





10th European Cave Rescue Meeting 2016

**Organized by Croatian Mountain Rescue Service on behalf of
European Cave Rescue Association**

Cave Rescue Commission Croatian Mountain Rescue Service

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Petzl NEST modifications for cave diving rescue operations



Cave Rescue Commission Croatian Mountain Rescue Service
CAVE DIVING RESCUE GROUP



What will we talk about?

- Why do we choose Petzl NEST?
- Our experience so far?
- Goals we have set
- Challenges recognized
- Solutions made to address the challenges



Why do we choose Petzl NEST?

- Proven tool through out the years in HGSS
- Quality of workmanship, durability even in toughest of conditions
- Easy adaptability to all rescue scenarios
- Readily available in major HGSS stations in Croatia



Our experience so far?

- First time used in 2008 in Zagorska Mrežnica
- Attendance in 2011 to a course in France on handling the stretcher underwater
 - Best to our knowledge, the French rescuers were the first to adapt NEST for cave diving rescue
 - Our modifications are a result of learning and improving on our experience gained from the French
- Yearly exercises with stretchers in underwater scenarios
- Combined all experiences from past years into a HGSS NEST modification



Goals we have set

- Provide a **safe** and **secure** way of transporting an injured person in a dry suit from a flooded channel or underwater cave
- Solve all recognized challenges in the same durable and adaptable way as the stretcher itself
- Provide solutions which can survive all tough conditions
- Make a **reusable set** of modifications, packaged and ready to be added/removed from **ANY** Petzl NEST stretcher



Challenges recognized

- Securing the tanks on the stretcher
- Balance and trim of the stretcher
- Securing the injured person in the stretcher



Challenges – SECURING THE TANKS ON THE STRETCHER

- Two tanks on the stretcher – **redundant** breathing mix source
- Easily **reachable** by rescuers
- Mounted **securely**
- Side oriented membrane for breathing in **all positions**



Challenges – BALANCE AND TRIM OF THE STRETCHER

- What are **balance** and **trim**?
 - Balance is countering both positive and negative buoyancy to become neutral in the water column
 - Trim is regulation of the position in the water column to become as horizontal as possible
- Balance and trim are crucial in cave diving → avoid raising silt, streamline swimming
- While diving the diver himself regulates balance and trim by adjusting the weights positioning and inflated air in various pockets for balancing (like the dry suit or the BC)

- With stretcher, the **rescuers** need to regulate it for the stretcher and the injured person!
- Additional challenge - balance and trim must be adjustable **while** diving!
- Even further – trim must be **precisely** adjustable to raise feet or head **independently**!
- Finally – as different persons will be transported, **weight quantity** and distribution should be adjustable!



Challenges – SECURING THE INJURED PERSON

- Precondition for safe transport – securely and tightly tied in injured person
- Dangers while diving include falling out, losing the regulator, getting scared and so on
- In dry caving rescue operations the factory straps work perfectly

- Straps are too short!
- Issues because of dry suit and thick undergarments
- Issues with dry gloves



Solutions made to address the challenges

- Keep the basic idea in mind – provide a **reusable set** mountable on **ANY** Petzl NEST!
- Securing the tanks on the stretcher
- Balance and trim of the stretcher
- Securing the injured person in the stretcher



Solutions – SECURING THE TANKS ON THE STRETCHER

- Make an **easy** to mount system which holds the tanks in a **secure** and **tough** way to withstand all rescue scenarios!
- Inox **tank holders** – 2 for each tank – 4 in total for two tanks!
- Added **cam straps** for the tank on each tank holder
- Tank holders are guided in **gap areas** on the sides of the stretcher
 - One near the head, one near the middle of the body to hold each tank
- System to secure and connect the tank holders with **bonding pins**
 - From left tank holder on the head to the right tank holder
 - Two bonding pins are set in place for top of the bottles and bottoms
 - Pins are connected to the tank holders with small carabiners which fit in the eyelets on the pins



Solutions – BALANCE AND TRIM OF THE STRETCHER

- Two issues to solve – first the **balance**, then **trim**
- Trim out the **head** and the **feet separately** to allow precise trimming through different environments
- Balance?
 - Fighting the negative buoyancy with positive buoyancy and vice versa
 - Add weight to get negative, add air pockets to get positive
 - Modularity of Petzl NEST comes with wooden boards in the bottom of the stretcher
 - We have replaced the wooded boards with inox beams
 - Option to add / remove weight by adding 2 or 4 beams, or by adding thinner or thicker strips
 - Add positive buoyancy force using a dry suit on the injured person or a wing BC bladder
 - It is a job of the rescuer to use balance the stretcher



Solutions – BALANCE AND TRIM OF THE STRETCHER

- Trim?
 - When balance of the stretcher is neutral, rescuers need to adjust their **trim**
 - Injured persons **head** must be **slightly raised** when transporting him
 - To pass various combinations of channels, trim needs to be **adjustable while diving**
 - For these reasons - **precise** trim adjustment must be possible!
- To achieve precise trim, we've put **two** separate **inflation options** on the stretcher
- First is the **dry suit** of the injured person – raises the head and front part
- For the feet, we put a **wing BC bladder** and strap it to the legs – raises the feet when needed



Solutions – SECURING THE INJURED PERSON

- Simple issue to solve – the **straps** are too **short**!
- Straps on the **shoulders** need to be made longer, and the **side straps** securing the person itself
- The added straps do **not** need to be of the **exact width** as the original ones, but simply close
- Our added straps are a couple of mm **narrower** because these can be found at all mountaineering shops
- On the **shoulders 2 new straps** are added in between the current ones and the buckles
- On the **side 4 new straps** are added to make the current ones longer
- To avoid additional buckles and weak points, the straps are connected using **Water knot**
 - As there is no big force on these straps, knots can be added and removed easily!

In conclusion

- Why NEST?
- Experiences?
- Goals?
- Challenges?
- Solutions?





Thank you!

Questions?