

# **Chugach Mountain Institute**

## **Level 2 Avalanche Safety, Snow-Season Backcountry Travel & Mountain Environment**

### ***Course Description:***

For backcountry travelers with prior experience and avalanche safety training that want to further develop their ability to recognize and manage risks while traveling safely and efficiently in snowy mountain environments, especially as a group leader and in areas where professionally provided avalanche information is unavailable or limited. This course exceeds American Avalanche Association standards for Recreational Avalanche Level 2. It consists of pre-course assignments and recommended reading with four in-person days of 8+ hours instruction (5+ hours instruction each day will be in the field). The small group instruction (5:1 max student:instructor ratio) by a Masters-level outdoor educator is differentiated according to individual and group needs. You must be able to travel with at least intermediate proficiency by ski or splitboard for four full days in potentially inclement mountain weather.

### ***Learning Objectives:***

- Improved ability to access and apply informational resources relevant to understanding snow, weather, and avalanche conditions where you intend to recreate
  - Ability to access and apply seasonal weather and snowpack information to current conditions
  - Ability to be your own avalanche forecaster for areas where professionally provided information is unavailable, and to critically examine and understand the limitations of professionally provided information
- A more nuanced understanding of avalanche mechanics (where, how, and why avalanches occur) and how to apply it to decision making relevant to conditions
- A deeper understanding of objective and subjective risk and how to manage associated variables appropriately
- Enhanced ability to recognize human factors and their implications for risk and decision-making
  - Ability to facilitate group communication to better understand and manage risks
  - A wider repertoire of practices to improve safety: trailhead checks, decision-making tools, safe travel protocols, group communication, debriefs
- Efficiently and effectively use avalanche rescue equipment and act as group leader in the event of an accident
- Ability to document key snow, weather, and avalanche observations so they can be shared effectively with others
- Ability to conduct “informal” and “formal” means of snowpack (in)stability assessment appropriate to conditions
  - A functional understanding of where, why, and how to apply various means of (in)stability assessment
- A deeper understanding of terrain management and how to apply it appropriately to conditions as group leader

### **Course Content**

### ***Pre-Course Assignments:***

- Thorough review of available seasonal snow, weather, and avalanche information resources up to the course date
  - Prepare a seasonal snow, weather, and avalanche conditions summary and use it to contribute to group discussion about appropriate objectives at the start of the course
- Self-evaluation (that will be used to provide you with a better and more individualized course experience as well as pre-course study recommendations based on your personal needs), submitted ASAP after registration and at least three days prior to the course (email to [Mat@ChugachSnow.org](mailto:Mat@ChugachSnow.org)), that addresses
  - Your strengths and weaknesses as a snow-season backcountry traveler, group member, group leader
  - Why you are taking this course and what you hope to get out of it
  - What course content (outlined below) is most important to you? Why?
    - What parts do you know the least about?
    - What parts do you know the most about?
- Familiarization with SWAG (Snow, Weather, and Avalanche Guidelines)  
<https://www.americanavalancheassociation.org/swag>

- Recommended reading for review:
  - Snow Sense (Fredston & Fesler)
  - Staying Alive in Avalanche Terrain (Tremper)
- Recommended reading for deeper understanding:
  - Secrets of the Snow (LaChappelle)
  - The Avalanche Handbook (McClung)

### ***Understanding Avalanche Danger***

- The nine avalanche problems
  - The four factors: type, location (distribution), likelihood (sensitivity to triggering), size
- Exposure and consequences: understanding the risk
- Gathering information (remotely, in the field) to forecast danger rating, avalanche problems, consequences, risk
  - Applying this to recreational objectives

### ***Avalanche Mechanics & Release***

- Snowpack variables (structure, strength, energy, friction, weight, compressive support) and equilibrium
- Avalanche release and the sequence of processes
  - Initiation and collapse of weak layer underlying cohesive slab
  - Crack onset and propagation through weak layer across slope
  - Crack arrest due to change in snowpack and/or terrain
- Snowpack characteristics, weather, and humans: implications for triggering, consequences, and risk

### ***Snowpack & Weather***

- Seasonal weather history and its relation to snowpack stratigraphy (layering)
  - How weather events create and affect strata (layers)
    - Strata formation and metamorphosis from snowfall and non-snowfall events
    - How weather affects snowpack variables and equilibrium vs. disequilibrium
- Snowpack variables and their relation to avalanche problems
- Snowpack metamorphism at and below the surface
  - Influence of wind, temperature, snowpack depth
    - Understanding temperature gradient within snowpack
  - Grain type and size within and between strata
  - How different layers interact
  - Cohesiveness vs. un-cohesiveness at and below the surface

### ***Terrain***

- Simple, challenging, and complex avalanche terrain
  - Start zones, paths, “terrain trap” implications
- Macro and micro terrain (region, range, drainage, slope) variables (climate, weather, characteristics of terrain)
  - Relationship to snowpack characteristics and variability
  - Relationship to avalanche problems and consequences
- How aspect and elevation affect snowpack characteristics, metamorphism, and avalanche problems
- Identifying snowpack problem areas: areas with a higher likelihood of human triggering
  - Deeper, stronger areas vs. shallower, weaker areas
    - Weak layer depth and distribution
  - Identifying and avoiding “sweet spots” for human triggering
- Using a terrain rose to track snowpack characteristics, avalanche problems, and surface conditions (riding quality)
- Understanding avalanche size and consequences relative to terrain and avalanche problem type

## ***Information Gathering & Planning***

- Using all available informational resources to understand and critically examine professional forecasts and/or create your own forecast
- Using a field book and/or smart phone for information documentation
- Using weather station data to inform understanding of snowpack development and current conditions
- Identifying and effectively utilizing crucial information necessary for answering critical questions related to current avalanche danger and problems
- Incorporating seasonal observations and reports, especially recent, to assess current conditions
- Identifying and managing uncertainties with appropriate terrain selection and targeted field observations
- Trip planning best practices: leadership and group discussion in consideration of
  - Group members' abilities and motivations
  - Avalanche danger, problems, weather, and riding conditions
  - Contingency plans and emergency response
  - Real time decision-making in the field: re-group and discussion points
- Using maps and IT resources to understand the nature of the terrain (simple, challenging, complex) and associated challenges, especially as it relates to current conditions (avalanche danger, problems, weather, riding conditions)
- Planning appropriate objectives and routes for current conditions
- Emergency response planning: communication and rescue resources

## ***Group Dynamics: Communication & Decision-Making***

- Leadership and group management
  - Understanding how individuals influence group dynamics
  - Communication practices to ensure mutually acceptable behavior of group members in the field
  - Consideration of objectives, routes, abilities, motivations, and limitations
  - Consideration of how changing conditions (objective and subjective) may challenge communication and decision-making in the field
  - Debriefing at the end of the day

## ***Snowpack Observations & Assessment***

- Targeting observations and (in)stability assessment, via “formal” and “informal” means, according to identified avalanche problems, unanswered snowpack questions, and group objectives
  - Identifying and prioritizing “red flag” and “no-go” observations (instability bias approach)
  - Quick and targeted assessment on the move
- Snowpit site selection and (in)stability test application appropriate to avalanche danger and problem
  - Using safe terrain to acquire information relevant to and representative of potentially dangerous terrain
  - Snowpit and (in)stability test limitations: value of multiple sites and additional means of assessment
- Using a field book and/or smart phone for field observation documentation
  - Documenting via terrain rose
  - Documenting weather observations: temperature, wind, and precipitation
  - Documenting snowpack observations: surface conditions, height of snow, depth and distribution of weak layers, storm snow settlement, daily changes
  - “L.E.A.S.T.” (location, elevation, aspect, slope, test) documentation of snowpit and (in)stability tests
  - Documenting full snowpit profiles
- Importance of snowpit practices: craftsmanship and consistency of formal (in)stability test technique
  - Identifying layers: hardness (strong vs. weak), grain type and size
  - Applying (in)stability tests according to avalanche problems
    - Testing for strength and fracture character (shear quality)
  - Bed surface, weak layer/interface, and slab characteristics: understanding structure, strength, energy, friction, and compressive support as they relate to avalanche size, probability, and consequences
- Snowpit profile and (in)stability test interpretation and integration with other field observations
- How current and forecast weather will affect the snowpack, avalanche danger, and problems

## ***Backcountry Travel***

- Recognize and discuss unanswered snowpack questions prior to field travel
  - Identify and gather observational information necessary for a better understanding of these unknowns
- Trailhead check-in: make sure everyone has everything they need, beacon tests, discuss how the trip planning will be implemented in the field, as well as communication and decision-making practices during the tour
  - Plan for unanticipated conditions and changes
- Practice uphill and downhill group management and safe travel protocols according to conditions and need for efficiency: spacing, one at a time, safe zones (to escape or regroup)

## ***Debriefing: End of Day Review***

- Group reflection: individual and collective
  - Best and worst parts of the day (objective and subjective, for the group and individual)
  - What went right, what went wrong, what could be improved (personally and for the group)?
  - Were there close-calls, mistakes, and/or decision-making errors that warrant further discussion?
  - What did we learn and how will we apply it next time?
- Share and discuss observations
  - Public information sharing
    - Discretion out of respect for locals, the wilderness experience, and sense of adventure in the last of places not yet “demystified”