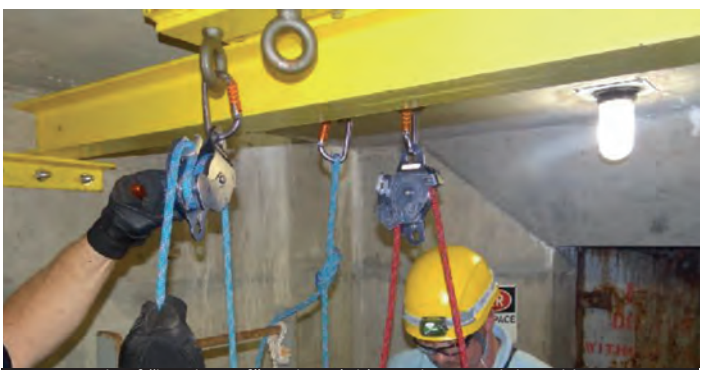
A sub b

or

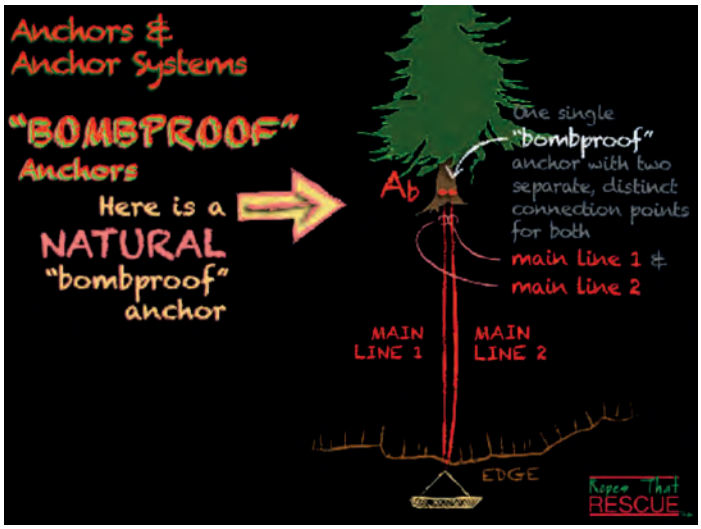
Ab

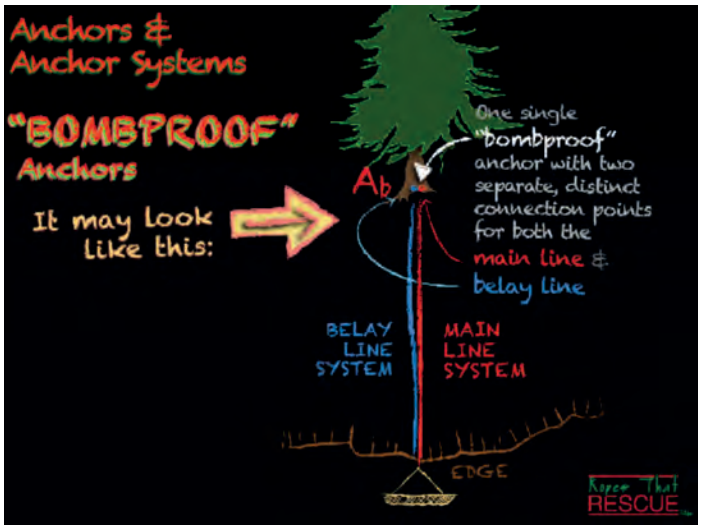
Also be aware that simply attaching one anchor to the bombproof tree, steel beam, or super large rock is not sufficient for both halves of your system whether it be a twin rope system with main and belay or a two-tensioned rope system. Ideally, two independent anchors should be placed to eliminate the possibility of a critical point in the system. There should be redundancy throughout the system.

As to whether a rock is big enough one must stand back and consider the consequences if it is not. Or, as in the photo opposite-bottom, can the huge rock roll? If it rolls, then it was unstable and that could lead to drastic consequences. Bottom line, there should be no doubt about the anchor if it is to be labelled "bombproof".



Two example of "bombproof" anchors (Ab) in industry and the wilderness: Right: a so-called "certified" anchor that was engineered above a confined space opening in a large New York Hydro Dam. Notice the riggers have used this bombproof anchor for both the main and belay. Below: A large juniper hardwood tree in Arizona which here is being used with a high strength tie off for a long highline. The webbing is the belay for the highline so both are tied at the base of this rather substantial tree. Local education on your flora is needed to determine just how strong certain trees are. Juniper trees are extremely strong.





BOMBPROOF FOCUSED ANCHORS

Definition:

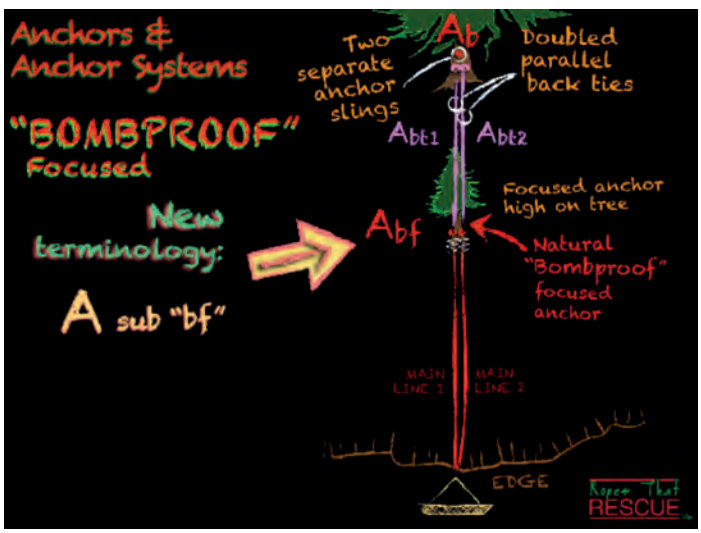
An object (such as a tree, hand rail, post) in a favorable position proximal to the edge which is secured by several pre-tensioned back ties. This object becomes a "bombproof focused" anchor and may be higher off the ground affording a better angle yet needs no opposition.

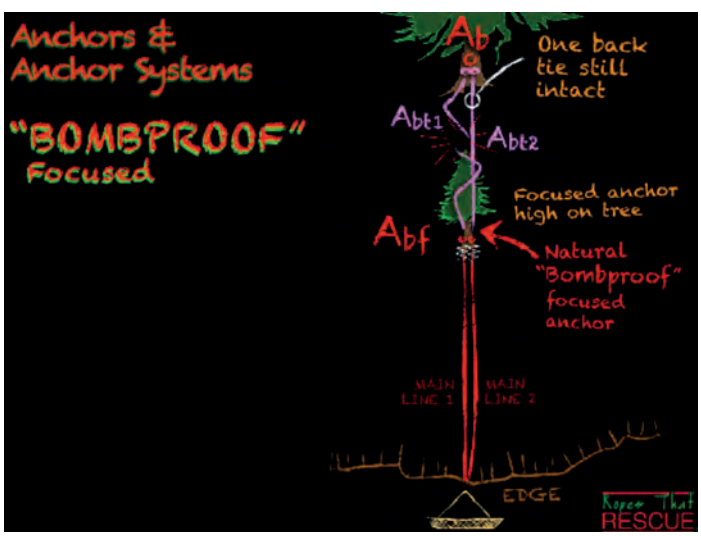
Any object like a small tree (as in these illustrations) can be sufficiently focused to a point where the focal point can be labelled "bombproof". As in the top illustration, if a bombproof anchor exists to the rear of the operation (A_b), that bombproof anchorage may be moved forward towards the edge by using two back ties (A_{bt1} & A_{bt2}) from independent anchors. That means separate anchors for each back tie on the same bomb-proof rear anchor.

The acronym for a "bombproof" focused anchor is:

A sub bf
or
A_{bf}

The "bombproof" focused anchor will normally be a natural anchor as it was already there when you arrived to build this anchor. Hence the "bombproof" focused anchor designation only applies to objects that already exist and you need to make "bombproof". Basically, you are extending the bombproof anchor to a better position proximal to the edge.

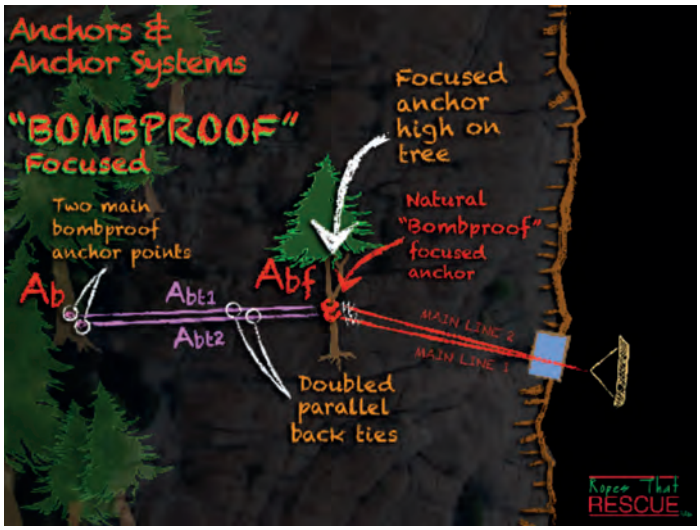




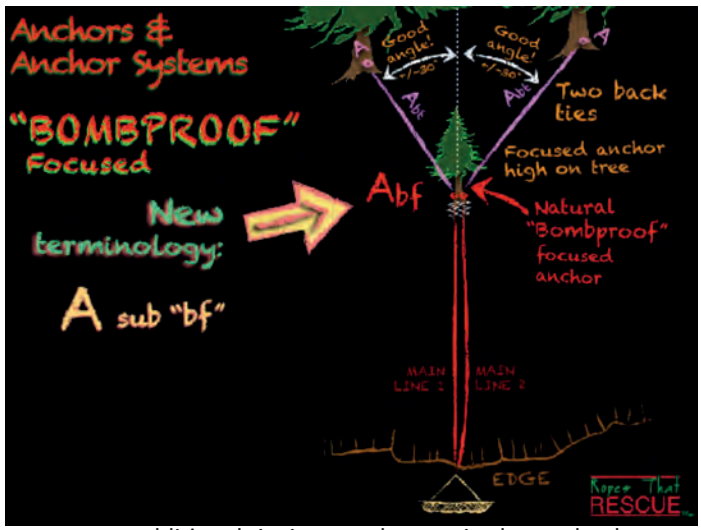
In the perspective illustration on the right you can see that everything in the system including all the back ties and their anchorages must be doubled and parallel to eliminate the issue of a critical point in the system. Also, remember to go low to high on the object to afford a better working angle to the edge as is customary.

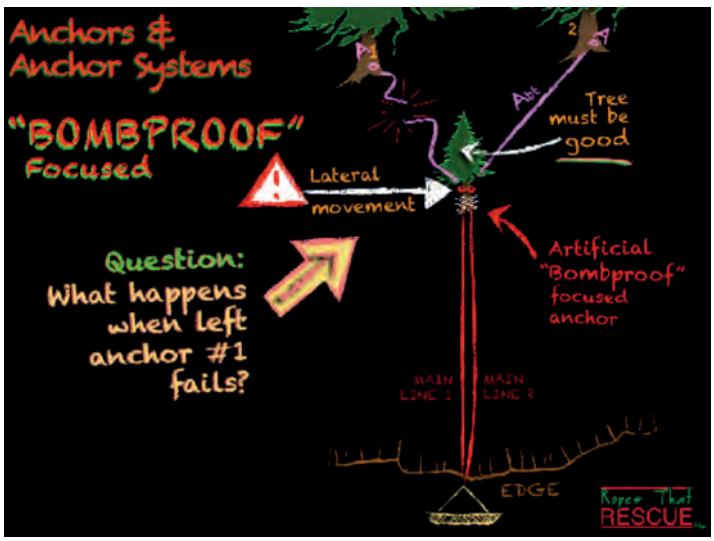
With vegetation such as with trees, particular attention must be paid to the method you use to make a bombproof focused anchor. If a suitable rear bombproof anchor cannot be found directly behind the tree or object you are focusing then two separate back ties will be required as shown in the top illustration.

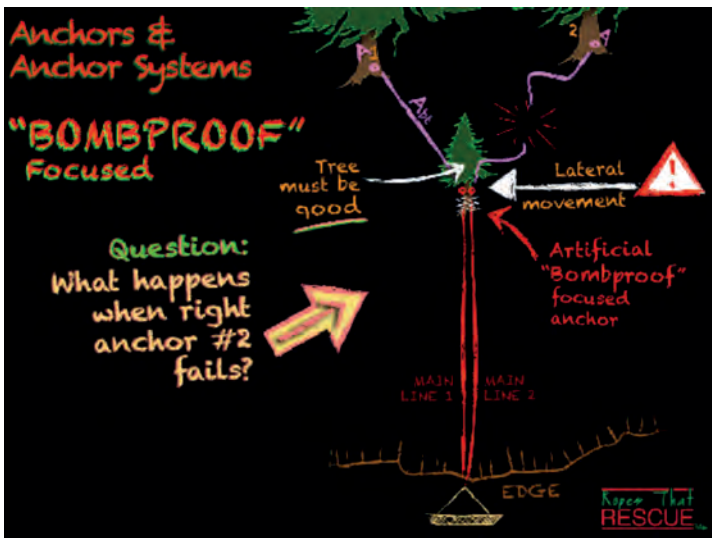
The focused tree nearer the edge must be examined to determine if it is able to resist lateral movement parallel to the edge if one of the back ties were to fail. If it can sustain this lateral movement then two back ties can be used provided that the angle to centerline (top illustration dotted line) is not too great (< 30°).



If one of the critical two back ties fails, the system will remain intact provided this object or tree can resist this lateral movement. If the focused object cannot withstand the lateral movement, additional rigging may be required to make the focused anchor bombproof.







TICK. TICK. TICK. TICK. TICK.

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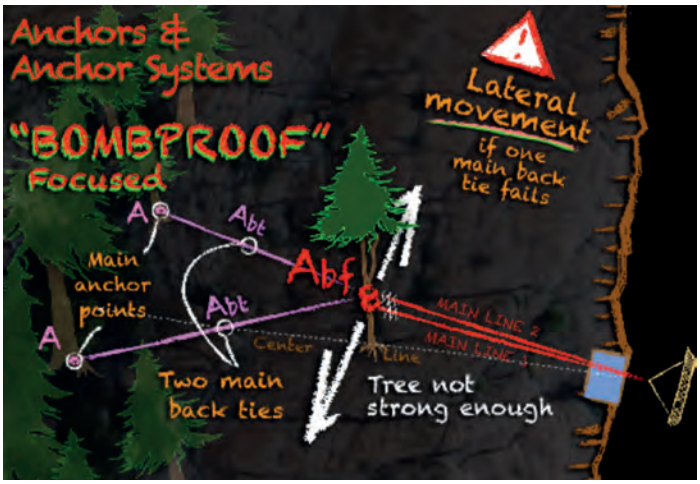
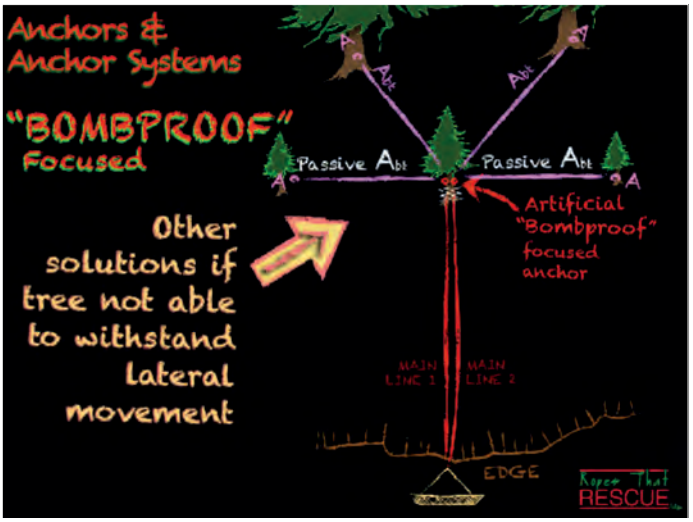
HARKEN

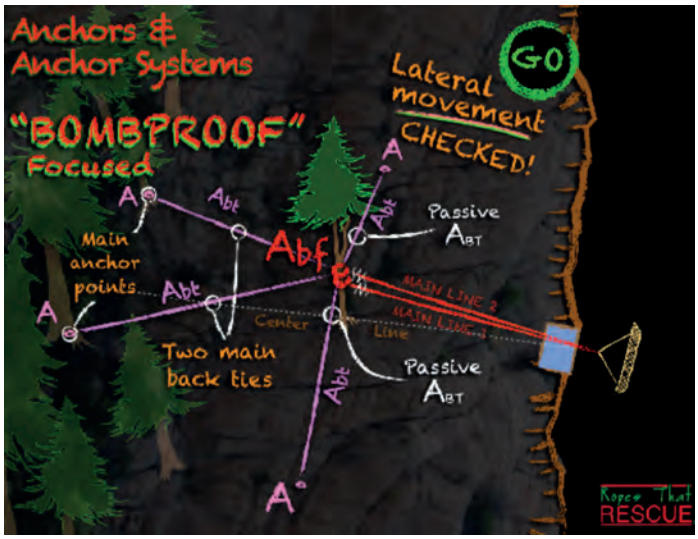
Simple lateral back ties may be added to any suspect focused object such this small tree. These lateral back ties could be considered "passive" back ties because they would only be protecting the main focus in the event of one of the two rear back ties failure.

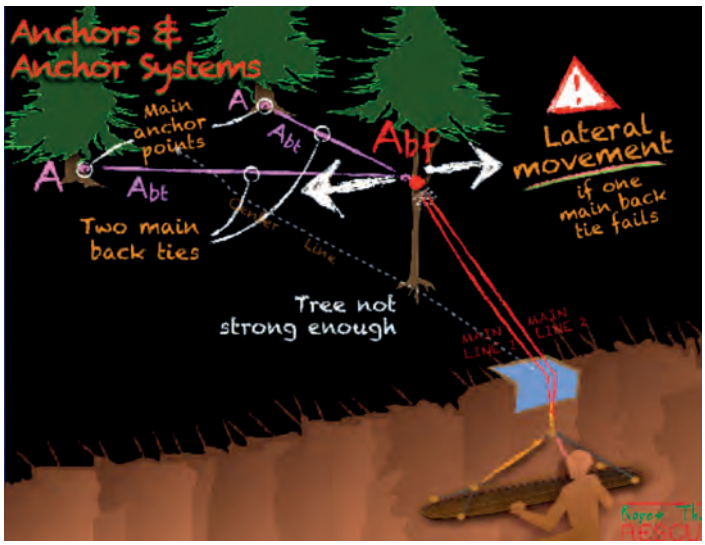


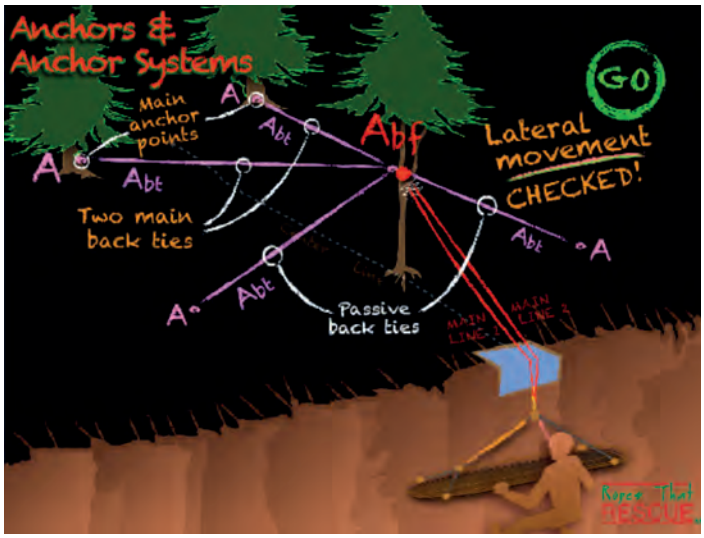


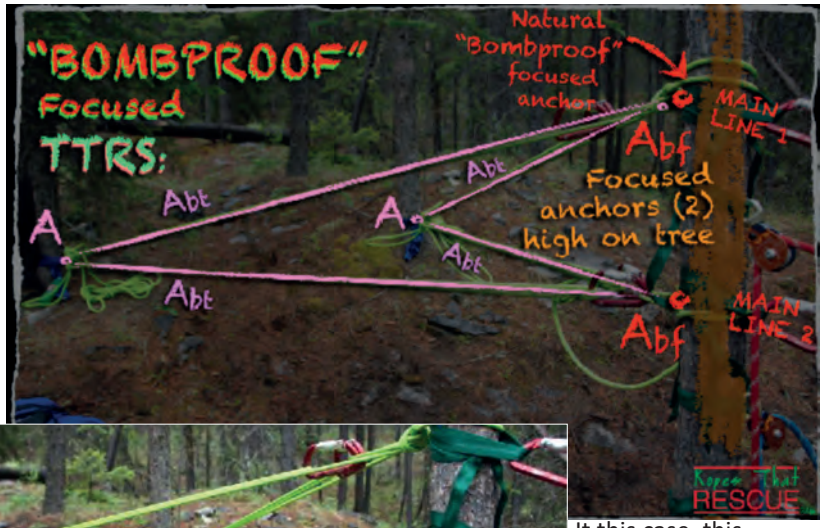
Lateral passive back ties installed on dubious bombproof focused anchor (A_{bf}).

IMPORTANCE OF THIS EXTRA RIGGING:
It may seem overkill to anticipate this kind of movement and normally for a regular anchor or half anchor we would not go to this kind of trouble. The difference here is that all your eggs are in one basket with anything you are hanging both sides of a two rope system on. If there is problems with it, then you have no other half to relay on for integrity of the system.





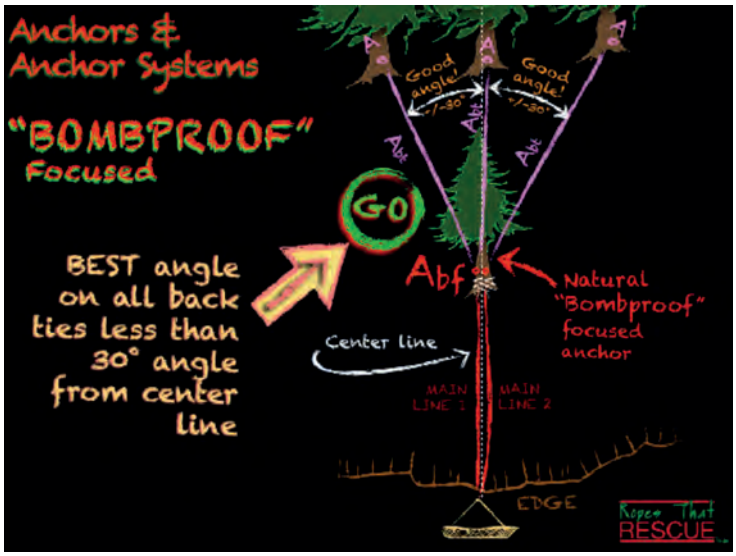




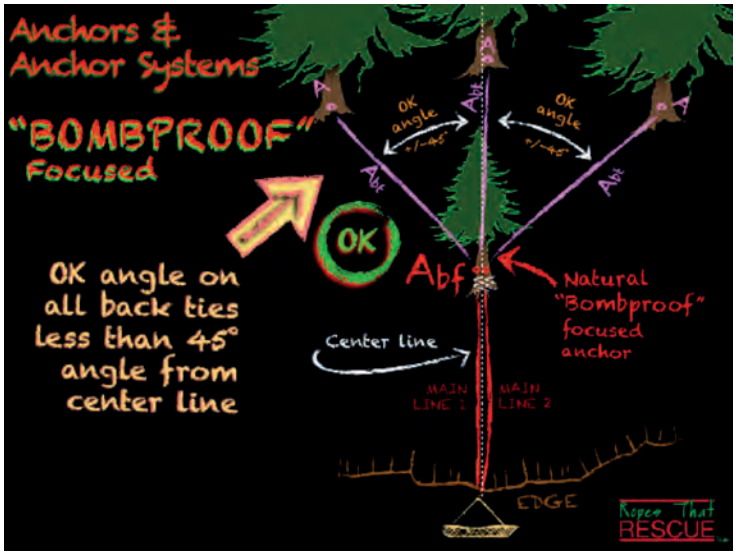
Another way to use two split back ties onto a single object of focus is to have one above, high, and one midpoint on the focused anchor. Again, these rear back ties need to be on separate anchors at the rear and can share the same anchor at the focused anchor. all four back ties are formed with one rope and a double bowline with Yosemite bight (top) along with a Sedona Blitz Anchor (bottom) was used on the tree intertwined with the webbing anchors.

It this case, this operation used a two-tensioned rope system so main line 1 & 2 went to each of these bombproof focused anchors. However, they have a few feet between each attachment.

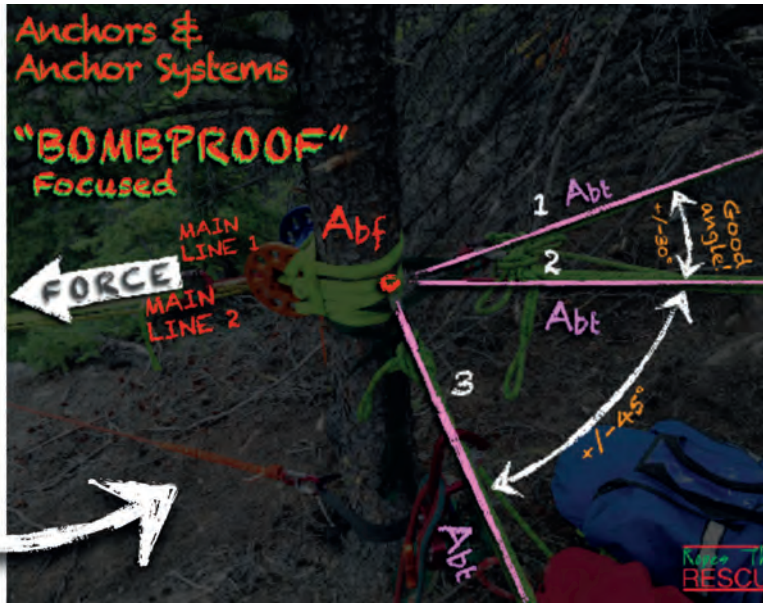
If no passive back ties are available to check lateral movement of the focused anchor as previously discussed, then three back ties to the rear may be the best option to attain the bombproof focused anchor (Abf) status. From the centerline (dotted) try and keep the two outside back ties as close to 30° as shown. 45° is about the maximum away from center line which would put the outside back ties 90° to one another. Just remember that the wider your go, the more force the center back tie is seeing and this can be problematic for any bombproof designation of a focused anchor.



In the below photo (bottom left) and schematic (bottom right) you can see that one back tie ended up at about at about a 30° (top and middle) and the second back tie angle ended up at about 45° (middle to bottom). Nature does not always cooperate in affording us ideal anchor locations.



Author note: In this bottom photo, the anchor webbing could have been independently ties so that all three back ties were all not on one anchorage. This would create a critical point at the bombproof focused anchor tree.



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NFPA 1983: 2017 (G)

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ELECTRO-'HYDRAULIC'

BATTERY TOOLS pt5

SPECIAL TOOLS

Holmatro's Door Ram uses their ***Greenline*** *battery series* **has the widest selection of Special tools within its battery tools including its *RIT* tool's ability to function as a ram using the jaws to spread the telescoping section out 80 cm/31"**
This is a handier-sized variation on an original design by *Powerhawk* where the spreader jaws are inserted into the a cut-out section on the barrel of a full-size, full strength ram.

Part 1 Combi-Tools
Part 2 Cutters
Part 3 Spreaders
Part 4 Rams
Part 5 Special Tools

This is not quite as all-encompassing a group of tools as you might expect and don't forget that many are still limited to hose-fed hydraulics rather than battery. - *Holmatro* for instance has power wedges, rebar/pedal cutters and concrete crushers but not in their battery range. In terms of professional battery hydraulics or 'hydraulic surrogates' we are really only talking about.....

- Tactical Combi/RIT entry tools for forced entry and chain or mesh cutting often with specialist tip options
- Special purpose cutters for pedals, rebar, sheet metal etc.
- Power wedges for opening a gap after insertion into an initially tight space
- Parallel jacking or separation like the Weber Door-Opener and the *Holmatro Door Ram* above for door busting, rail/ mesh separation etc.

See our **Guide to Batteries** in the **USAR/EXTRICATION BUYERS GUIDE** for a complete list of rescue-relevant batteries.

RIT/COMBI TOOLS

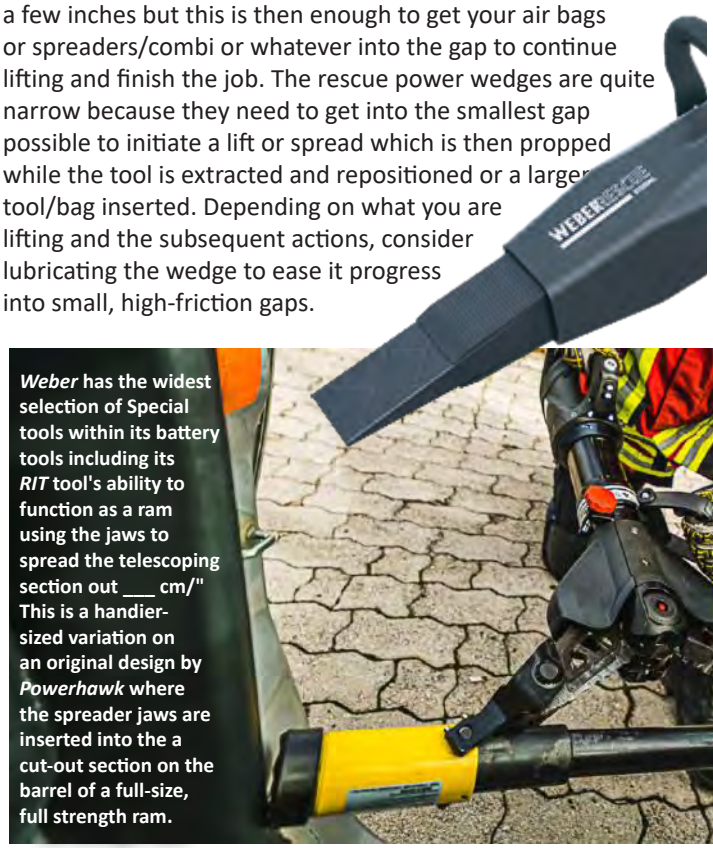
Since these are all hydraulic-electric tools as distinct from simply elecro-mechanical, there is a degree of crossover between the combi-tools which are true multi-role and the dedicated specialist tools that have a spreading or forced opening capability. The *Weber RIT* tool (opposite) for instance has a telescopic ram attachment and some detachable tips for forced entry can be narrow enough to do the same job as a wedge. It is safe to say that you your agency had to choose only one tool with which to perform or try to perform, ALL rescues it would be a RIT or Rapid Intervention Tool and if you were equipping a helicopter, motorcycle or small vehicle with a tool small enough to do meaningful work across a broad range of rescues it would be either a battery-powered RIT with it's bag of accessories or one of the Power-Drill tools like the *Ogura* but that's not really a single tool as all the head attachments are a quite significant size and weight. In fact, truth-be-told, we would possibly be looking at a hand-hydraulic combi if there was any chance of not having access to fresh batteries or recharging but for the most part, that's not an issue these days. So a RIT or mini-combitool has both spreading and cutting capabilities and with the addition of entry-tool tips it can force open doors, gates and roller shutters as well as acting as a powered wedge, which we will come to next. Their problem would be length of tool in the case of the key brands - *Lukas/ Hurst, Weber/Genesis* and *TNT*. The heads may b smaller but the bodies are the same size as their full size Combi, cutter and spreader brethren. The overall tool weight however will be smaller and the jaws are designed to take the entry tips that make RIT combis so useful. The *Lukas/Hurst StrongArm* has tips that look so substantial they wouldn't look out of place on a JCB digger. The images above show the adaptability of a RIT

The *Hilti NRC-6-22* is a more specialised rebar cutter because it cuts flush to the ground or concrete substrate. In rescue this can be extremely useful in removing the sharp stubs that other tools leave as significant snag hazards .

from diminutive cutting to spreading-lifting and forced entry. and don't forget that both *Lukas* and *Weber* have versions that can be used underwater! Police and military are particularly keen on RITs for door busting - electricity is quiet, the tools can be easily self-contained and back-packed to the scene and the range of tips gives good options for lock or hinge attack in terms of how the door is actually opened. Wedges and jacks can also do this job depending on the type of hinge if they have clearance within the door jam to force the door upwards rather than outwards.

POWERED WEDGE

A wedge is a long, triangle of material, metal in the case of rescue tools but there are extremely strong polymers that may end up being used. The wedge is forced forward by the hydraulics or mechanics of the tool forcing a narrow opening into a larger opening albeit over a short distance because it will only be to the height of the triangular wedge - usually just a few inches but this is then enough to get your air bags or spreaders/combi or whatever into the gap to continue lifting and finish the job. The rescue power wedges are quite narrow because they need to get into the smallest gap possible to initiate a lift or spread which is then propped while the tool is extracted and repositioned or a larger tool/bag inserted. Depending on what you are lifting and the subsequent actions, consider lubricating the wedge to ease it progress into small, high-friction gaps.



Weber has the widest selection of Special tools within its battery tools including its *RIT* tool's ability to function as a ram using the jaws to spread the telescoping section out ___ cm/" This is a handier-sized variation on an original design by *Powerhawk* where the spreader jaws are inserted into the a cut-out section on the barrel of a full-size, full strength ram.

The *Eder Titan 80 Remote* is one of three similar wedges by Eder aimed at the foresty industry but with numerous application in rescue - the Titan 50 is powered by hand or by a Milwaukee M18 impact driver but this larger self-contained remote version offers rescuers the chance to place and then move to a safe distance to activate it.

REMOTE CONTROL

Our selection in the tables are almost all from the rescue sector but one, the *EDER Titan Pro* is from forestry and has a feature that is becoming more common in battery tools though not yet in rescue - remote control. We are currently looking at a cutter from *Milwaukee* that has remote control cutting and similarly, most powered ascenders and some winches also have remote control. It's surprising that this is not more common in rescue and USAR/structural collapse in particular where the risks of carrying out a forced lift or cut and causing more collapse is quite high. *Titan* is a felling wedge but it's similar in action to the *Holmatro* and *Weber* wedges albeit with a lower power capacity but it does have an 80m/260ft remote control that enables you to place the wedge and then stand well back while you perform the lift - perhaps with binoculars because there is a lot to be said for having sight and feel of your lifted medium during the operation.

REBAR, BAR & PEDAL CUTTERS

While most of the tools we have included are unique to rescue there is a group of tools that we could have filled the entire magazine with - rebar cutters. These are designed to cut iron reinforcing bar used in concrete structures and have quite compact heads because the are only cutting an inch or so of bar (<25mm) . These are most often an anvil-style cutter where a straight blade is pushed forward (parallel with the body of the tool). The material being cut is caught by, and compressed against, a substantial hook- or square-shaped end and the blade pushes through the bar. Some rebar cutters have a blade that rotates or pivots onto and against a fixed 'anvil ' (pic above) and one or two have the more familiar parrot beak with hardened blades often on a straight section within a material capturing curved end to ensure the material is not simply spat out as the jaws close. Construction and demolition use such

IMAGES NOT TO SCALE

cutters to cut reinforcing bar hence the vast number of models available. Pretty much anyone that makes a battery powered trade tool has a rebar cutter but we have selected only those actively marketed for rescue and those using battery systems that you may already be using like the *Milwaukee M18, DeWalt FlexVolt* and *Makita XGT/LXT*. Vehicle rescue has traditionally used them as pedal-cutters able to cut through a vehicle's accelerator, brake and/or clutch pedal. There's no real distinction between the blade's capacity to cut metal bar because they will also cut head restraints and seat-backs etc , it is more about less front-end bulk and manoevrability that allows the tool to be used in the tight confines of a vehicle footwell. The *Edilgrappa* and *Ogura* models have a cutting head on the end of a short flexible hose with the controller able to be operated up to a metre away in the case of *Ogura*'s *HRT*. While rebar and pedal cutters have smaller heads there is a rescue range from *Weber/Genesis* for much more substantial cutting and one from *Holmatro*, the *Mini-Cutter* (above) that is somewhere in between able to cut almost an inch (22mm) metal bar, so steering wheels, seat-backs and chains as well as rebar. The *Weber/TNT* model is called a Mass-Transit Cutter in the US because it is marketed towards train/tram/bus operators able to cut more substantial bar, rail and tube materials than the smaller rebar-style cutters. Its huge jaw can accommodate 120mm/almost 5" of material but that is not the same as cutting a 5" solid bar - it will cut a 20mm bar but it will also cut 14mm sheet steel and will run up the outer skin of a train or vehicle leaving a neat 20mm wide line instead of a wavy corned-beef tin style cut so it also falls into the sheet material cutter category below.

SHEET MATERIAL SHEARS/CUTTERS

These are usually like a cross between secateurs and scissors with an action equivalent to a reciprocation saw where the trigger initiates the open and close cutting action. We mostly haven't included this class of tool because the rescue companies don't currently include them. Their uses are limited to some larger panel-sided vehicles and roller shutter entries and rescue agencies have other tools that will do this job. Nevertheless, if you already have the batteries and have got room on your truck they can be handy. We have however, included *Ogura*'s sheet cutter not just because it is part of an existing range but because it is will cut small diameter bar or heavy gauge wire as well as being a sheet material cutter.

LIFTING JACKS

Similar in function to a ram but with a set of 'jaws' to insert into gaps and push or lift or spread apart. These are in-line rather than pivoting as you get with a spreader. Primary usage is on roller shutters, lift doors and doors that open outward so they get more use in Scandinavia than they do in the UK where front doors open inwards. However, as mentioned earlier some door can be removed by lifting upwards rather than outwards. As with Power Wedges, the minimum insertion height is a key consideration. Jacks need more space corresponding to the physical with of the two halves of the jaw when fully closed for insertion. Power wedges are around 6-10mm whereas jacks are closer to 10-15mm.

CONCRETE NIBBLERS/CRUSHERS

Not at all common in Rescue battery tools with some companies like *Holmatro* and *Edilgrappa* so far choosing to stick with hose-hydraulics but there is one from *Weber* (pic below) and a Chinese model that we''re not familiar with. These function in the same way as a cutter or spreader jaw but with a meaty inward facing point on the end of each jaw. This exerts a precise point-load to slab concrete cracking away small sections (hence the term nibbler). It can generally only work from the outer edge of a slab so can work with up to 250mm wide sections at a time but it can often exploit a crack line and perpetuate that crack further into the slab to break off larger sections. The tips are replaceable and this is a very useful tool in structural collapse where extremely noisy disc cutters are often the only other option.

Weber Concrete Crusher Pic courtesy of Richard Wood

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THE FIRST CORDLESS MINI CUTTER
TO COMPLETE ANY RESCUE SET.

www.holmatro.com/minicutter

IN THE FOLLOWING TABLES.....
The tool length, width or height and weight are all WORKING spec so they **include the battery**. See our comprehensive Guide to Batteries in the USAR & Arborist BUYERSGUIDES for full range of options. Many companies quote figures without the battery so at first glance seem lighter but when added has a significant affect on both the physical size and weight of a tool when in use. As with all cutting and spreading tools, the largest or highest figures are not necessarily the best for the job. Stroke power is highest at the shortest extension. **All force figures are given in KiloNewtons and US (short)tons**

Any use, feature, accessory or component that is inherent in the tool is shown as a solid coloured square ■■■■
If it's an option it is shown as an outline square □□□□
● this feature is only partially present and/or is OK but not ideal.
A model variant is shown in cyan blue and any features or specifications that differ from the standard version are also in cyan or will have a cyan outline to a black or orange square ■■.
WiFi/ CAPABLE: The tool and/or battery are linked to a mobile device via Wifi &/or Bluetooth to manage functions, servicing and inventory.
TOOLS-IN-RANGE: refers to the other types of tool available jn this specific series of tools using this specific battery.
■=Cutter ■=Spreader ■=Combi ■=Ram
ORIGIN: The company's home country, not necessarily the country of manufacture which is indicated by an inset flag or two equally sized flags if the tool is made in both countries.
COST: rarely quoted because these are usually bulk agency purchases. The batteries are an expensive consumable as well - eg. a *Milwaukee* M18 8Ah battery costs £/$/€150-200 though individuals could purchase through *Amazon* etc. and save a packet! Any prices included are a rough guide only & include local taxes/VAT. They vary with exchange rates, extra taxes etc. We usually round up to the nearest Pound£/US Dollar$/Euro€. Cost is for a basic model with included accessories indicated in the notes. Our USAR/Extrication BUYERS GUIDE may be able to include prices as we find them but don't hold your breath.
WEIGHT IN HAND: the operational weight that the rescuer experiences in using the tool so it includes any on-board batteries but not backpack batteries and not necessarily any extras like clip-on lighting or tips.
WEIGHT of BATTERY: is for the default battery supplied or preferred by the manufacturer. Those that use 'off-the-shelf' brands like *Milwaukee* and *DeWalt* may well be able to use either higher Ah models for greater capacity/duration or lower Ah for decreased cost and perhaps weight but less duration. CAS is a battery coalition where several brands fit the same tools.
BATTERY DURATION & RECHARGE TIME: Work-time or duration is much trickier as it depends on the resistance of the material being cut/pushed/supported, the temperature, the age of the battery and even how meticulously you follow the recharge guidelines. Consequently some won't quote a figure at all and others are generous to say the least - consider most to be the absolute maximum with minimal workload. Tools last much longer carrying out hundreds of short duration cuts/spreads/lifts than one concerted high-load effort. **Recharge time** can be more specific though it varies wildly between basic and high speed chargers. The time shown is for the charger supplied or preferred by the manufacturer and may give a time-range if referring to different types of charger.
DIMENSIONS: Length by width by depth/height of tool ready to store on the truck and/or ready to work.
STANDARDS: CE ■ **NFPA** ■ **-** This varies with the type of tool - combi/RIT, cutters and spreaders have ratings as rescue tools but wedges and rebar cutters may only be CE by virtue of a powertool standard You will know the type of standard by any cut/spread ratings given.
CUT/PUSH/SPREAD FORCE: Is the maximum *theoretical* force that can be exerted and, like spreaders and cutters, is highest closest to the power unit. The strongest jacks are short and single-stage. Telescoping gives you much needed reach but the second stage is very much weaker than the first stage and this is extremely important to remember - you may have easily pushed your target material with the first stage but beware that you don't overwhelm it's capabilities when you extend into the second, telescoping stage. **It is also vital that you push in direct line with the power unit - if your target load starts to stray off-centre as it moves you could damage the jack's's cylinders.** Our figures are in kN (KiloNewtons) and **US (Short) Tons**. There are 1.10 US short tons to a UK/metric ton (or more accurately tonne).
STROKE RANGE/DISTANCE: The maximum distance the target load can be pushed/lifted.
ROTATE HEAD/HANDLE: The handle can

rotate around the cylinder for better access to the target.
LED LIGHTS ☐: Integral lighting from the handle or housing to illuminate the area being cut/spread.Some may be add-on.
IN-WATER-CAPABLE: The tool/battery can be used underwater
TOOL/BATTERY IP. Ingress protection for dust (first number) & water (second number) - IP54 resists water splashes, IP57 & 67 withstand inundation to 1metre, IP58&68 deeper than 1metre. Trade batteries like *Milwaukee* are **not** waterproof without a bespoke cover and tend not to quote an IP number because they are dependant on the tool to create an effective seal. Specialist batteries like *Holmatro* and *Lukas* are watertight (IP68) but regular trade batteries are no more than IP54 so they are splashproof but not submersible without a bespoke cover.

IMAGES NOT TO SCALE

SERIES - VARIANT in CYAN BLUE
OTHER TOOLS IN RANGE:
■= Combi ■= Spreader ■=Ram
■= Cutter
●= PARTIAL FEATURE
□□□= Option
DIMENSIONS include battery
~ = Approximately
N/A = info Not Available/not given

MODEL	Titan 50	Titan 80 Remote	TP10	Pro-Cut 12
SERIES WiFi/Bluetooth-capable		-	-	-
VOLTAGE	18v	18v	18/20v	18/20v
COMPANY	**EDER**	**EDER**	**EDILGRAPPA**	**EDILGRAPPA**
TYPE OF TOOL	WEDGE/ENTRY	REMOTE WEDGE/ENTRY	FLEXI-CUTTER	BAR CUTTER
TOOLS IN RANGE	-	-	■ ■ ■ ■	■ ■ ■ ■
ORIGIN	DE	DE	IT	IT
COST inc tax / VAT	£751 $978 €895	£1975 $2567 €2350	N/A	£2530 $3200 €3030
WEIGHT IN HAND inc BATTERY exc ACCESSORIES	3.2kg* 7lb*	9.9kg 21.8lb	8.6kg 18.9lb	7.2kg 15.8lb
BATTERY — **WEIGHT - DEFAULT BATTERY**	1.1kg 2.4lb	1.1kg 2.4lb	0.7 1kg 1.52.2 lb	0.7kg 1.5 lb
BATTERY — **BATTERY Ah OPTIONS**	Milwaukee 5Ah	Milwaukee 5Ah	DeWalt FlexVolt 4 6Ah*	DeWalt FlexVolt 4 6Ah*
BATTERY — **BATTERY DURATION RECHARGE TIME**	<45mins 60-105mins	<45mins 60-105mins	10-15mins /~100 cuts 40-90mins	10-15mins / ~100 cuts 40-90mins
DIMENSIONS — **LENGTH** retracted with tips/extended	420mm / 16.5" 520mm /20.5"	620mm /24.4" 780mm /30.7"	1034mm/ 40.7" -	494mm/ 19.4" -
DIMENSIONS — **HEIGHT/WIDTH**	255mm / 10"	120mm / 4.7"	*348mm / 13.7"	*348mm / 13.7"
DIMENSIONS — **DEPTH (max diam)**	118mm/ 4.6"	180mm/ 7"	143mm / 5.6"	184mm / 7.2"
STANDARDS — **EXTENSION(S) & OPTIONS** or **CUT/SPREAD CE/NFPAClass**	- -	- -	- -	- -
STANDARDS — **CE ■ NFPA□**	-	■	■ ■	■ ■
STANDARDS — **EN CLASSIFICATION**	-	-	-	-
FEATURES/CAPACITIES — **CUT / PUSH/SPREAD FORCE t=US Ton**	147kN 16.5 USt	245kN 27.5 USt	232.4kN 26.1 USt	120kN 13.4 USt
FEATURES/CAPACITIES — **CUT-MATERIAL/BAR Ø STROKE/SPREAD RANGE**	50mm / 2" lift height	80mm / 3.15"		12mm / 0.5"
FEATURES/CAPACITIES — **JAW OPENING DISTANCE INSERTION HEIGHT**	- -	- -	52mm / 2" -	15mm /0.6" -
FEATURES/CAPACITIES — **WORKING PRESSURE** (HYDRAULIC)	-	-	550 Bar / 8K psi	300 Bar / 4.4K psi
FEATURES/CAPACITIES — **HEAD / HANDLE ROTATES**	■	-	■ ■	■ ■
FEATURES/CAPACITIES — **SPEED CONTROL ON-BOARD LED**	Button+Lever	Button+Lever	Trigger	Trigger
FEATURES/CAPACITIES — **IN-WATER USE BATTERY/TOOL IP**	54 54	54 54	54 54	54 54
NOTES	These *Eder* wedges are electro-mechanical rather than hydraulic. *Dimensions will vary with impact wrench and battery type, we would recommend the 8Ah.	Designed for felling of large trees - inserted into the back-cut and activated from a safe distance <80m but will work for any incidents requiring forced-separation. 80Pro head can also fit drill as per the Titan50	A flexible head cutter intended for manoeuvring into confined spaces like a vehicle footwell for peddle cutting. *6AH -add 50mm to height	Rotational Blade Multi-material/bar cutter. Anti-jamming release lever *6AH -add 50mm to height
WEBSITE	eder-maschinenbau.de	eder-maschinenbau.de	edilgrappa.com	edilgrappa.com

					
MU16-USAR		SilverCut 20-USAR	Mass-Transit Cutter	Mass-Transit Cutter	Mini-Cutter CCU10
-		-	SLi	E-Force 2.0	CAS - Generic
18/20v		18/20v	18v	28v	28v
EDILGRAPPA		**EDILGRAPPA**	**GENESIS RESCUE**	**GENESIS RESCUE**	**HOLMATRO**
BAR CUTTER		BAR CUTTER	HD CUTTER	HD CUTTER	CUTTER
£2700 $3400 €3220		£2530 $3200 €3030	N/A	N/A	£3400 $4280 €4050
9.3kg 20.5lb		10kg 22lb	18.4kg 40.6lb	23kg 51lb	4.9kg 10.8lb
0.7kg 1.5 lb		0.7kg 1.5 lb	1.1/1.7kg 2.4/3.74lb	1.45/1.1kg 3.2/2.4lb	0.4kg 0.9lb
DeWalt FlexVolt 4 6Ah*		DeWalt FlexVolt 6Ah*	Milwaukee 5-8Ah*	Genesis/ Milwaukee 5Ah*	Holmatro CAS (inc Milwk/ DeWalt) 2Ah
10-15mins / ~100 cuts 40-90mins		10-15mins / ~100 cuts 40-90mins	60/90mins 45-60-105mins	<45mins 90 60-105mins	<70 cuts 30mins
486mm/ 19.1" -		504mm/ 19.8" -	765mm /30.1" -	743mm /29.3" -	554mm /21.8" -
*348mm / 13.7"		*348mm / 13.7"	188mm / 7.4"	205mm / 8.1"	154mm / 6.1"
184mm / 7.2"		176mm / 7.2"	230mm/ 9"	241mm / 9.5"	92mm / 3.6"
- -		- -	A4 B3 C5 D6 E6 F3	A4 B3 C5 D6 E6	B 1D 2D 3C A4 B3 C2 D4 E4
-		-	-	-	AC59-B-4.9
171kN 19.2 USt		189kN 21.2 USt	111kN 12.5 USt	142 (47*) kN 16 (1.8*) USt	220 kN 24.7 USt
16mm / 0.9"		20mm / 0.8"	20mm / 0.8"	?	22mm / 0.9"
20mm /0.8" -		21mm / 0.8" -	120mm / 4.7" -	120mm / 4.7" -	59mm / 2.3" -
550 Bar / 8K psi		550 Bar / 8K psi	700 Bar / 10.1K psi	700 Bar / 10.1K psi	720 Bar / 10.4K psi
Trigger		Trigger	Rocker switch	Rocker switch	Rocker switch
54 54		54 54	68* 58	54 54	54 54
Rotational Blade Multi-material/bar cutter. Anti-jamming release lever *6AH -add 50mm to height		Anvil Blade Also a 16mm version Multi-material/bar cutter. Anti-jamming release lever *6AH -add 50mm to height	Designed for heavy duty cable/ bar cutting in rail and municipal transport incidents *IP68 only with battery cover shown. IP54 splash cover for 12Ah	Designed for heavy duty cable/ bar cutting in rail and municipal transport incidents* Also a 3Ah option All E-Force tools can convert to hose.	Small hand-tool capable of getting into tight spaces or being easily carries in a response car/bike
edilgrappa.com		edilgrappa.com	genesisrescue.com	genesisrescue.com	holmatro.com

IMAGES NOT TO SCALE

SERIES - VARIANT in CYAN BLUE
OTHER TOOLS IN RANGE:
■= Combi ■= Spreader ■=Ram
■= Cutter
●= PARTIAL FEATURE
□□□= Option
DIMENSIONS include battery
~ = Approximately
N/A = info Not Available/not given

	MODEL	Door Ram GDR200EVO3	LE 100 StrongArm	HRS931/941	932S Stubby Shear
	SERIES WiFi/BT-capable	Greenline EVO3	-	HRS	HRS
	VOLTAGE	28v	25.2v	18v	18v
	COMPANY	**HOLMATRO**	**HURST/LUKAS (IDEX)**	**OGURA**	**OGURA**
	TYPE OF TOOL	ENTRY	COMBI /ENTRY	HRS POWER/MOTOR	SHEETCUTTER
	TOOLS IN RANGE	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
	ORIGIN			●	●
	COST inc tax / VAT	N/A	N/A	N/A	N/A
	WEIGHT IN HAND inc BATTERY exc ACCESSORIES	13.4kg 29.5lb	11.1kg* 24.4lb	3.9/4.2kg 8.6/9.3lb	+5.7kg +12.6lb
BATTERY	**WEIGHT - DEFAULT BATTERY**	1kg 2.3lb	1.3kg 2.9lb	1-1.36kg 2.2-3lb	1-1.36kg 2.2-3lb
BATTERY	**BATTERY Ah OPTIONS**	Holmatro EVO3 5/6Ah*	StrongArm 4Ah	Makita 5-6Ah*	Makita 5-6Ah*
BATTERY	**BATTERY DURATION RECHARGE TIME**	0mins 90mins	30-60mins 75-150mins	<12mins 55-120mins	<12mins 55-120mins
DIMENSIONS	**LENGTH** retracted with tips/extended	728mm /23.1" 1028mm /53"	775-796mm 30.5-31.3"	303/328mm / 11.9/12.9"	328mm / 12.9" -
DIMENSIONS	**HEIGHT/WIDTH**	365mm / 14.4"	195mm / 7.7"	272/273mm / 10.7/10.7"	130mm / 5.1"
DIMENSIONS	**DEPTH (max diam)**	134mm /5.3"	210mm / 8.3"	111/111mm / 4.4/4.4"	104mm / 4.1"
STANDARDS	**EXTENSION(S) & OPTIONS** or **CUT/SPREAD CE/NFPAClass**	- -	1E-2D-3D-4D-5D A5 B3 C5 D6 E6	1m Expansion Hose. Cutter, Spreader, mini ram, Stubby Shear, Pedal Cutter, L&S Door Opener.	-
STANDARDS	**CE** ■ **NFPA** □	■ ■	■ ■	-	-
STANDARDS	**EN CLASSIFICATION**	-	-	-	-
FEATURES/CAPACITIES	**CUT / PUSH/SPREAD FORCE** t=US Ton	72 kN 8 USt	155/20-700kN 17.4/ 2.25-78 USt	-	78.4kN 8.8 USt
FEATURES/CAPACITIES	**CUT-MATERIAL/BAR Ø STROKE/SPREAD RANGE**	<300mm 11.8"	184-215mm 7.2-8.5"	-	2/1.6mm sheet steel/StSt 0.08/0.06" sheet steel/StSt
FEATURES/CAPACITIES	**JAW OPENING DISTANCE INSERTION HEIGHT**	800mm 31.5"	207mm 8.1"	-	26mm 1"
FEATURES/CAPACITIES	**WORKING PRESSURE** (HYDRAULIC)	720 Bar / 10.4K psi	700 Bar / 7K psi	N/A	N/A
FEATURES/CAPACITIES	**HEAD / HANDLE ROTATES**	-	■	■ ■	■
FEATURES/CAPACITIES	**SPEED CONTROL ON-BOARD LED**	Rocker switch ▫	Rotating Star Grip ■*	Trigger	-
FEATURES/CAPACITIES	**IN-WATER USE BATTERY/TOOL IP**	57 57	■ 68 58		54 54
	NOTES	Effectively a powered jack that will lift doors/roller-shutters or separate railings or burst gate locks etc. *6Ah replaced previous 5Ah	LE version =Tactical Black. *LED Light is an option * Add 700g for heaviest door-opening tips shown, Combi tips	FOR USE WITH OGURA HRS HEADS	USE WITH HRS931 or 941 360° swivel head.
	WEBSITE	holmatro.com	lukas.com	ogurarescuetools.com	ogurarescuetools.com

					
	923 Pedal Cutter	936 Door Opener	946 8" Door Opener	ESLCC	RIT TOOL
	HRS	HRS	HRS	Storm Surge	E-Force/Smart-Force
	18v	18v	18v	18v/20v	18v
	OGURA	**OGURA**	**OGURA**	**TNT RESCUE**	**WEBER RESCUE**
	PEDAL/BAR CUTTER	ENTRY	ENTRY	COMBI /ENTRY	COMBI /ENTRY
	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
	●	●	●	🇺🇸	🇩🇪 🇦🇹
	N/A	N/A	N/A	N/A	N/A
	+5.4kg +11.9lb	+6kg +13.2lb	+8kg +17.6lb	19.1-19.5kg 42.2-43lb	13.3 / 14.2kg 29.3 / 00lb
	1-1.36kg 2.2-3lb	1-1.36kg 2.2-3lb	1-1.36kg 2.2-3lb	1.1kg /2.4lb 1.2[1.36]kg /2.6[3]lb	1.1/1.7kg 2.33/3.74lb
	Makita 5-6Ah*	Makita 5-6Ah*	Makita 5-6Ah*	Milwaukee M18 8/9Ah Makita [6Ah] DeWalt FlexV20 9Ah	Milwaukee M18 5/8Ah
	<12mins 55-120mins	<12mins 55-120mins	<12mins 55-120mins	10-15mins 87 / 60mins	60/90mins 45-83mins
	240mm / 9.5" -	255mm /10" 325mm /12.8"	338mm /13.3" 544mm /21.4"	791mm /31.1" -	540mm /21.3" 908mm /35.7"
	105mm / 4.1"	155mm / 6.1"	152mm / 6"	299mm / 11.75"	340mm / 13.4"
	84mm / 3.3"	110mm / 4.3"	142mm / 5.6"	268mm/ 10.5"	134mm/ 5.3"
	-	-	-	A6 B5 C7 D7 E6	Long, Spreader,Door, jack/ram & pulling tips 1H-2H-3H-4H-5H A6-B7-C6-D7-E7-F3
	-	-	-	■	■ ■
	-	-	-	-	AC140H-13.314.2
	70.6kN 7.9 USt	39.2kN 4.4 USt	34.3kN 3.8 USt	528/5.3kN 59.3/11.8 USt	111/30-1305kN 12.47/3.3-146 USt
	16mm/⅝" rebar 38x6mm/1.5x0.23" bar	70mm 2.8"	206mm 8.1"	304.8mm 12"	285-380mm 11.2-15"
	16mm ⅝"	00mm 0"	00mm 0"	231.77mm 9.12"	215mm 8.5"
	5.8K-6.4K psi	N/A	N/A	722 Bar / 10.5K psi	550 Bar / 7.9K psi
	■	■	■		
	-	-	-	Rotating Star Grip ■	Rocker switch ■
	54 54	54 54	54 54	54 54	■* 54/68* 58
	USE WITH HRS931 or 941 360° swivel head	USE WITH HRS931 or 941 360° swivel head	USE WITH HRS931 or 941 360° swivel head	- TNT prices include 2 batteries and Dual Rapid charger. Storm2 series DISCONTINUED Mains adapter=option.	All E-Force tools can convert to hose. Smart=WiFi Capable *for SMART Version-IP68 only with battery cover. IP54 splash cover for 12Ah
	ogurarescuetools.com	ogurarescuetools.com	ogurarescuetools.com	tntrescue.com	weber-rescue.com

IMAGES NOT TO SCALE

SERIES - VARIANT in CYAN BLUE
OTHER TOOLS IN RANGE:
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■= Cutter
●= PARTIAL FEATURE
□□□= Option
DIMENSIONS include battery
~ = Approximately
N/A = info Not Available/not given

	MODEL	BC250 Concrete Crusher	SPK250 Power Wedge	C120 Cutter	DO140 Door Opener
	SERIES WiFi/Bluetooth-capable	E-Force/Smart-Force	E-Force/Smart-Force	E-Force/Smart-Force	E-Force/Smart-Force
	VOLTAGE	18v	18v	18v	18v
	COMPANY	**WEBER RESCUE**	**WEBER RESCUE**	**WEBER RESCUE**	**WEBER RESCUE**
	TYPE OF TOOL	CONCRETE CRUSHER	COMBI /ENTRY	HD CUTTER	ENTRY
	TOOLS IN RANGE	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
	ORIGIN				
	COST inc tax / VAT	N/A	N/A	N/A	N/A
	WEIGHT IN HAND inc BATTERY exc ACCESSORIES	20.5/21.3kg 45.2/47lb	11.9/12.7kg 26.2/28lb	23.1/00kg 51/00lb	13.2/14.1kg 29.1/31lb
BATTERY	**WEIGHT - DEFAULT BATTERY**	1.1/1.7kg 2.33/3.74lb	1.1/1.7kg 2.33/3.74lb	1.1/1.7kg 2.33/3.74lb	1.1/1.7kg 2.33/3.74lb
BATTERY	**BATTERY Ah OPTIONS**	Milwaukee M18 5/8Ah	Milwaukee M18 5/8Ah	Milwaukee M18 5/8Ah	Milwaukee M18 5/8Ah
BATTERY	**BATTERY DURATION RECHARGE TIME**	60/90mins 45-83mins	60/90mins 45-83mins	60/90mins 45-83mins	60/90mins 45-83mins
DIMENSIONS	**LENGTH** retracted with tips/extended	- 890mm /35"	770mm / 30.3" 831mm /32.7"	745mm / 29.3" -	619mm / 24.4" 759mm / 29.9"
DIMENSIONS	**HEIGHT/WIDTH**	380mm / 15"	241mm / 9.5"	238mm / 9.4"	228mm / 9"
DIMENSIONS	**DEPTH (max diam)**	302mm/ 11.9"	150mm / 5.9"	188mm/ 7.4"	178mm/ 7"
STANDARDS	**EXTENSION(S) & OPTIONS or CUT/SPREAD CE/NFPAClass**	- - -	- EN 13204 -	1H-2H-3H-4H-5H A6-B7-C6-D7-E7-F3	- EN 13204 -
STANDARDS	**CE ■ NFPA□**	- -	■ ■	■ ■	■ ■
STANDARDS	**EN CLASSIFICATION**	-	-	AC120D-23.1	-
FEATURES/CAPACITIES	**CUT / PUSH/SPREAD FORCE t=US Ton**	110kN 12.3 USt	248kN 27.8 USt	111/45kN 12.47/5 USt	101kN 11.3 USt
FEATURES/CAPACITIES	**CUT-MATERIAL/BAR Ø STROKE/SPREAD RANGE**	- -	61mm 2.4"	- -	140mm 5.5"
FEATURES/CAPACITIES	**JAW OPENING DISTANCE INSERTION HEIGHT**	250mm 9.8"	8mm 0.3"	120mm 4.7"	12mm 0.5"
FEATURES/CAPACITIES	**WORKING PRESSURE** (HYDRAULIC)	700 Bar /7K psi	700 Bar / 7K psi	550 Bar / 7.9K psi	550 Bar / 7.9K psi
FEATURES/CAPACITIES	**HEAD / HANDLE ROTATES**	■	-	■	■
FEATURES/CAPACITIES	**SPEED CONTROL ON-BOARD LED**	Rocker switch □	Rocker switch □	Rocker switch □	Rocker switch □
FEATURES/CAPACITIES	**IN-WATER USE BATTERY/TOOL IP**	■* 54/68* 58	■* 54/68* 58	■* 54/68* 58	■* 54/68* 58
	NOTES	Tips can be replaced when worn. Smart=WiFi Capable All E-Force tools can convert to hose. *for SMART Version-IP68 only with battery cover. IP54 splash cover for 12Ah	Smart=WiFi Capable All E-Force tools can convert to hose. *for SMART Version-IP68 only with battery cover shown. IP54 splash cover for 12Ah	Smart=WiFi Capable. All E-Force tools can convert to hose. *for SMART Version-IP68 only with battery cover shown. IP54 splash cover for 12Ah Cuts sheet, bar and sandwiched cross-sections	Smart=WiFi Capable All E-Force tools can convert to hose. *for SMART Version-IP68 only with battery cover shown. IP54 splash cover for 12Ah
	WEBSITE	weber-rescue.com	weber-rescue.com	weber-rescue.com	weber-rescue.com

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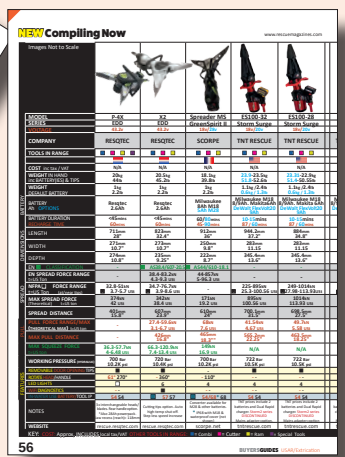

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Our **WATER RESCUE BUYERSGUIDE** is compiling now and will be out WINTER 2024/25 although some of these categories are so detailed and complex that some will still be compiling through 2025.

FREE link:
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Inflatable Sleds
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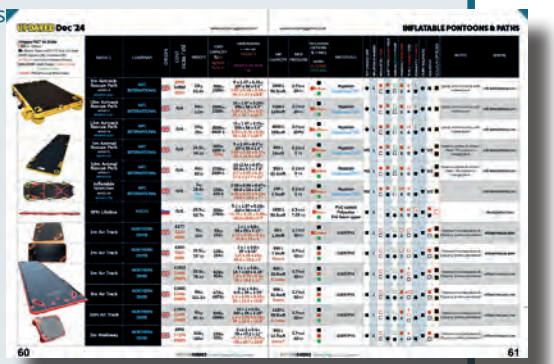
Mini Hauling Systems
Water Rescue Rope
Throwlines & Throwbags
Water Rescue Knives
Submersible lighting
Water Rescue Manikins



FPV from drone having dropped a flotation collar (quick Collar) to an in-water 'victim'

UAVS FOR WATER RESCUE & EVOLVING METHODS

Evolving Technologies and Applications in Swiftwater Rescue using Drones, accessories and associated technology

Dr Michael Croslin

Mitch Sasser

Sean Norman

TJ Buddrus

Harley Hiles

Idan Perez

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

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

Sean norman: *Batallion Chief Cal Fire, Head of Butte Co, Swiftwater OES Type 1 Team. Swiftwater instructor Cal Fire/Rescue3/ 30yr experience leading the busiest team in California.*

TJ Budrus*: Austin Fire Dept., Special Operations, Texas A&M Texas Task Force 1,*

Harley Hiles: *Drone Pilot. 10 years experience on fixed wing and multi-rotor UAS. Harley strives to make aviation more accessible and pioneer new uses for UAS.*

Idan Peretz *is the co founder and CEO of Highnovate, an Israeli company that develops solutions for safer and easier rope rescue and access. He has more then 30 years of experience in rescue and technical rescue training.*

INTRODUCTION by Travis 'TJ' Buddrus - *Travis spent 5 days with our collaborative drone group learning to pilot and operations and subsequently joined the development group*

Over the years, the use of drones in rescue operations has grown beyond what most of us ever thought possible. Today, we can confidently recognize drones not only as platforms for observation but as tools capable of far more. Drone technology, whether commercial or homemade, provides rescuers not just with real-time data but, as we will explain in this article, can also deliver equipment, set anchors for access, and even perform rescues without sending a responder into the water. Commercial drones offer ease of operation, high-quality cameras, and software that can autonomously fly to a scene and provide vital information to first responders. But their navigation systems and sensors can become problematic when flying in challenging conditions or carrying a payload meant for rescue purposes. And if one of these drones crashes, you're literally watching money disappear from your budget while you wait weeks for it to be repaired or replaced.

More recently, through social media, we've witnessed the use of homemade drones piloted manually in first-person view (FPV) or "acro-mode" with incredible precision to deliver payloads in modern warfare. But what about using these drones for good?

Over the past year, a group of us has teamed up to start a revolution, which we call the “Rescue Drone Project.” After countless hours of testing, discussions, deep dives into FPV drone videos on YouTube, and consulting with subject matter experts, we've concluded, that specifically for water rescue: We can do this! We can use this technology to our advantage, put ourselves

Pic-Left & main pic: Quick-Collar dropped precisely by drone to a mid-stream strandee. We strongly believe that the Quick Collar shown in these images and in the panel below, is a game-changer for water-rescue drone operations.

The drone flies 30-50ft past the rescuer drop point to counter the snap back recoil upon release. The harder the pull on the drone, the greater the recoil.

in safer positions, and conduct rescues with drones. By utilizing an FPV drone, we take full control of the drone's flight path, unlike with automated systems. Imagine *Ant-Man* from the *Marvel* movies flying a mini helicopter while sling-loading payloads. FPV drones can carry payloads without a computer mistaking the drag of a rope in water for a strong headwind or misinterpreting the shifting of a payload as something that requires sudden adjustments in thrust, pitch, roll, or yaw. The pilot has immediate control of the drone's reactions.

Pic-Left: Drone delivering a, tethered, undeployed REACH device to a mid-stream or opposite-bank rescuer.


Initial testing of the pulling power of the *FPV* drone carrying 5/16"water rescue rope rather than carrier line

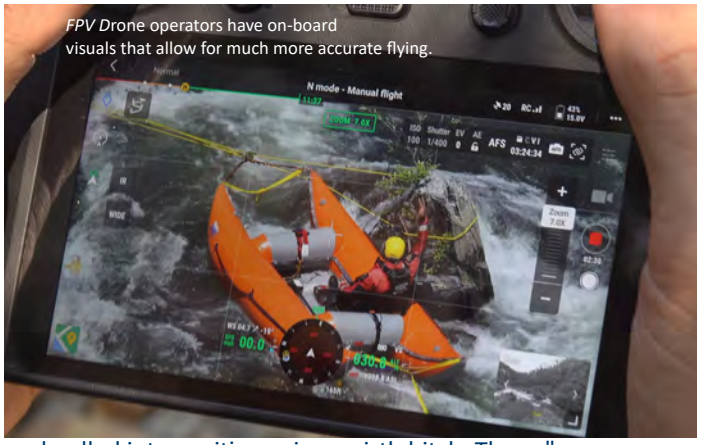
As for the cost, consider this: while a commercial *M30* drone with thermal capability and a 5-pound payload costs around $13,000, we can now build a 10-inch FPV drone with a payload capacity of over 20 pounds for just over $1,000! These robust carbon-fiber drones can withstand harsh conditions, and if an arm breaks or a motor is damaged, it costs less than $100 and about an hour of work to repair it.

Now, let's talk about water rescues, starting with life jackets. With a wide variety of payload release mechanisms available online, most public safety drones can deliver a life jacket. However, you may want to disable the bottom sensors to avoid any interference.

But what about gaining access and providing egress for stranded survivors? A waterway's bottom condition, flow pattern, strength, width, and unpredictable environmental factors make rescue operations nerve-racking. Even then, we often need more information to be able to commit to a rescue. Working in a fire department's special operations division, where we respond to up to 17 different technical rescue disciplines, I've realized I'm not a "jack of all trades" but rather a student of all possibilities. As I grow as a leader, I constantly evaluate risks and benefits. While risk assessments are nothing new to those who came before me, I often obsess over one question: Can we do this better? Can we execute a rescue without putting rescuers in harm's way? In situations where the answer used to be "no," I now believe it's "yes."

We developed a simple technique: attach a rope to a drone's payload release mechanism and deliver it as needed. Field testing has shown that we can extend lines up to 600 feet using a 5/16" Ultraline line or 4mm Dyneema, flown upstream, downstream, and across the water. The slick outer surface of this rope prevents it from snagging, it flies well, has minimal stretch, and is strong enough to perform Tension Diagonals and Pendulums and vectoring fast access evolutions. With practice, drones can fly over turbulent channels or flooded areas, allowing rescue personnel to set anchors for tension diagonals or deliver equipment by boat.

Anchors can be set in place using a line capture device wrapped around a tree by the drone, which is then released



FPV Drone operators have on-board visuals that allow for much more accurate flying.

and pulled into position using a girth hitch. These "access advantage" anchors work because they are set in the direction of the current, avoiding the high load forces typical in land-based rope operations. Additionally, drones can deliver gear, such as equipment to assist a stranded boat team, via drop mechanisms.. Let's look at the specifics of such operations.

FPV VERSUS COMMERCIAL DRONES

by **Harley Hiles**

When using UAS to carry various payloads for rescue operations you have 2 options for what kind of system to use. One is the traditional commercial systems such as a DJI M30, or M300/350 with a third party drop mechanism. The next is DIY FPV systems typically 7" rotor class and above. There are pros and cons to using both systems. There are circumstances when one system will be superior to the other.

Commercial UAS are typically user friendly, extremely reliable and can carry a wide range of optical instrumentation and third party accessories such as drop systems. They also feature autopilot and obstacle avoidance enabling pilots to let go of the controls and focus on the aircraft's sensors while the autopilot maintains the aircraft's position and altitude. These systems are fairly easy to operate and someone can be trained to use them in a short period of time.

FPV PROS	FPV CONS	Commercial PROS	Commercial CONS
Inexpensive	Difficult to fly for inexperienced	Easy to use	Expensive
High payload	Lacks reliable autopilot	Wide range of instrumanetation & payloads	Lower payload
High speed	High reliability	High reliability	Difficult to deploy in confined areas
Versatile to deploy	Autopilot	Autopilot	Not very portable
Very precise control	Operation is not user-friendly		Limited precision
Easy to repair	Lacks obstacle avoidance		
Deploys in <1 minute			

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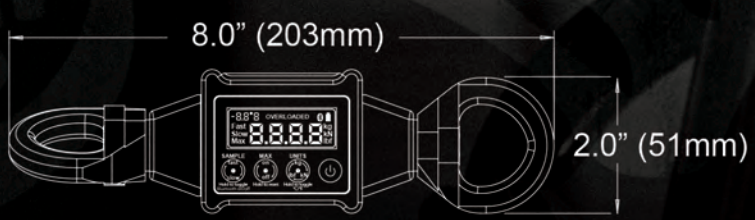

Weighs just 14oz. (397 gm) with batteries!

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FPV (First Person View) systems are more simple than traditional commercial UAS. They are DIY multi-rotors purpose built for speed and power. Unlike traditional systems that are flown from a large controller featuring a monitor, FPV drones are flown through VR goggles and traditional RC aircraft controllers. This enables the pilot to focus more on flying and creates better spatial awareness. This is necessary because these systems lack complex autopilots and obstacle avoidance. The aircraft has to be flown manually at all times and is more akin to flying a traditional helicopter. This may seem like a disadvantage, but it is actually crucial when carrying heavy loads, or pulling lines in strong current.

The flight computers in commercial drones interpret the payload as aerodynamic disturbances and attempts to correct for it. This occasionally results in the aircraft performing in a non ideal way.

CREW-BASED BOAT CONTROL

Moving upstream or downstram along a fixed longline draped on the outside of flooded vegetationlines or when approaching floodd treelines from downstream using the Kiwi Method

Line-guide through carabiner attched to runner keeps the rope between tubes

Anchor around tube

QRAB progress-capture belay device (see inset pic)

Highnovate's QRAB is a mini-tactical descender. The red button allows quick-release from the rope but NOT while under direct load

ASCENDING A FIXED LINE

Pulling against the flow with a rope-grab on a long line with the QRAB functioing as a progress capture (with the rope tail being continually pulled through)

FPV drones do not react to outside disturbances in the same way and enables the pilot to manually control the load and maintain precise control and confidence.
FPV systems are very affordable and practically disposable. The aircraft can range from $1000-$5000 and in most cases can be repaired in couple hours for a few hundred dollars.
Some downsides to Commercial systems are that they are very expensive, or difficult to replace if damaged. They have a lower payload capacity as they are not designed to carry heavy cargo. Commercial systems are typically harder to transport and require an open area to launch and land. Aircraft are typically large and heavy making them difficult to transport by foot.

There are also disadvantages to using DIY FPV systems. The major one, is the level of difficulty to become a proficient FPV pilot quickly. Although It can take a year or more to gain the necessary skills, simulators and networking with FPV pilots can shorten the learning curve. Next is they are not user friendly. They are DIY multi-rotors that require patience and skill to troubleshoot problems. It is a steep learning curve, but well worth the required effort.

Personally I prefer FPV systems as I feel more in control of the aircraft and have a better sense of spacial awareness. The power to weight ratio is also much higher making it easier to pull heavy loads with confidence. Typically a whole kit can be consolidated to a backpack and the aircraft can be deployed in confined areas and from someone's hands if there's no clear area on the ground to deploy and land in.

ASSISTED BOAT OPERATIONS

IRB Inflatable Rescue Boats make excellent rescue platforms, however, they require a high level of competence for the crew to operate effectively in the current. This type of training is difficult to obtain and more difficult to master. Whether motorized or non-motorized, boat handling skills presuppose a great deal of time and investment on an ongoing basis. Skills are easily lost, and trained personnel are often placed in flow states and conditions beyond their comfort or skill level. This occurs with specialists as well. The decision to utilize a boat of any type in moving water in a rescue setting starts with training in how to deploy the boat in a fully controlled manner remotely, with and without a trained rescuer from shore.

When properly trained using rope-based systems, the use of a boat on a tethered rope system presents less risk than the use of these boats roaming free in and around the river. This judgement stems from the fact that when boats are tethered, at least shore crews are capable of recovering the craft (in most cases) and having containment at the rescue site. It also requires less expertise and skill in the basic use of the craft involved. The rope systems and shore-based operators effectively impart a degree of controlled brute force that can overcome the problems of countering water flow. Therefore the safety factor of tethered vs. free operating craft is strictly a function of the training and expertise of the rescue team involved. There are many boat operators trained to perform in harsh conditions without ropes in the water and should be allowed to do so within the scope of their training and experience without the 'interference' of shore-based operators

who are not experiencing the flow and boat-handling characteristics. Experienced boat crews know when it's too hazardous to allow free boat operations and should be trained to remotely control light inflatables using floating, high strength rescue rope to access and evacuate from high risk sites and the conditions presenting in that moment…volume, gradient, features, debris, suspended load, flash flooding, specific atmospheric cells. In each of those areas, lessons, techniques, and equipment can be swapped into or from other areas of access and rescue. We are always looking for a way to do things faster and safer with less (and sometimes more) equipment or entirely new approaches that require assessment and serious evaluation, changes that directly affect how we approach what we do and how we operate and maybe contrary to years of prior training and knowledge. Drones is such a development. Five advancements involving drones have the potential to influence the operational landscape for swift water rope-based access.

1. Stronger, lighter floating water rescue rope
2. Line capture technology and evolutions it has generated in remote loop anchoring techniques.
3. UAV systems both small commercial and custom FPV quad-copters with powerful lifting capability for their size and cost.
4. Radio controlled drop systems utilized to haul and release rope much longer distances.
5. Compact, light inflatable rescue devices purpose-built to be precision flown or thrown accurately.[Quick Collar}

UNMANNED AERIAL VEHICLE/DRONES

Drone-based floating rope delivery methods can affect how we keep rescuers safe while expanding our capability and flexibility to access and deliver essential resources to a rescue site such as flotation, rescue rope, and equipment, and can be used to set into position and build an entire rope based evolution, from shore without putting a rescuer in harm's way when conditions are too risky for rescuers to enter the water.

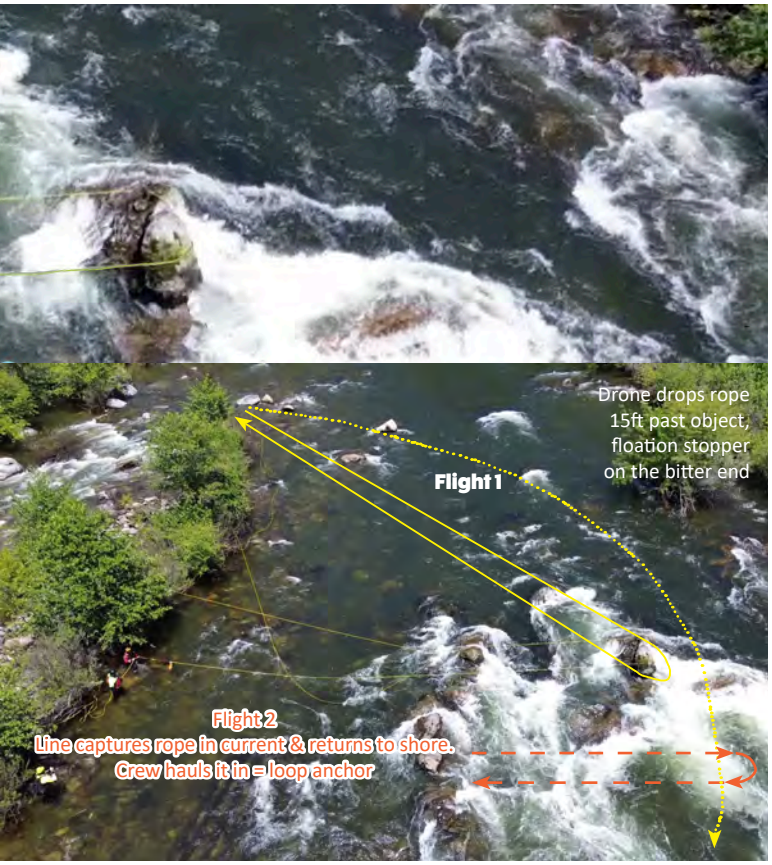
Drone-delivered floating rope-based interventions can be deployed quickly from shore and under the direction of SRT-trained teams, are designed to be 'access and containment'-focused in preparation for human-rescuer intervention which will by that time involve far less risk than traditional swiftwater contact rescue.

METHODS

1) **Deployment of floating static rescue rope** 1/4"/6mm to 3/8"/9mm diameter suitable for rope-based interventions at distances over 400ft/121m over high energy channels/rivers

2) **Delivery of inflatable rescue collar/PFDs** to rescue sites attached to rescue cordage capable of evacuating safely using pendulum method and shore-based line capture. No rescuer is needed if the victim is capable of self-rescue with assistance

3) **Delivery of rescue cordage and inflatable quick collar to fast-moving swimmers/victims** in high energy channels accurately across and downstream in chase function up to 500ft/150m (give or take a 100ft/30m). Using a pendulum belay to shore augmented by line capture assist to speed exit.



4) Full chase mode downstream to deliver Rescue *Quick Collar* to runaway rescue swimmers or flushed victims.
These are next level rescuer containment and downstream protection strategies for pre placed teams on standby or teams fully deployed for high risk active flooding events.

5) Remote Access capability using drones to sew technical rope-based solutions (Kiwi method routinized by line capture) to access mid-channel rescue sites from one side of the river.

6) One-sided fast access methods/evolutions (see images left) with long-distance application capability due to drone hauling rope and line capture capability. The implication here is in extreme conditions of water flow or gradient it is possible to now safely access from shore using loop anchors to build Tension Diagonal to send inflatable boat or rescuer+boat if needed. This is a two step, 2 flight method. First flight deposits the rope past object anchor to dangle in current. Second Flight captures and returns the rope to shore.

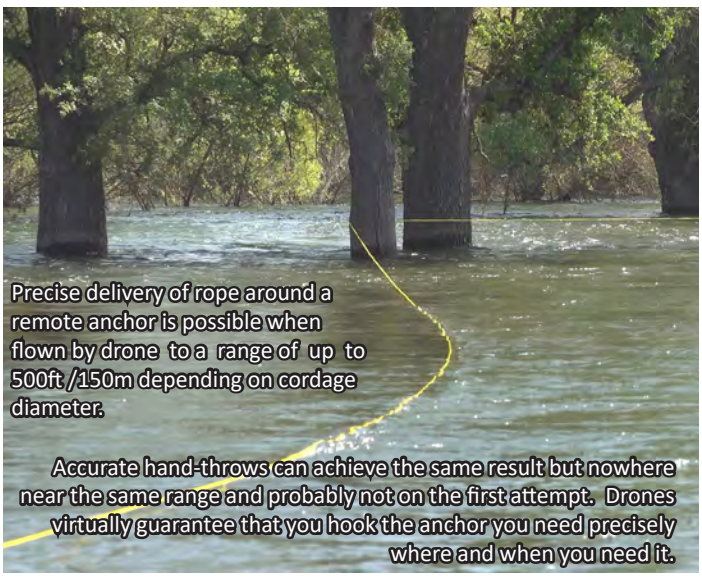
7) Direct remote anchoring techniques using drones.
This is not limited to *Reach* dual use or a Line Capture/ Anchoring device

A. Direct drop of device to targeted area, to snag, jam, chock in rock, boulders, trees, vegetation for "access advantage" to set steep angled>50 degrees TD anchor to assist inflatable boat access, guide rescue swimmer, move equipment…PFD etc.

LONGLINE VECTORING

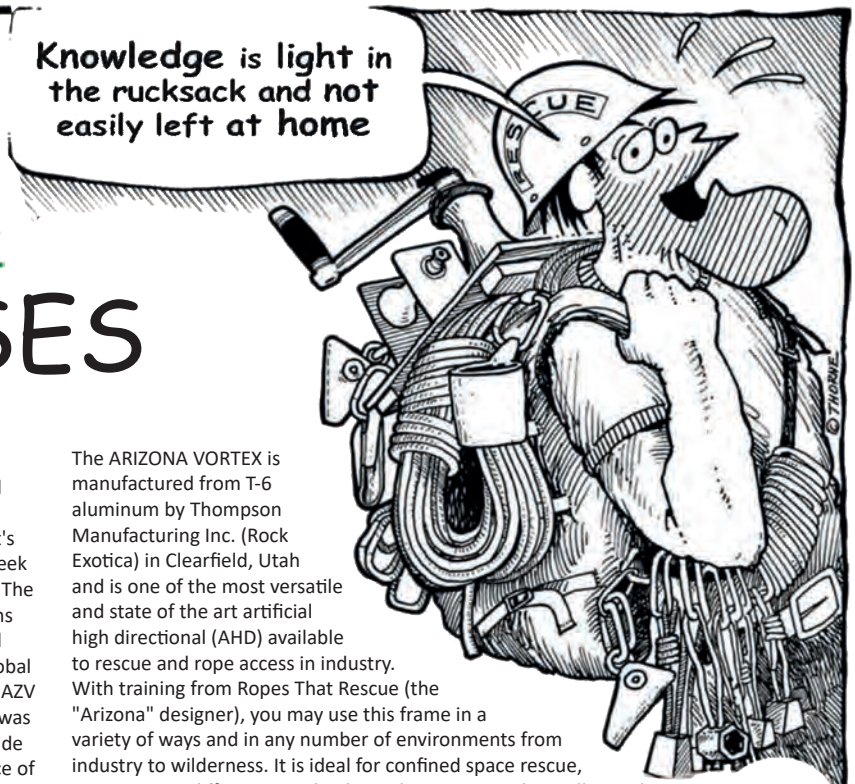
Conditional anchor, pull tested through load arc.
B. Drone looping object, tree, or urban pole - done flies past 30ft, initiates wide turn around object and drops Reach (line capture device) across the looped rope, when hauled in, captures own rope creating a mechanical girth hitch anchor.

There are many applications for these methods: Downstream progressive use of loop anchors allows a light inflatable and a single rescuer to pendulum and ascend to the loop anchor, in many cases this is the actual rescue site. This is the safe, gold standard method of moving a boat and rescuers from downstream to upstream through tight treelines to access stranded swimmers. Drone based line hauling operator skillsets have opened up this technique to application at distances that greatly expand shore based rescuers ability to safely access from shore.



There are important force multiplying effects that need to be taken into account; water drag and vegetation snagging in particular but these have less impact with more powerful hauling capabilities that FPV QuadCopters provide. Specific piloting skillsets and training methods are also key to overcoming such problems and our collaboration research group has developed, tested and passed on these skills to highly motivated novice pilots from various programs. A swift water-proficient drone specialist trained to fly FPV evolutions becomes the gopher, for all manner of tasks; remote rigger, line flier, line capture, remote anchor, builder of fast access rope based protection systems that all usher in a new, key job description, that greatly increases the safety and capabilities of the entire team. Our goal was to train assets from top tier, forward thinking teams that have year-round training requirements. Numerous other access options are made possible from the accurate presentation of functional floating rope at a distance. There is line capture and its ability to create

Ropes That RESCUE ®Ltd.



2025 COURSES

ARIZONA VORTEX COURSES

The ARIZONA VORTEX (or AZV) is expressly considered an "artificial high directional" used as a true 1) high frame directional (at the edge or over an opening) or 2) anchor frame. It is so named from it's development in the rugged highlands of northern Arizona's Oak Creek Canyon through the rigging and rescue school, Ropes That Rescue. The term "vortex" came from the many such-named red rock formations in the Sedona and Oak Creek Canyon area which serve the spiritual gnostic cult community and has become a mainstay of Sedona's global tourist popularity. Reed Thörne, the school's owner developed the AZV with the help of Rock Thompson at Rock Exotica, in Utah. The AZV was created from years of trial and error and of having worked with crude but functional lashed wood frames at RTR. It represents the essence of at-the-edge frames which no standard tripod can match today.
The A.Z.O.R.P. (AZORP = Arizona Omni Rigging Pod) is a valuable accessory to the ARIZONA VORTEX which adds to its ultimate versatility when used in tandem. Anchoring frame back-from-the-edge rigging monopods, bipods and tripods may therefore be constructed using the AZORP + VORTEX adding valuable rigging elements to any rope rescue or rope access operation or job.

The ARIZONA VORTEX is manufactured from T-6 aluminum by Thompson Manufacturing Inc. (Rock Exotica) in Clearfield, Utah and is one of the most versatile and state of the art artificial high directional (AHD) available to rescue and rope access in industry. With training from Ropes That Rescue (the "Arizona" designer), you may use this frame in a variety of ways and in any number of environments from industry to wilderness. It is ideal for confined space rescue, mine rescue, cliff rescue and industrial rescue. It is also well suited to bridge inspectors, rope access, the construction trades and the movie industry.

We offer many instructor-level workshops on the Arizona VORTEX in differing locations around the US, Canada, UK and Australia (and around the world). See the RTR Open Enrollment Schedule for these offerings under "Artificial High Directional Workshop" or AHDW.

WORKSHOP	STATE COUNTRY DATE & *FLYER*	TYPE	VENUES Classroom-Wilderness or Industrial	Req. Equip *You will NEED*	Dura-tion Days	Physical exertion Easy 1 Hard 10	Prerequisites (if any), Program Liaison & Special Notes	Location & Sponsor *Open links for Program FLYERS!*	Tuition *(Other non-RTR costs may apply)*	RTR Lead Instruc-tor(s)
Mountain Rescue Workshop	AZ March 29 April 4,2025	Mountain Rescue	Classroom & Wilderness ONLY	MRW Equip List 7/22	Saturday/ Friday *7 days*	6 some hiking	**No Prerequisite** Prior rope rigging experience and climbing ability are strongly recommended.	See Website for Flyers See Jerome Fire MRW Flyer	$1,700 *(50% off AZ Volunteer discounting available)*	Reed & Keith Thorne
Artificial High Directional Workshop	UT May 4-10, 2025	Arizona Vortex	Classroom Industrial & Wilderness	AHDW Equip List 7/22	Sunday/ Saturday *7 days*	6 some hiking	**No Prerequisite** Prior rope rigging experience strongly recommended.	**Utah USA** *Rock Exotica* & *South Davis Metro Fire* See Utah Program Flyer	$1,750	Reed & Keith Thorne
Team Skills Rescue Workshop-5	CO May 12-16, 2025	General Team Rescue	Classroom & Industrial ONLY	TSRW Equip list 7/22	Monday/ Friday *5 days*	2	**No Prerequisite** Prior rope rigging experience recommended. There is a 5 day option for those not wishing to use the wilderness venues at Red Rocks Amphitheater Park. All students must be present for first 5 days of this workshop. REGISTER with Denver FD Liaison joshua.odendahl@denvergov.org Phone: (720) 618-5319	**Colorado USA** Denver Fire Dept. (Taught at COORS FIELD, other local Denver venues) See Denver Flyer	$1,750 Register with DFD Liaison (see left)	Reed & Keith Thorne
Team Skills Rescue Workshop-7	CO May 12-18, 2025		Classroom Industrial and Wilderness		Monday/ Sunday *7 days*	5 some hiking		**Colorado USA** Denver Fire Dept. (Taught at COORS FIELD, RED ROCKS PARK and other local Denver venues) See Denver Flyer	$2,000 Register with DFD Liaison (see left)	
Personal Skills Rescue Workshop	MI May 13-19, 2025	Solo-Semi Solo Rescue	Classroom Industrial & Wilderness	PSRW Equip List 4/21	Tuesday/ Monday *7 days*	8	**No Prerequisite** Good physical conditioning strongly recommended. Liaison:Michael DeCraene	**Michigan USA** Grand Ledge – Auburn Hill See Program Flyer	$1,750	Michael DeCraene
Tree Rescue Workshop-Firefighter	CA TBA October 2025	Bottom Up Tree Rescue	Classroom & Wilderness ONLY	TRW-F Equip List 7/22	*7 days*	10 tree climbing required	**Prerequisite: Climbing Trees** This program is specifically designed for responding tree emergency personnel in excellent fitness	**California USA** Nevada City See TRW-F Program Flyer	TBA	Keith & Reed Thorne

www.ropesthatrescue.com

legitimate loop access anchors and “fast access advantage” where we chock, jam or clip conditional pull test anchors.

These are defined as a **remotely placed anchors** where a REACH device or similar is thrown or flown across a high risk waterway to anchor/clip/jam chock for the purpose of gaining “access advantage”. this is pull tested only to ensure you can't pull it out, or dislodge it. Even if you can't see the anchor you can and should use it to gain access advantage.
Additionally it is possible to provide safe access by looping an entire grouping of trees midstream rather than just one, this is quicker and simpler and provides very quick to access from downstream or from upstream anywhere along the outside of vegetation lines.
The greatest benefit to shore based crews is the flexibility to extend floating rope-based solutions quickly in a manner that allow safe access from shore at distances that make it possible to rescue where motorized boats and helo-based hoist assets have been previously been the only option. This is an important and vital capability for swiftwater teams and overall resource allocation. These additionally remain the lowest cost and lowest risk interventions in the toolbox. Drone assets are a boon as a force multiplier to trained teams with immediate application benefits.

MINIMAL EQUIPMENT RESCUE TACTICS - MERT

By **Sean Norman**

Sean has been using the Reach device for over 20 yrs with his team. MERT is his team-based version of Swiftwater 2.0, we stole it for our drone program, cause it works!

We rely on our Reach Devices as a vital tool in our missions on the river. It accomplishes the task of truly creating a “layered” series of safety systems. The tool allows us to turn a standard throwbag from a single role tool to a dual role tool. By the quick addition of a Reach we can incorporate it into our systems to now not only just catch a line, but now we can vector and more importantly gain access to a mid river site when we only have access to a single side. Where we have found that the tool has really revolutionized what we do is in the concept of Minimal Equipment Rescue Tactics. With MERT we reinforce the basics and the use of smaller less complex systems to accomplish rescues. Often this means.. what you have on your person. When we combine the Reach with tools like waist worn throw bags, small pulleys and a handful of carabiners we actually have a very diverse range of options available to us to accomplish rescues. We encounter MERT situations in rural and remote situations, and in urban floods where we are pressed further and further from our vehicles or base of operations.

MERT tactics involve the use of hand held tensioned diagonals, quick capture methods where the Reach is used in conjunction with a throwbag to quickly move a boat into a mid river entrapment site. The “Kiwi” method is the cornerstone of this operation. A throw bag is thrown upstream of an obstacle and allowed to float down, it is then captured by a Reach device. You now have created an anchor point and depending on current conditions you can advance the boat to the obstacles or pull a larger diameter line through.

In the true form of MERT we look to remain as light as possible to accomplish the task. We look to use smaller rafts or “Paddle Cats”. We have had great success incorporating small pulleys positioned just behind the Reach device. Once the Reach has been established you can now create a true continuous loop to ferry rescuers and victims to and from an obstacle such as a vehicle trapped in a flooded roadway. Once you begin to experiment with MERT tactics you can develop many solid rescue practices. The cornerstone of all of these tactics is the use of the Reach device.

TUNNEL COLLAPSE

PRE-RESCUE RISK ASSESSMENTS & TUNNEL BORING – An engineer's perspective

Charlotte Ina Sterland
interviews Dr Rita Sousa

Following three collapses in the Porto Metro system in 2001/2 Portugal's Dr Rita Sousa compiled a comprehensive database of tunnel accidents in developing a risk assessment model that combined changes in geology with construction methodology options to predict the lowest level of risk

Title pic: The Utterakhand Collapse in 2023 trapped 41 workers for 14 days.

Last year's tunnel collapse in India highlighted the advantages of having skilled miners using old-school methods when plan A to use a giant boring machine to reach the trapped workers ended with it breaking down. Instead of our usual focus on rescue this article discusses how to avoid these situations in the first place. Dr Rita Sousa is associate professor at NYU and was design Engineer during the construction of the Lisbon Metro. Charlotte spoke to her a month or so after the Utterakhand Tunnel Collapse in the Indian Himalayas in November 2023. She Offers Insights into what can lead to tunnel collapse disasters in a variety of terrains and how To make operations safer.

WHAT IS YOUR BACKGROUND?

I did a PHD and started working as a tunnel design engineer for Lisbon Metro. I was fascinated by tunnelling and how tunnels are designed. I had designed other structures; I normally do the design and know nothing about the construction. With tunnels you follow the construction and constantly reassess your design as you go. Then, after 3 years of doing that, I went to do a PHD with a focus on risks and tunnels. I collected data on tunnel accidents to find the major causes, etc..I found most of the tunnel collapses were a combination of things, and the Indian tunnel collapse was no different. The initial survey was lacking. There were some poor tunnelling practices in terms of maintaining the tunnel profile. Sometimes, we need to go and re-profile the tunnel. This could have been done poorly and would have been one of the main causes of the collapse. There was also a lack of emergency exits. A chain of events lead to that incident.

The work I did at MIT was on risk assessment; trying to identify risks, not only these kinds of freak accidents, but also geology related. This translated into financial risks. We then have techniques to consider uncertainty. When we go in we don't know the exact geology there. This has effects on construction costs. We find ways to assess risks at the planning stage. We could find indicators that the risk level is unacceptable, so we need to get more information about this part of the tunnel, or that we need more info about that part of the tunnel. There might be some shear rock, or we need to put more boreholes under the ground and get to know the area better.

DOES THE PRESENCE OF SHEAR ROCK MEAN THERE IS A RISK OF COLLAPSE?

On the Indian Tunnel collapse; one expert opinion I read was that there were several areas which could have been a shear zone: Normally these can be quite long, but if weaker, you know exactly where they are and might want to get more info on this during the tunnel construction. Sometimes it's possible to do a pilot tunnel which is smaller in diameter going through that zone, which means you can gather info and say, 'we need to realign the tunnel,' depending on how effective it is.

Advances like early identification of geological hazards allow you to collect some data, reassess the construction method, (this was done in one of the alpine tunnels in Lochenberg), where they bored a pilot tunnel first to get more info about the geological zone, about the cross-section, then redesign the tunnel.

We can do things prior to tunnelling and during the survey, but can also do things during tunnel construction. Another thing which was important for the Lisbon Metro was monitoring. Most ongoing stress adjustments are there; when there is still no physical [man-made] support. When there is support, it should be stabilised, we then monitor the stability of the tunnel, while excavating. It's important to follow the monitoring, to

see if things are stabilising and see if we want to stop and take people out. We don't know if this was done during the Indian tunnel incident, but it seems that there were a lot of construction issues and poor tunnelling practices and perhaps negligence in the profiling work.

When re profiling the tunnel, stress is redistributed which may weaken or apply more load to other zones of the tunnel. So we are, in effect, messing with something which was already stabilised. That could have been one of the issues they faced, when re-profiling areas. That can cause the collapse of an inner part of the tunnel which had already been excavated. If the tunnel had already been built, it would have had the lining so should have been stable. If doing re-profiling work and not studying the repercussions, we may be increasing the load or destabilising certain areas that have already been stabilised. This may be one of the things which happened.

So after finishing one section, they could have gone along and found a weaker zone but were now pushing on a weaker section.

In the case of the Indian tunnel collapse, re-profiling work was being done, which means they were unable to maintain the required profile of the tunnel. It may have had the right cross section, even the correct diameter, but could not be continued further into the mountain. Going back to zones which had already been excavated to change the profile of the tunnel, would have meant redistributing the stresses again and destabilising other zones which were already stable.

Accidents happen when not thinking about the consequences of this. I don't know all the specifics of the Indian tunnel, but re-profiling is a risky manoeuvre, if not planned properly. The aim is going for a certain tunnel diameter where this is possible. We can go in with a plan to do it like this but might need to make it smaller or larger. It seems to me they were not able to maintain the right profile of the tunnel and excavate the right tunnel profile. I imagine the tunnel was 6m and they weren't able to manage that. They have gone back and re-profiled the tunnel.

IT NEEDED TO BE THAT SIZE?

Yes, if they didn't achieve what they wanted and they had to reshape or modify the tunnel walls, that could have contributed to the collapse, as this would now definitely be inducing some stress. There could have been instability if this work was not planned properly. It was an operation which was going to cause some effects on what has been done already and was stabilised. That could explain it somewhat.

SO WHAT CAUSED THE INDIAN TUNNEL COLLAPSE?

It's hard to tell immediately: There is a lot of literature on the Indian Government about the techniques used.
I think it's a combination of things. From our database of tunnel accidents: In most cases it's a chain of events and a combination of things: The most prevalent is unpredictable geology, and ground conditions which were not well predicted. A combination of this and a lack of monitoring often result in a disaster.

SO MONITORING IS REALLY IMPORTANT?

Whatever your plan: You have to ask: Are we using the right ground equipment? Are we getting the right results with certain formulae? Mostly deformation monitoring is done inside the tunnel. We do also have sensors above the ground generally.

To get an idea of internal deformation around the tunnel, we look at what the tunnel excavation is doing to the surrounding rocks; the formation inside the tunnel, etc. We have several measuring stations around the profile of the tunnel. We measure displacement towards the inside of the tunnel, as close to the face as we can. With the back part of the tunnel already excavated, we want to see the formations stabilising at a certain point. If you go pick a certain one, you want to see the tunnel stabilise, as you now have the lining. If we don't see this we get worried.

SO WE NEED TO MAKE SURE THERE IS NO MOVEMENT?

Yes, things start to stabilise a few metres from the face, those sections should be stable. We determine this also during the design phase; what the rates are, which start warning us. For all these calculations; if we get a measure of movement (x metres per day, this kind of thing), it's worrying; that's the red alert. There is an actual story that goes on during the design, we are looking for a way of monitoring what is a code alert situation. This can be purely to do with the geology.

We definitely don't want to damage buildings though.

THE LISBON COLLAPSE WAS RELATED TO IT BEING SOIL?

In Porto, yes. I collected the data, but I was not part of the design team at the time. I was in Lisbon. There was a collapse; a wrongful operation of the Tunnel Boring Machine (TBM).

SOMETHING NOT STABILISING?

Voids were created; there was another accident where it occurred behind the TBM. Voids were created. Operators found ground conditions they thought were more favourable, but no one was monitoring them, or paying attention to certain conditions: The soil was coming out. There was a period of between Christmas and New Year, when there was some lack of communication between operators and engineers and designers. So it's a lot to do with monitoring.

It's important because I think as much as we can do during the planning phase, we can never predict what will happen. We have to be on top of monitoring.

In Porto, the TBM was adapted for both rock and soil. Operators thought they were going through rock and were operating as if going through rock but it was actually more like a soil formation. That was the main reason for what happened in Porto. It's the same with geology; when we see something which does not look like our expectation.

YOU MENTION THE TUNNEL BORING MACHINE (TBM) A LOT. DOES THIS USE FORMULAE TO ANALYSE DATA OR DO OPERATORS HAVE TO DO THIS THEMSELVES?

These are very popular in urban areas as they provide shields, and they can provide some support at the face. Sensors measure a lot of things; that data which is collected is used to try to predict hazards, or the geology, if changing. I did this during my thesis. I looked at the data coming from the TBM, the penetrating rate, the torque, the earth press and the thrust to see that collection of data gives us an indication of the ground we are going through. This TBM cannot see the face of the tunnel. It relies on data from the machine. In trying to find signature ground conditions we were able to detect the geology of how the ground conditions were changing. We wanted to detect several metres before where the accident occurred. Something of this sort is used to say how the geology was changing, to check things are correct, before going in, full force.

It's not a perfect model, but we were able to see some changes in the ground conditions just by looking at certain sensor readings; especially looking at advances in machine learning. We should be able to interpret this quite quickly. Predicting what's coming ahead may be more challenging, or not possible, but predicting the geology's conditions are changing could have been beneficial.

HAS SOMEONE CREATED A SOFTWARE FOR THIS?

We have been doing work on this ourselves, but it's very challenging generating these models. We have data for two tunnels in Porto. We have used some models in one tunnel and tried to predict conditions in the other tunnel and it's challenging even in the same city, with similar conditions. It's a challenge to use the data from one tunnel to another and get good predictions, so we are working on that, trying to also get more data, from other companies; but it's difficult to get data from TBM manufacturers. It's challenging but I have been looking into that with students. That is the future. TBM at Porto (20 years ago or more) was measuring 170 sensors, so there is a wealth of into that needs to be used and operators only look at some of this data.

IT'S SENSITIVE, PRIVATE DATA?

Yes, we can see a lot of noise for sure. We have data from many years back, so we don't know the new TBMs. They should be similar but can smooth it out. It's measured every ten seconds, and can smooth out the spaces. When we measure every ten seconds, we see a lot of up and down, but are more interested in the trends.

So one thing is that we should regularly be taking readings and then using this data in the right way.

COULD THIS BE USED IN ALL TUNNEL CONSTRUCTION PROJECTS?

No, for example, in India, they weren't using TBM, it was drill and blast. In Lisbon, we had also drill and blast for formations where there wasn't rock but there was also a sequence excavation method. So it depends on the geology, but we had TBMs for the most part.

AS THIS WAS IN AN URBAN AREA?

We had TBMs on the most densely populated areas, where we could we have open areas as it is safer and we could cut to the surface. In certain areas we had this sequential excavation method, so it was a combination of things.

DO A NUMBER OF ESCAPES EXIST?

I can't remember the actual distance required, but I designed a few so we had to have escape exits yes.

SO IT'S HARDER IF EXCAVATING A MOUNTAIN ?

Yes, essentially. They didn't have these emergency exits in India, which is astounding. There will be a post accident survey.

WHAT FURTHER WORK ARE YOU DOING ON TUNNEL DATA MODELLING?

In NYU we have a centrifuge which allows small scale models, of foundation tunnels, etc. We are trying to build mini robotic TBMs to look into these aspects of formations and we are creating 3D formations using centrifuge testing. We are continuing to work on TBMs and try to improve them.

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