# USING A CHECKLIST FOR TRAVEL IN BACKCOUNTRY AVALANCHE TERRAIN

Don Carpenter[1], Don Sharaf[1] and Sarah Carpenter[1]

[1]American Avalanche Institute, Victor, ID, USA

ABSTRACT: Novices are often overwhelmed with the amount of information presented in avalanche courses. Even experienced backcountry travelers have trouble putting all their observations and information into well-considered decisions. Investigations into avalanche accidents often conclude that rather than a lack of clues contributing to the accident, a series of oversights or "non-decisions" led to the final critical mistake. At the American Avalanche Institute, we have developed a checklist to help guide backcountry travelers through the forest of information they encounter during a backcountry tour. None of the individual checkpoints are revolutionary; the goal of the checklist is to provide a system for decision making in avalanche terrain. The checklist is a mix of simple steps (that might be forgotten or skipped) and "pause and think points" at critical stages in the decision-making process. No checklist could ever function as a comprehensive "how to" guide for decision making in avalanche terrain; the environment is too complex. Experience, good judgment, skills, and improvisation are still needed. Nevertheless, a good checklist can foster teamwork, communication, and better decision-making in avalanche terrain. After using the checklist for the past three years, we have seen students approach decisions with more organization, more focus, and an enhanced ability to communicate their observations to others in their touring groups. Checklists work for aviation, wildland fire fighting, and surgeons. We have found the checklist to be a useful tool to aid in decision-making in avalanche terrain too.

KEYWORDS: checklist, decision-making, avalanche terrain, avalanche education, complex environment

## 1. INTRODUCTION

Each year, there are countless reports of avalanche accidents. Many of these accidents are studied by those involved, their friends and families, and outside experts. Often these investigations conclude that the accident occurred not because of a surprising layer in the snowpack or a freak wind storm that loaded a slope, but because of human error. (Atkins, 2000) Human error can occur because of to two possible reasons: ignorance or ineptitude. (Gawande, 2010) Someone with no knowledge of avalanches may "wander" into avalanche terrain unknowingly -- this is an example of an error of ignorance. Traditional avalanche education attempts to teach about avalanches and prevent errors of ignorance.

In an error of ineptitude, the knowledge of the hazards and of mitigation efforts exists, but this knowledge is applied incorrectly. When we study avalanche accidents, there were often obvious

signs of instability present in the environment. (McCammon, 2006) The information was there, but it wasn't used properly.

It is said that there are "kind learning environments" and "wicked learning environments". (Hogarth, 2001) Kind learning environments are those where one gets immediate feedback as to whether or not a mistake was made (i.e. bowling – when you bowl poorly, you throw a gutter ball). Wicked learning environments are those where one does not get immediate feedback about the decision. Backcountry travel is a wicked learning environment. Backcountry users often "get away" with bad decisions, ski powder and go home happy. This can lead to bad habits.

The American Avalanche Institute Backcountry Avalanche Checklist aims to give backcountry travellers a system to sort and prioritize information, and to make better decisions. Studies in the medical and aviation field show benefits of checklists include improved team cohesion, improved awareness of safety issues and reduction of errors. (Verdaasdonk, 2008) The AAI checklist consists of six different sections which prompt users through pre-trip planning, on-tour observations,

* Corresponding author address:
Don Carpenter, American Avalanche Institute
4970 Skyline Loop, Victor, ID 83455;
tel: 307-733-3315
email: avalanche.institute@gmail.com

terrain assessment, decision-making, safe travel, and a debrief.

By using a systematic approach to decision-making, a group of backcountry travelers begins working and communicating as a team. In a team environment, people tend to be more comfortable voicing a concern when a correction can still be made. This is a goal of "Crew Resource Management" training that has been implemented in the aviation industry, where communication and teamwork are as much a part of the culture as checklists. (Gordon et al. 2012) This tone of teamwork and communication is an important goal of using the AAI Backcountry Avalanche Checklist.

## 2. SIMPLE VS. COMPLEX PROBLEMS

Traveling in avalanche terrain presents a variety of problems. These problems can range from completing a transceiver check, to assessing snowpack stability, to making a decision at the top of a slope. We can divide these problems into "simple problems" and "complex problems".

### 2.1 *Simple Problems*

A simple problem is one with clear steps in the process. If you follow the steps, you are highly likely to succeed. Baking a cake is an example of a simple problem.
A cake recipe is a good example of a checklist for a simple problem. Follow the steps (or the recipe) and you have a high likelihood of success (or a cake).

### 2.2 *Complex Problems*

With a complex problem, there is a high level of uncertainty, and success one day is no guarantee of success the next day. There is not a standard step-by-step recipe for complex problems. Raising a child is an example of a complex problem. Parents may raise a first child well, but a second child may require an entirely different approach. Experience may help, but is not a guarantee of success. (Gawande, 2010) Decision-making in avalanche terrain is a complex problem. There are many variables to consider and an incident-free tour one day does not guarantee safe passage another day.

When making decisions in a complex environment, according to Gawande (2010), there are two significant difficulties – human memory/attention to de-

tail, and the possibility of being lulled into a false sense of security.

1. Human memory/attention
It is easy to skip or forget a step in any process. Engineers refer to an "all or none process" where skipping 1 step may be disastrous.

2. We can be lulled into a "false sense of security" in complex decision-making because not every step matters every time. We start to skip steps because on many days they do not matter. One day that skipped step is critical. This is very true in the "wicked learning environment" of avalanches. We do not get direct feedback on a regular basis and may get into the habit of skipping steps while making decisions and traveling in avalanche terrain. An example would be failing to ski slopes one at a time. On most ski tours we do not trigger any avalanches, therefore there are no consequences when we "gang ski" a slope or choose a poor safe zone. We develop bad habits because there were no consequences in the past.

## 3. COMPLEX PROBLEMS & CHECKLISTS

As was discussed in the previous section, complex problems are accompanied by uncertainty. Several industries, such as aviation, construction, and medicine, have introduced checklists into their operations to help manage uncertainty. These checklists do not provide a recipe to fly a plane, build a skyscraper, or perform surgery. There is a certain level of knowledge required to utilize the checklists. What the checklists do provide is a series of pause points where discussion or task completion is necessary.

### 3.1 *The Aviation Industry*

The aviation industry adopted checklists in the 1930's. Checklists in the aviation industry are part of the professional culture and are crucial aspects of pilot, flight attendant and mechanic training from day one. These checklists continue to be utilized in the aviation industry because they repeatedly have proven their worth in the field. Checklists have helped pilots land planes with limited to no engine power, to manage a plane that had bird strikes to both engines, and evacuate a plane safely and efficiently. (Gawande, 2010)

### 3.2  *The Construction Industry*

Building a skyscraper is a very complex endeavor with many workers, contractors, subcontractors and experts from different fields.  The checklists that have been adopted in the skyscraper construction workplace are used in two situations:

1. Simple tasks that need to happen, but may be skipped if someone is not seeing the big picture
2. Points in time where experts need to talk in order to sort out the myriad of unexpected challenges that will undoubtedly arise  (Gawande, 2010)

### 3.3  *The Medical Field*

Medicine has more recently adopted checklists. Structured checklists in surgical processes are probably effective because they standardize human performance.  They ensure that procedures are followed correctly and avoid relying on human memory alone. (Verdaasdonk, 2008)  The World Health Organization tasked leading surgeons and researchers with developing a surgical checklist to reduce surgery-related deaths.  Listed below are findings from early checklists use in the Johns Hopkins Hospital Intensive Care Unit in 2001. (Gawande, 2010)

- When doctors and nurses created checklists for what they thought needed to be done, consistency and quality of care improved.
- Checklists helped with memory recall and clearly set out the minimum steps necessary in a process.
- Even experienced personnel did not always grasp the importance of some steps in the process.  The checklist helped to highlight these steps.
- A higher standard of baseline performance was established.

A "Safe Surgical Checklist" was developed and implemented in eight hospitals by the World Health Organization.  According to Gawande (2010) their findings include:

- However straightforward a checklist may appear, if a team is used to functioning without one, adding the use of a checklist may not be straightforward.
- Teams did stray from the checklist, not because it was difficult, but because it was not the social norm.
- The checklist caught specific steps that would have been skipped or missed.
- Several hospitals discovered that some of their procedures were out of line with industry standards/best practices.  These procedures were changed.
- Staff reported that they were working better as a team and thus able to handle unexpected complications more effectively.

## 4.  THE AAI BACKCOUNTRY CHECKLIST

After studying the use of checklists in other industries, we at the American Avalanche Institute began to develop a backcountry checklist.  This checklist was developed three years ago and has been utilized in avalanche courses and on tours by AAI students and instructors since that time.  We do not yet have any hard data, but anecdotal evidence has suggested that the use of our checklist aids in decision-making in avalanche terrain.

The AAI Backcountry Checklist is a "living document."  Development and implementation of a checklist is a multi-step process of creation, implementation, re-creation, and re-implementation. Checklists need to be tested in the field and edited to be usable and effective. This allows teams to identify a simple task included in the checklist that proves to be cumbersome or unrealistic to complete in the field.  The AAI Backcountry Checklist has gone through several drafts and we expect more to come.

There are two steps in the process of putting a good checklist in the field.  The first is creating the checklist.  This may seem obvious, but creating a good checklist is easier said than done.  There is a fine balance between having the critical steps in the checklist without making it too long and cumbersome. (Gawande, 2010)  If a checklist is long and cumbersome, people will not use it.  AAI staff

# American Avalanche Institute
# Backcountry Avalanche Checklist

## 1. Pre- Trip Planning Discussion

☐ Current avalanche conditions discussed:
- Recent Avalanches?
- Is Weather contributing to instability?
- Avalanche forecast. Danger Rating _____

☐ Avalanche problem(s) identified:

☐ Loose Snow
☐ Storm Snow
☐ Wind Slab
☐ Wet Slab

☐ Persistent Slab → extra caution advised
☐ Deep Slab → extra caution advised
☐ Cornice Fall

☐ Route discussed. Terrain appropriate for your group and avalanche conditions. Terrain/Run List:

Closed:_____

Standby (possible, but needs more assessment):_____

Open (without contrary findings):_____

☐ Concerns with plan?
☐ Appropriate backcountry travel gear & rescue gear.
☐ Transceiver check.

## 2. On Tour Observations—Presence of Yellow/Red Flags

### Bull's Eye Clues

☐ Recent Avalanches
☐ Shooting Cracks
☐ Collapsing
☐ Persistent Weak Layers

### Weather: Is the Current Stability Changing?

☐ New Snow or Rain
☐ Wind
☐ Rapid Warming

### Stability Test Results – Layer of concern yellow/red flags?

☐ Low Strength
☐ Propagation Potential
☐ Poor Structure

## 3. Terrain Assessment

☐ Terrain consistent with the pre-trip plan?
☐ Avalanche problem(s) present on this slope? Likelihood of triggering/ potential avalanche size?
☐ Identify terrain characteristics: ☐ Simple ☐ Challenging ☐ Complex
☐ Slope Angle?
☐ Consequences? (What happens if you get caught?)

## 4. Go/No Go – Is this a good terrain choice for today?

☐ Ignoring any Yellow/Red Flags from section 2?

☐ Yes → Consider simpler terrain
☐ No → Continue with checklist

☐ Are you working as a team to avoid human factor traps?

☐ No → Consider simpler terrain
☐ Yes → Continue with checklist

☐ Uncertainty or concerns with this decision?

☐ Yes → Consider simpler terrain
☐ No → Continue with Safe Travel

## 5. Safe Travel Techniques

☐ Identify escape routes and islands of safety.
☐ Determine spacing and order of descent.
☐ Communicate plan.

## 6. Post Trip Discussion

☐ Did you make good decisions today or "get away" with it?
☐ Did you manage your travel through the terrain well? What could you have done better?
☐ Did the conditions encountered match the forecast?
☐ What concerns linger for future tours?
☐ Any observations to share with the local avalanche center?

**www.americanavalancheinstitute.com** revised 8/22/2014

and students have spent many hours using and evaluating the checklist in an effort to streamline this tool.

The second step is implementation of the checklist, which also has its difficulties. "Buy-in" to the use of a checklist is a challenge. Even those of us creating the checklist were reluctant to use it at first.. Our staff have traveled in avalanche terrain for decades without a checklist. As avalanche professionals we pride ourselves on our experience, skills, good judgment, and ability to improvise in the field This may be part of the reluctance to use a checklist.

Use of the Backcountry Avalanche Checklist will not tell you if you should ski a slope. Experience, skills, and good judgment are still required. The individual steps and pause points are important, but the checklist also encourages teamwork and communication. If this tone is set, each member of a recreational group or guide team is more likely to voice a concern, when a potential error can be corrected. The Backcountry Avalanche Checklist sets a tone of teamwork and offers a system for making better decisions in avalanche terrain.

Over the three years that AAI has been using the Backcountry Checklist, we have seen increased "buy in" from instructors and students alike. Instructors have come to appreciate the checklist as a teaching tool. Students can refer to the checklist both on course and during their private excursions. It serves as a reminder of the many steps of backcountry travel and decision-making. Students and instructors adopting it during courses and outside of avalanche education report that it offers a systematic approach to traveling in the backcountry. It drives conversation, and forces discussion before diving into avalanche terrain.

### 4.1 *Overall Goals of the Backcountry Avalanche Checklist:*

- Set a tone of communication and teamwork. This tone can help a group handle the many unexpected challenges, which are not addressed by the checklist, but are part of decision-making in avalanche terrain.
- Prevent simple steps from being skipped or overlooked.

- Introduce specific "pause points" to discuss options at critical stages in the decision making process.
- Create a higher baseline standard for decision-making in avalanche terrain.
- Help a group recognize when there is too much uncertainty and the best decision is to choose simpler terrain.

### 4.2 *Goals for each section of Checklist:*

We elected to divide our checklist into six sections so as to help users isolate the groups of factors involved in their decisions. These are the sections we delineated:

Pre-Trip Planning Discussion:

- Encourage planning before the tour starts, instead of reacting to conditions in the field when it may be too late to escape safely.
- Set the tone for teamwork and communication prior to the tour.
- Discuss current snow, weather, and avalanche conditions.
- Identify appropriate terrain, and rule out inappropriate terrain for the       tour.
- Leave the trailhead with a good plan for the day.

On Tour Observations--- Presence of Yellow/Red Flags:

- Identify obvious snow, weather, and avalanche clues that may be dangerous to your group. These "red flags" are clues taught on basic through professional level courses.

Terrain Assessment:

- Discuss the avalanche problem and the nature of the terrain prior to exposing your group. Understand the risk to you and your partners.
- Make certain the terrain choice is an informed decision.

Go/No Go:

- Pause to double check that you are not overlooking obvious clues or falling prey to human factor traps.

- Assess whether uncertainty or intuitive misgivings (bad gut feelings) dictate a more conservative terrain choice.

Safe Travel:

- Determine safe zones and travel techniques to minimize exposure.
- Communicate that plan.

Post-Trip Discussion:

- Actively seek feedback, because it may not be provided by the environment. Just because we didn't trigger an avalanche doesn't mean we made good decisions.
- Analyze and learn how you and your group, make decisions.
- Encourage mentorship and continued learning about snow.

## 5. CONCLUSION

Decision making in avalanche terrain, especially for novices, can be likened to trying to drink water from a fire hose. The amount of snow, weather, and avalanche observations can be overwhelming and hard to prioritize.

The Backcountry Avalanche Checklist has become a focus on AAI courses. AAI has adopted the Backcountry Avalanche Checklist as the primary tool to help students work as a team, prioritize and sort information, and make decisions in the backcountry.

AAI is experiencing the same challenges that have faced other checklist builders in other industries. It takes use, feedback, and careful wordsmithing to build a useful checklist. AAI has found that it takes more than just putting it out there to foster checklist adoption. It takes explanation, role-modeling, and prompting for people to adopt the checklist. If the checklist is robust, then people will buy into it, but it is far from a laissez-faire process. The end result, with proper checklist development and implementation should be better communication and teamwork and a more systematic approach to observation and decision-making in the backcountry.

## REFERENCES

Atkins, D., 2000: Human factors in avalanche accidents. *Proceedings of the International Snow Science Workshop.* Big Sky, MT. 46-51.

Gawande, A., 2010. The Checklist Manifesto How To Get Things Right. Picador, 215 pp.

Gordon, S., P. Mendenhall, B. O'Connor, 2012: Beyond the Checklist: What Else Health Care Can Learn from Aviation Teamwork and Safety. 1st ed. ILR Press 272 pp.

Hogarth, R. 2001, *Educating Intuition*, University of Chicago Press*, 355 pp.*

MacCammon, I. Obvious clues method: A users guide. *The Avalanche Review, 2006, Vol. 25, No. 2, pp. 8-9.*

Verdaasdonk, E. et al., 2008, *Requirements for the design and implementation of checklists for surgical processes.* Official Journal of the Society of American Gastrointestinal and Endoscopic Surgeons. Paper retrieved from: http://link.springer.com/article/10.1007/s00464-008-0044-4/fulltext.html#CR30