# Things That Go Bump in the Night

"To err is human". We, as human beings, make errors and as technical rescue operators we can learn from those errors we make during operations. The popularity of the books "Accidents in North America Mountaineering" and "The Snowy Torrents" show the capability of humans to learn from the mistakes of others. Newer methods for risk mitigation include the "Just Culture" used to reduce medical errors and "FACETS" which is learned as a model in human factors for avalanche avoidance and education. We can improve our risk management by adopting and understanding various risk mitigation strategies as team members. This presentation focuses on various strategies to improve operational safety and risk mitigation including: A Technical Rescue Near-Miss Reporting System, Crew Resource Management, Use of the GAR Checklist, Briefing Use in Emergencies, Blindness, Confirmation Bias (as it relates to the safety check process) and What Makes Teams Perform at High Levels. We start our journey by looking at three cases that were never reported.

## Case 1

There is a high angle rescue in progress and the edge line has been attached to the responding agency's ambulance. The Emergency Medical Responder/Driver unties the edge line without telling anyone, including the edge attendant. His purpose is to get his unit back in service.

## Case 2

A fire department on scene of a low angle rescue and victim at the bottom of a cliff decides to move their 4 X 4 rescue unit in line and employ their front mounted Warn winch to pull the stokes litter up the slope with the victim in it.

## Case 3

A new employee on his first day of high angle training is assigned the edge position. As he approaches the edge to send the litter down, his edge line catches under wood debris. It suddenly releases and he is propelled forward. His edge line saves him from serious injury or death.

These cases illustrate different educational learning points that a technical rescue "near miss" reporting system can capture and pass on to other teams and rescue professionals.

Case 1 shows the importance of securing vehicles used as anchors in a systematic matter on scene and briefing scene personnel about rescue anchors.

Case 2 is an application of equipment that is not supported by Warn winch manufacturers. This illustrates the educational point demonstrated in several "near miss" reports.

Case 3 illustrates a standard safety method that prevented a serious injury or death.

Technical rescues are infrequent events that can challenge responding personnel. It has been documented that human factors are the cause of accidents in 60-70% of aviation accidents. The author collected web-based technical rope rescue near miss and accident reports from numerous sources. He then checked other near miss accident report systems for firefighting, avalanche and

emergency medical services. The author looked for patterns and common themes in near misses and accidents in technical rope rescue.

Data collected included 17 rappelling accidents listed in the federal OSHA website, 15 near misses/accidents listed under the technical rescue section of the "Firefighter Near Miss" reporting system http://www.firefighternearmiss.com/ , two reports found on the ITRS website that involved team accidents. Data sources also included The Mountain Rescue Association website detailed analysis of a National Park Service high angle rescue accident along with the MRA book Accidents in Mountain Rescue Operations by Charley Shimanski. The National Institute Occupational Health (NIOSH) investigation conducted on a Firefighter Line of Duty Death (LODD) investigation F2011-12 released in October 5, 2011. https://www.cdc.gov/niosh/fire/reports/face201112.html. A published article in "Fire Engineering" and presented at ITRS on "Rope Rescue/Rappelling Deaths" by Christopher Feder. In addition, the author looked at other near miss reporting systems including the; The Avalanche Near Miss System which has 19 near miss events recorded and the Emergency Medical Services EMS EVENT (EMS Voluntary Event Notification Tool) which had 40 reports in 2017.

After examination of the above sources and reports the author concludes that a national based Technical Rescue Near Miss Reporting System would be beneficial to improve locating, sharing lessons learned and educating technical rescue teams about other teams' near miss events. Another tool that can increase safety and manage the human factor that the aviation industry uses that would be invaluable to technical rescue operations is the aviation industry use of "Crew Resource Management", formerly known as "Cockpit Resource Management". The newer title encompasses a team approach for aviation safety that includes the whole flight process.

The aviation industry has used "Crew Resource Management" since 1978. These management strategies were used after several high-profile aviation disasters including the crash of United Airlines Flight 173 outside of Portland, Oregon on December 28th, 1978 when the airplane ran out of fuel because the flight crew was fixated on a landing gear problem.

"The captain focused on the landing gear problem for an hour, ignoring repeated hints from the first officer and the flight engineer about their dwindling fuel supply. Only when the engines began flaming out did he realize their dire situation. They crash landed in a wooded suburb of Portland, Oregon, over six miles short of the runway. Of the 189 people aboard, two crewmembers and eight passengers died. The NTSB made several recommendations in their report including:

Issue an operations bulletin to all air carrier operations inspectors directing them to urge their assigned operators to ensure that their flightcrews are indoctrinated in principles of flightdeck resource management, with particular emphasis on the merits of participative management for captains and assertiveness training for other cockpit crewmembers. (Class II, Priority Action) (X-79-17)"[1]

"Cockpit voice recordings of various air disasters tragically reveal first officers and flight engineers attempting to bring critical information to the captain's attention in an indirect and ineffective way.

[1] https://en.wikipedia.org/wiki/Crew_resource_management

Experts in CRM came up with 5 step process to bring attention to an unsafe act or situation

- **Opening or attention getter** - Address the individual: "Hey Chief," or "Captain Smith," or "Bob," or whatever name or title will get the person's attention.
- **State your concern** - Express your analysis of the situation in a direct manner while owning your emotions about it. "I'm concerned that we may not have enough fuel to fly around this storm system," or "I'm worried that the roof might collapse."
- **State the problem as you see it** - "We're showing only 40 minutes of fuel left," or "This building has a lightweight steel truss roof, and we may have fire extension into the roof structure."
- **State a solution** - "Let's divert to another airport and refuel," or "I think we should pull some tiles and take a look with the thermal imaging camera before we commit crews inside."
- **Obtain agreement (or buy-in)** - "Does that sound good to you, Captain?"

These are often difficult skills to master, as they may require significant changes in personal habits, interpersonal dynamics, and organizational culture.

Recommendations from “Crew Resource Management” that apply to Technical Rescue Operations include-
enhanced situational awareness, self awareness, leadership, assertiveness, decision making, flexibility, adaptability, event and mission analysis, and communication. Specifically, CRM aims to foster a climate or culture where authority may be respectfully questioned”.[2]

A third method of controlling risk is operational risk management and the GAR process. These processes are used by the United States Coast Guard and National Park Service. The processes are a result of a number of accidents that these agencies experienced. They are based on the following key operational risk management principles.

1. Accept No Unnecessary Risk
2. Accept Necessary Risk When Benefits Outweigh Costs
3. Make Risk Decisions at the Appropriate Level
4. A Continuous Process.

The GAR process is a communication process and risk management tool that is used by participants to discuss and score concerns and risks in an upcoming mission. All the elements are covered in a reverse authority gradient to give the least experienced member an opportunity to be heard at the briefing. The NPS uses an eight element GAR process and the USCG uses six elements. The extra elements in the NPS process are Communications and Contingency Resources. The USCG has just implemented GAR 2.0 which has a Risk vs. Gain Matrix which is lacking in the present GAR process. GAR 2.0 has also added other elements and down played the number system preferring to go to the colors Green, Amber and Red.[3]

The National Park Service GAR APP is located at-

https://www.ncptt.nps.gov/blog/risk-spe-orma-and-gar-calculator/

[2] Ibid
[3] http://wow.uscgaux.info/content.php?unit=085&category=gar-orm


4

SAR GAR is a tool that has been adopted for SAR operations in Oregon and is in the "Technical Rescue Riggers Guide" Third Edition by Rick Lipke with Kirk Mauthner.

Adoption of a "Technical Rescue SAR GAR" is a potential improvement to enhance safety issues involved in the technical rescue operations field. The following areas of concern were identified by reviewing the near miss and accident data:

Technical Rescue SAR GAR

Incident Command/Safety positions filled

Team briefing

PPE established

[4] Coast Guard Emergency Response Operations PPT Lt. Gabriel Klaff,

Environmental hazards

Communications- closed loop

Assignment complexity- have we trained for this?

The Emergency Scene Briefing is another tool that can be used to enhance communications and feedback for the team leader or Incident Commander. This briefing serves its purpose as a short checklist on scene to review actions to be taken and can be laminated into a wallet card.

1) Here's what I think we face;
2) Here's what I think we should do;
3) Here's why;
4) Here is what we should keep an eye on;
5) Now talk to me…[5]

Safety checks used during technical rescue operations are an important component before operations proceed. The safety officer must know about confirmation bias and blindness during his field checks.
These two issues contributed to the death of a firefighter in a rappelling accident in July 2009 and a volunteer in September 2013. The firefighter was checked 4 times by personnel before he rappelled from the helicopter. None of the personnel noted that his harness attachment point was a rubber o-ring.

## Blindness

"A misconfigured harness is a very rare event. Wolfe et al. (2005) demonstrated that when a target is rare, participants are surprisingly poor at detecting it. The rarity of the target leads to "disturbingly inaccurate performance." Rich et al. (2008) explored some of the possible mechanisms for why we miss rare targets, one of them being ending the visual search prematurely. Research in visual attention has also revealed several ways that people don't see what is in their visual field. This is simply how the human visual system works.

Inattentional blindness is the "looked-but-failed-to-see" effect. It occurs when attention is focused on one aspect of a scene and overlooks an object that is prominent in the visual field and is well above sensory threshold.

[5] Adapted from Dr. Karl Weicke. South Canyon Revisited: Lessons from High Reliability Organizations

Change blindness is a failure to notice that something is different from what it was. Large changes to a visual scene are very likely to go unnoticed if they occur during saccades (eye movements) because visual analysis is suppressed during that time.

**Confirmation Bias**

Confirmation bias is a tendency to search for or interpret information in a way that confirms our preconceptions/expectations and to ignore, not look for, or undervalue what contradicts our preconceptions. Hollnagel (2004) states that this feature of human thinking (a strong tendency to look for confirming evidence) is an example of the Efficiency-Thoroughness Trade-Off (ETTO) principle. Klayman and Ha (1987) state that some confirmation bias results are due to over-application of a positive test strategy. A repeated review of an established condition (e.g. a correctly configured harness) reinforces the expectation that the system is in that specific configuration. This is an example of reinforcement through experience which leads one to miss potentially critical anomalies.

The existence of inattention and change blindness, as well as the influence of expectations on vision (confirmation bias), helps us make sense of this tragic event."[6]

The second accident in September 2013 was a result of a faulty hook up on a helicopter lowering operation. The accident investigation reported in Fire Aviation.

"The report concluded that the helicopter crew's safety man did not maintain adequate oversight during flight and hoist operations and that Mr. Krogen's use of his personal equipment "excessively cluttered the area around the load-bearing metal D-ring", interfering with a safe connection and visual inspection. And, "due to the extremely close proximity of the Yates harness load bearing D-ring in relation to the Condor tactical vest's non-load bearing D-ring, and the concealment of both D-rings by the cluttered pouches on the Condor tactical vest, which included a handgun, the [safety man] incorrectly concluded the Civilian Fatality was properly secured".[7]

Technical rescue teams can improve safety and effectiveness by following standing operating guidelines, using checklists such as GAR, using closed loop communications which is a technique of repeating back the message to the original sender who then confirms it with a "yes". Other techniques used to improve team performance are the "briefing and debriefing process and the recently suggested "Edge Brief" during edge transitions.[8]

[6] https://wildfiretoday.com/2010/03/04/report-released-on-usfs-rappelling-fatality/
[7] https://fireaviation.com/2014/01/26/cause-of-hoist-fatality-similar-to-earlier-rappel-death/
[8] Technical Rescue Riggers Guide Third Edition by Rick Lipke with Kirk Mauthner page 2

A recent article in “Circulation”, the scientific journal of the American Heart Association, found that hospitals with highest hospital survival for cardiac arrest had four common traits:

- Team members with diverse disciplines
- Established clear roles and responsibilities of team members
- Exhibit better communication and leadership in hospital cardiac arrest
- Hold in depth mock cardiac arrest codes in the setting they occur in[9]

This study looks at what makes high performing teams work well in stressful, dynamic situations. Technical rescue teams work under the same conditions in a team environment. These same techniques can help technical rescue teams perform at a higher-level during operations.

## Conclusion

Technical rescue teams can improve safety and effectiveness by using checklists such as the Emergency Briefing and recently suggested “Edge Brief” during edge transitions. Along with GAR, using closed loop communications which is a technique of repeating back the message to the original sender who then confirms it with a “yes”. A central Technical Rescue “Near Miss” website will improve locating and tracking of near miss incidents and collecting data for further research. Members of technical rescue teams should be made aware of “blindness” – “looked but failed to see” and “confirmation bias”. The technique of talking back up the “chain of command” used in Crew Resource Management should be taught as a way to change unsafe operations.

## Implementation

These risk management techniques can be bundled into a single education program that would be available to new team members and experienced team members. Acknowledgement in the technical rescue culture that we are not above perfection and we all can make mistakes is an important step toward development of a culture of risk management acceptance and implementation. The emergency scene briefing page following sets the ground rules during training and operations on the scene.

[9] https://www.ahajournals.org/doi/pdf/10.1161/CIRCULATIONAHA.118.033674

# Safety in Technical Rescue

## *Safety is the number one consideration in Rescue*

- **Assign a Safety Officer**
- **Use Personnel Protective Equipment**
  - Gloves, helmet and eye protection. Carry trauma scissors and a way to go up and down the rope.
- **Protect yourself from the environment**
  - Carry equipment to keep yourself operational during a rescue- water, warm layers, and storm layers. Carry a headlamp for night operations with extra batteries. Beware of fatigue and avoid complacency.
- **Know your limits**
  - Don't go beyond your technical skill level. Ask questions if you are unclear of instructions. Check on your fellow team members.
- **Anyone can yell "STOP"**
  - On an incident anyone can yell "STOP" if they have a safety concern. Only the Rescue Group Leader or Operations can say "Go" on an incident.
- **Double check you are tied in**
  - When working within 10 ft. of the edge be tied in and establish a safety perimeter at the edge.
- **Make sure your rescue system is backed up**
  - Double check your systems. Analyze the system, for points of failure. Watch for side loaded carabiners and pad sharp edges. Consider an auto-block with SRT.
- **Pre-clean and secure the edge before an operation**
  - Yell "rock" if anything is dropped. Keep the operational area clean and organized, keep team and personnel gear separated.
- **Avoid Complacency**
  - Be engaged in rescue operations and situationally aware. Learn and improve your rescue skills. Don't assume or blow off the basics of the safety check.
- **Expect to learn different techniques during instruction**
  - You will learn different techniques during training from instructors. There are many ways to perform rope rescue. Learn the difference from a "show stopper" and "style points".

Schlinkmann/Phillips 2003, Ramsdell 2012, Walters 2017 (revised)