NATIONAL SKI PATROL SYSTEM, INC.

AVALANCHE INSTRUCTOR'S MANUAL

SECTION 3

AVALANCHE SENIOR ELECTIVE
(2023 REVISION)

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AVALANCHE SENIOR ELECTIVE

Course Standards

Overview

This course gives an introduction to critical knowledge and skills taught in avalanche education courses. The goal of this course is to introduce critical avoidance skills such as terrain analysis, route selection, and decision making. This includes the importance of leadership and teamwork in the rescue skills, which needs to be immediate, but also needs to be methodical and coordinated.

Target Audience

This course is designed to be a senior elective for divisions that do not have adequate terrain and/or snowpack to conduct full Level 1 courses. For divisions that do have adequate terrain and snowpack it is recommended that the full Level 1 course be used as the senior elective.

This course is not open to non-NSP members.

Intended Outcomes

Patrollers completing this course should be able to:

- Describe safe terrain selection and travel practices
- Describe proactive elements of safe trip travel planning and preparation.
- Describe pertinent data for decision-making and implementation in the field.
- Describe and demonstrate proper use of avalanche beacon
- Describe and demonstrate proper probing techniques
- Describe efficient shoveling techniques
- Describe safe and efficient small-group rescue procedures

Prerequisites and Pre-Course Study

There are no enrollment prerequisites for this course.

Suggested Text

Snow Sense (latest edition) by Jill Fredston and Doug Fesler

Venue

This course combines both classroom session(s) and field exercises. Suitable classroom settings for each subject are described in Section 2 of this manual.

Field session(s) for this course do not need to be conducted in actual avalanche terrain. Slopes of 20° with natural snow cover suitable for skills practice are preferable, but not required, depending on time of year and available terrain and/or snow cover.

Time Commitment and Scheduling

This course may be scheduled in a variety of formats to meet patroller and instructor time availability, as long as continuity between lessons is maintained.

It is ultimately up to the IOR to schedule lesson time limits that allow patrollers to reasonably attain learning objectives yet not waste time. This course combines classroom and field skills. No specific times are required for either component. Suggested times are 4 hours of classroom lessons and 4 hours of field activities.

Grading

Use the Level 1 Avalanche Skill Evaluation score sheet found in Section 7 of this manual.

Final grade of Pass

- A score of "Pass" on all field skills and written exam

Final grade of Incomplete

- Less than passing score in no more than one skill
- Remedial work and skill re-evaluation can be made up before the end of the season

Final grade of Fail

- Less than passing scores on two or more skills
- Patrollers who fail the course must repeat the entire course for certification.

Resources

- Section 1 for course and instructional quality guidelines
- Section 7 for recommended instructional references and other resources

Instructor Requirements

IOR and Instructors must be NSP Avalanche Instructors. It is recommended that presenters be at least General members of the American Avalanche Association.

Lesson Guides

Check-in/Orientation

Overview

This completes initial administrative matters.

Purpose

- Complete course enrollment/check-in process
- Introduce patrollers and instructional staff to each other
- Explain that this course in only an INTRODUCTION to avalanche skills

- Describe how the course will be conducted (classroom, field, etc.)
- Clarify participation/certification standards
- Explain course safety standards and procedures
- Give patrollers an opportunity to convey personal needs/concerns

Materials/Resources

- Course syllabus, assigned text, study guides, handout packets, etc.
- Name tags
- Division Instructor Activity Report (if applicable)
- Liability release
- Receipts if collecting on-site enrollment fees

Content

A. Check-in
   1. Students
      a. Ensure all students are properly enrolled
      b. Liability Release (required)
      c. Enrollment fees
      d. Name tags
      e. Turn in pre-course study guide if assigned
   2. Instructors
      a. Information on Instructor Activity Report
      b. Assist with student check-in, room setup
      c. Check student pre-course study guides (if applicable)

B. Student Orientation
   1. Instructor/student introductions
   2. Purpose of the course; student and instructor expectations
   3. Course schedule, breaks, restrooms, refreshments, meals, gear storage, etc.
   4. Texts, reading assignments, note taking, quizzes/tests, homework
   5. Field session preparation (if applicable)
      a. Personal clothing and equipment needs
      b. Physical condition and ability to navigate in avalanche terrain
   6. Performance and certification standards

Topic 1: Avalanche Statistics

Overview

Prior to learning the detailed procedures of avalanche avoidance and rescue, patrollers must have a basic knowledge of avalanche incidences and critical principles of rescue. Viewing and discussion of the "*Know Before You Go*" video from the Utah Avalanche Center is required as part of this topic.

Concluding Objectives

At the end of this topic, patrollers should be able to:

- Describe avalanche accident statistics
- Describe victim demographics

Materials/Resources

- Colorado Avalanche Information Center – Accident Statistics
- Avalanche Rescue Fundamentals

Content

A. Survival Statistics
    1. Buried
        a. Time buried
        b. Trauma
        c. Asphyxia
            1) Importance of air pocket
    2. Demographics
        a. Age
        b. Gender
        c. Sport
            1) Skiing/snowboarding
            2) Snowmobiling
            3) Climbing
            4) Hiking

Topic 2: Personal Safety

Overview

This topic brings together different aspects of personal safety in avalanche terrain. It introduces proactive planning principles, travel techniques and procedures that build in safety and act as a counterpoint to rash decision making. Patrollers should also understand that plans and travel formulas are not perfect; continuous decision making in the field is still essential for safe and efficient travel. One also needs techniques for improving survival chances if risk management fails and he/she becomes caught in an avalanche.

Topic 2A: Introduction to Avalanche Forecasts

Overview

Understanding avalanche forecasts is a critical skill for individuals who intend to travel in avalanche terrain. This subtopic introduces avalanche forecasts and how to interpret the information they contain.

Concluding Objectives

At the end of this topic, patrollers should be able to:

- Describe what information is contained in an avalanche forecast.
- Describe accuracy issues with avalanche forecasts.
- Describe how the information contained in avalanche forecasts should be used in decision making process.

Content

All avalanche centers present their forecasts differently, but the information contained in the forecasts is the same.

A. The area a forecast covers
    1. Large area forecasts
        a. Cover large areas with a general forecast
        b. May or may not be applicable to a very localized area. (spatial variability)
B. North American Avalanche Danger Scale
    1. Hazard rating 1 through 5
    2. Travel advise associated with each rating
C. Avalanche type or problem
    1. Loose Dry
    2. Storm Slab
    3. Wind Slab
    4. Persistent Slab
    5. Deep Persistent Slab
    6. Loose Wet
    7. Wet Slab
    8. Cornice Fall
    9. Glide
D. Aspect and Elevation
    1. Aspect and Elevation Rose
        a. Aspect
        b. Elevation
        c. Danger scale rating
E. Characteristics
    1. Likelihood
    2. Size
    3. Trend
F. Narratives
    1. All avalanche centers present narrative discussions with their forecasts. These discussions vary in style and content but can contain valuable information on current and forecasted future conditions.

Suggested Demonstrations/Patroller-Centered Activities

- Present forecasts from more than one forecast center. Show how layout of information varies but how the information is essentially the same

Suggested Questions for Summary/Evaluation

- What critical information is contained in an avalanche forecast?
- Is the information in a forecast specific to the area you may be traveling? Explain.

Topic 2B: Principles of Safe Travel

Overview

This subtopic starts with general route selection principles based on consideration of the combined effects of weather, terrain, and snowpack. These basic principles form the foundation for making appropriate decisions before and during a trip into the backcountry. Application of these principles helps to mitigate problems associated with human factors. Draw patrollers into the discussion with focusing questions and case studies.

Concluding Objectives

At the end of this subtopic, patrollers should be able to:

- Recognize potentially dangerous conditions.
- Describe basic safe terrain selection and travel practices.

Content

G. Recognize potentially dangerous conditions
   1. Introduction to Weather
      a. Temperature
      b. Precipitation
      c. Wind
      d. These Weather factors interact in combination with each other, as well as with Terrain and Snowpack.
   2. Introduction to Terrain (The 5 'A's)
      a. Angle
      b. Aspect
      c. Altitude
      d. Appearance (shape)
      e. Anchoring
   3. Introduction to Snowpack
      a. Layered snowpack
      b. Slabs
      c. Weak layers
      d. Bonding
      e. Sensitivity to triggers
      f. Seasonal snowpack

H. Use safe travel practices
   1. General travel "practices"
      a. Minimize exposure to hazardous terrain
      b. One at a time; no bunching up unless in relatively safe areas
      c. Stay in same track, not below/above your partners
      d. Keep in sight of each other
      e. Always have a potential escape route
      f. Travel gently (no gorilla turns, jumping or excessive use of poles)
      g. Terrain that least skilled member can negotiate without falling
      h. Continuous observation of the snowpack
      i. Only stop at identified safe zone

   2. Ascending (best time for observations)
      a. Windward side of ridges/spines
      b. Anchor point to anchor point
      c. Low angle slopes
   3. Traversing
      a. Cross as high and fast as possible
      b. Safety point to safety point
   4. Descending
      a. Identify an escape route
      b. Start from the top

c. Ski/ride along flanks
d. One at a time; companions in safe location but able to see descent

I. Precautions if a suspect avalanche slope must be crossed
1. Consider alternatives again
2. Identify the point of no return
3. Choose an escape route
4. Zip and bundle up (especially parka hood, waist draw cord and cuffs)
5. Snug pack straps
6. Remove pole/ski/board straps
7. Avalung® mouthpiece in mouth, if so equipped
8. Ready access to avalanche air bag triggering system

J. Survival if Caught/Bottom line Escape
1. Shout out
2. Ski/ride to side
3. Attempt self-arrest
4. Grab onto rocks or trees, if possible
5. Dig poles, ski tails into bed surface if slab is shallow
6. If knocked down
a. Shed skis/poles (problems with snowboards & shoes)
b. Try to clamber up moving blocks to get as much snow below you as possible
c. Attempt to roll or tumble sideways toward a flank (side)
d. Protection/Survival
1) Try to keep feet downhill, head facing upward
2) Use hands and arms to protect face and head
3) Make yourself as "large" as possible
4) If you sense the slide is slowing, act immediately
a) Clear and close mouth; make a breathing space
b) Reach up—attempt to get a body part or equipment to the surface
5) If buried when the slide stops
a) Move any body part on the surface
b) Dig yourself out if possible
c) Yell if you hear rescuers; if not, conserve energy
6) Reality checks
2. Rapid acceleration and deceleration—little time to do anything
3. Turbulent flow—"rag doll in a dryer"
4. You inhale what surrounds you—snow
5. Any opening will be packed with snow
6. As flow slows it sets up solid—body movement of any kind rarely possible
a. Survival statists favor victims with large air pockets

Suggested Demonstrations/Patroller-Centered Activities

- Use case histories and video clips to illustrate consequences of poor route selection.

Suggested Questions for Summary/Evaluation

- What did you learn from this presentation? (What else?)
- What are some generally safe routes and places to avoid in backcountry travel?
- Are generally safe routes always safe? Explain.
- What are some generally safe travel practices for backcountry travel?

Topic 2C: Proactive Travel Planning and Preparation

Overview

Proactive travel planning may be the most effective place to build safety into a trip. Because of human factors, on-the-spot decisions in the field appear to be far less effective. Plans set the basis for safe decision making in the field. Make this lesson as interactive as possible, with patrollers supplying most of the content. The majority of class time should be devoted to application of the principles in small-group planning activities.
Most patrollers should already have at least a rudimentary familiarity with topographic maps. If not, they need to be informed they are not adequately prepared to navigate out of bounds. It takes only a few minutes to teach the basics, especially with modern 3-D map projections and overlaid satellite imagery. Patrollers lacking map reading skills should be grouped with more capable patrollers during the activities.

Concluding Objectives

At the end of this subtopic, patrollers should be able to:
- List and describe basic elements of safe trip planning and preparation.
- Identify local resources for backcountry information.
- Use avalanche bulletins in trip planning.
- Identify potentially safe and hazardous terrain on a topographic map.

Content

A. Principles
   1. Select companions carefully
      a. Attitudes
      b. Knowledge and skills
      c. Leadership
   2. Everyone properly equipped
      a. Patrollers generate a list and explain why each item is necessary
      b. Supplement patroller-generated list, if necessary
   3. Similar physical abilities and similar skills within your sport
   4. Establish primary and back-up leadership and mode of decision-making
   5. Learn about the terrain to be traveled
   6. Plan alternative routes, destinations, activities
   7. Have a proactive emergency plan, including communications
      a. Avalanche
      b. Illness/injury
      c. Stranding by broken equipment, poor visibility, etc.
   8. Group buy-in—shared attitude toward safety

B. Preparation
   1. Week prior to the trip
      a. Monitor weather
      b. Monitor avalanche forecasts
      c. Check with others who have been there
      d. Mark on map
         1) Potentially hazardous terrain
         2) Planned route

3) Back-up route/destination
e. Practice transceiver skills
f. Check condition of all equipment

2. The day before the trip
   a. Obtain weather and avalanche hazard forecasts
      1) Sources
      2) Usage
      3) Contact forecast sources for more specific data
   b. Adjust plans in view of most recent information
   c. Review avalanche risk reduction with group
      1) Communication
      2) Route
      3) Spacing
      4) Hazard recognition
      5) Acceptable/unacceptable hazard levels
      6) Criteria for going to planned alternatives
      7) Actions if there is an emergency
   d. Leave travel information with friends

C. Upon departure
   1. Check function of transceivers and GPS
   2. Compare local weather with forecast
D. Along the way
   1. Minimize exposure
   2. Bring concerns to conscious level by discussing them
   3. Adapt plan to real-time situation
E. Extended travel
   1. Begin each day with situational assessment
   2. Adjust plan accordingly

Suggested Demonstrations/Patroller-Centered Activities

- Have patrollers generate a list of minimum equipment each traveler should carry on a trip expected to last a full day and explain why each item is necessary.
- Show a topographic map of some complex terrain and a photo (or Google Earth images) of the same terrain. Have patrollers compare the information presented by each.
- Show various tools. Cal Topo, etc.
- Demonstrate ways to mark direction of prevailing winds on contour maps.

Suggested Questions for Summary/Evaluation

- What did you learn from this presentation? (What else?)
- Why is proactive advance planning important?
- What safety factors should be included in proactive backcountry travel planning?
- What are some route selection decisions that can be made as part of proactive advance planning?
- What kinds of information can be used for proactive advance planning?
- Do good plans reduce the need for good decision making in the field? Explain.
- What needs to be done with safe route selection and travel practices in order for them to be effective?

Topic 2D: Decision Making in the Field

Overview

Proactive, advanced plans are the foundation of a continuous decision-making process but plans then need frequent modification based on the realities of the environment. Emphasize that this is where people most often make decisions that get them into trouble. Decision-making aids help to objectify the process—another safeguard against the potentially harmful effects of human factors. At least half of the allotted time for this session should be devoted to familiarization and practice with a variety of decision-making aids, which then need to be put to use in the field (thus encouraging likely use).
Mock scenarios in the classroom will help patrollers to become familiar with decision-making aids, but follow-up in the field is necessary to make this content stick.

Concluding Objectives

At the end of this subtopic, patrollers should be able to:
- List pertinent data for decision-making.
- Integrate multiple types and sources of information when making decisions.
- Prioritize evidence of hazard.

Content

Remember: The best piece of safety equipment you carry is your brain. However, in avalanche terrain it can also be your worst enemy.

A. Data Gathering
   1. Approach to departure site (What can you see from the car?)
      a. Weather
      b. Avalanche activity

B. Use decision making aids (demonstrate)
   1. Information-Based
   2. Bull's eye—direct data (Class I)
   3. Observed avalanches
   4. Shooting cracks
   5. Hollow, drum-like sounds underfoot
   6. "Whumpfing" underfoot
C. Recognizing/evaluating human factors
   1. Unexpected changes
   2. Physical and mental condition of your party members
   3. Acceptance of risk and vulnerability
D. Decision to go
E. Constant reevaluation of factors en route
   1. Weather
   2. Snowpack
   3. Terrain
   4. Human
   5. Alert to group pressures acting on others
F. Others watch for those acting on you
G. Alternatives if conditions indicate increased danger

1. Continue on original route
2. Alternate route
3. Wait until conditions improve

H. Same route back

Suggested Demonstrations/Patroller-Centered Activities

- Draw a bull's eye and have the patrollers categorize notional data.
- Invoke the Alice in Wonderland quote, "I give myself very good advice, but I seldom follow it."
- Give notional weather, snowpack, terrain and human factor data. Have patrollers use decision-making aids to make go/no-go decisions.

Suggested Questions for Summary/Evaluation

- What did you learn from this presentation? (What else?)
- What kind of information needs to be gathered constantly while traveling in the backcountry?
- How does the North American Avalanche Danger Scale help with decision-making?
- What kinds of information are used to assess stability?
- How is stability information prioritized?
- What is the usefulness of avalanche center advisories?
- Why does the discovery of a relatively small, isolated area of instability outweigh many, widespread findings of stability?
- What is a convenient acronym for assessing avalanche probability?
- Which decision-making tool do you prefer? Why?
- Why might it be useful to have members of a group use more than one type of decision-making tool?
- If the data and tools indicate moderate or higher hazard, what are your options?

Topic 3: Avalanche Equipment

Overview

All people entering backcountry terrain during the winter should carry avalanche safety and rescue gear. This includes knowledge of how to use equipment and how to properly test equipment prior to use.

Concluding Objectives

At the end of this topic, patrollers should be able to:

- Describe the basic characteristics and functions of avalanche transceivers.
- Describe potential sources of interference with transceiver reception and how to minimize it.
- Describe the four phases of transceiver search.
- Describe features of a suitable probe pole.
- Describe and demonstrate spot-probing techniques.
- Describe and demonstrate probe line principles and techniques.
- Describe appropriate avalanche shovels and shoveling techniques.

Topic 3A: Transceivers

Content

A. Avalanche transceivers
   1. Basic features & care

a. Antennas
b. Batteries
c. Wearing
    1) On body per manufacturer's recommendations
    2) Use supplied harness
    3) Beneath outermost clothing layer for protection/quick access
    4) Not near electronic devices or metal objects

2. Basic functions
    a. Transmitting
        1) Intermittent electromagnetic pulses (457 kHz)

    b. Receiving
        1) Antenna sensitive to electromagnetic pulses
        2) Electronics filter and respond only to 457 kHz impulses
        3) Receiver activates various output devices (sounds, LED, LCD, etc.)
        4) Overall reception factors
            a) Relative orientation between transmitting and receiving antennas (coupling)
            b) Distance between transmitter/receiver antennas
            c) Electromagnetic interference
                (1) Causes
                (2) Precautions
3. Search strip versus range
    a. Range is maximum reception under ideal conditions – rarely real world
    b. Search strip = recommended distance between searchers
    c. Use search strip specification, not range claim
    d. Manufacturer's search strip specifications valid if no interference
    e. If unknown, presume 40 m (131 ft)
4. Four-phase search procedure
    a. Signal Search—rapid coverage to detect a signal
        1) Based on effective search strip distance
        2) Begin on debris nearest you location
        3) Search patterns
            a) Narrow path/single searcher
            b) Wide path/single searcher
            c) Wide path with multiple searchers
        4) Upon detecting a signal, mark location and notify leader
    b. Coarse Search—following the flux line
        1) Multiple antenna units interpret flux line
        2) Get within approx. 3 m (10 ft)
    c. Fine Search
        1) Bracketing and marking
        2) Do not change transceiver orientation
    d. Pinpoint - confirmation with probe
        1) Perpendicular to slope
        2) 25 cm (10 in) spacing

Topic 3B: Probes and Probing Techniques

Content

A. Probing

1. Probe types, pros and cons
    a. Collapsible segmented probes
    b. Convertible ski poles
    c. One-piece
2. General Principles
    a. Probe is to feel, not perforate
    b. Methodical, consistent pattern
    c. Avoid lateral pressure on probe (horizontal deflection)
    d. Body has a distinctive (spongy) feel
    e. Upon strike, keep probe in place
    f. Dig to uncover potential strike (specific methods taught later)
3. Spot probing
    a. Area to be probed is relatively small compared to other probing situations.
        1) Probe spacing
        2) Surface clues
        3) Potential catchments
    b. Probe orientation
        1) Perpendicular to surface for transceiver pinpoint
        2) Vertical for clues and catchments
    c. Ensure each area is probed thoroughly prior to moving to next area.
    d. Recommended hole spacing and patterns
4. Probe line (brief familiarization only)
    a. When used
        1) If spot probing proves unsuccessful
        2) When enough people are available
            a) Another touring group
            b) Organized rescue teams

Topic 3C: Shovels and Shoveling Techniques

Content

A. Shoveling
1. Reasons for carrying a shovel
    a. No rescue without extrication
    b. Digging often takes more time than finding
    c. Hardness of avalanche debris
    d. Volume and mass of snow that needs to be removed
2. Shovel selection criteria
    a. Weight
    b. Materials
    c. Strength
    d. Shaft length & handle type
    e. Scoop size & shape
    f. Portability
    g. Ergonomics
    h. Versatility
3. General Principles
    a. Avoid standing directly over victim
        1) May pack snow, cutting off air exchange
        2) May destroy air pocket

        3) Narrow, vertical hole; cannot extricate
    b. Minimize lifting snow
    c. Starting point downhill of probe
    d. Keep gloves on
    e. Keep back straight
    f. Use trunk instead of arms; use thighs for leverage
    g. Move snow to the sides or downhill
    h. If more than one shoveler
        1) Keep safe distance
        2) Rotate diggers frequently to avoid exhaustion
        3) Be aware of adjacent shovelers
    i. Cut vertical face, horizontal platform for extrication (give reasons)
    j. Scrape when getting close
    k. Use first exposed body part to estimate location of head
    l. Expose head/clear airway
    m. Dig out chest and remainder of body
    n. Extricate onto prepared platform
4. Strategic method (after Edgerly & Atkins)
5. Conveyor method (after Genswein)

Topic 3D: Other Safety and Rescue Equipment Considerations

Content

A. Helmets
    1. Trauma statistics
B. Airbags and Avalung
    1. Pros and Cons
    2. Taking more risk
        a. False sense of security
C. RECCO
    1. Chips in clothing
    2. No chips on equipment (skis, snowmobiles, etc.)
    3. Receivers normally used only by organized rescue groups or guide services
D. Avalanche Rescue Dogs.
    1. Live recoveries extremely rare
    2. Do not contaminate search area (drop personal gear, food, urinate, etc.)
    3. Do not distract dog
        a. Continue your task and let dog continue theirs
E. Rescuer safety is number 1 priority
    1. Must evaluate remaining hazard
        a. Does hang-fire exist?
            1) If so, can it be mitigated?
    2. Safe zone
        a. Identify safe zone
        b. Ensure all rescuers know locations
    3. Escape routes
        a. Identify escape routes to safe zone

   c. Ensure all rescuers know routes
4. Must consider exit routes and timing
   a. Based on conditions, does party have safe route out?
   b. When will the party be forced to leave to make it back safely?
      1) Changing weather conditions
      2) On coming darkness
      3) Equipment and supplies to continue rescue
         a) Food and water
         b) Camping gear

Suggested Demonstrations/Patroller-Centered Activities

- Use pictures/diagrams/models to demonstrate electromagnetic field, antenna coupling and range.
- Show patrollers examples of different transceiver makes/models & characteristics of each.
- Display a collection of different shovels or images of different shovels; describe advantages and disadvantages of the different features.

Sample Questions for Summary/Evaluation

- What did you learn from this presentation? (What else?)
- What is the advantage of everyone in a group having an avalanche transceiver?
- What is necessary for any avalanche transceiver to be effective?
- Name and describe the phases of avalanche transceiver search.
- What is the "best" avalanche transceiver?
- How does depth of burial affect the pinpoint accuracy of a transceiver?
- What are some advantages and disadvantages of probing?
- Describe some different types of probe poles, their advantages and disadvantages.
- What are some general principles for effective probing?
- What is spot probing? Where is it most effective?
- What is a probe line? Where is it most effective?
- When should probe lines be set up?
- What is the spacing for the most efficient probe line? How is this achieved?
- How should probes be aligned? Why is this important?
- Why is a shovel essential for travel in avalanche terrain?
- What are some factors for choosing an avalanche shovel?
- Why avoid digging a vertical hole straight down to the victim?
- What is the most efficient digging strategy?
- What other equipment would you recommend?
- How should you work around dogs?

Topic 3E: Field Exercises
Transceiver Skills

Overview

Transceiver searches may be interspersed throughout the course with increasing degrees of difficulty and number of target burials. Patrollers should be aware that true proficiency will take additional practice beyond this course. All buried transceivers should have probing targets

above them. See specifications below.

Concluding Objectives

At the end of this subtopic, patrollers should be able to:

- Perform initial transceiver range and function check.
- Demonstrate the four-phase search technique for locating a single transceiver under a variety of slope and burial-depth conditions.
- Demonstrate appropriate use of the probe to pinpoint a buried transceiver.
- Demonstrate a search technique for multiple burials appropriate for the transceiver they use.

Activities

A. First Exercise—Fundamentals
   1. Set-up
      a. Demonstration/guided practice area—any relatively flat area, away from skier traffic
      b. Independent practice areas—shallowly buried transceivers (30-50 cm or 12-20 in) deep), far enough apart to serve as separate practice stations
   2. Discussion/demonstration/assessment of knowledge
      a. Proper transceiver care
         1) Batteries
         2) Type
         3) Replacement schedule
         4) Removal at end of season
         5) Protection from hard blows
      b. Proper wearing
      c. Basic transceiver operation
         1) Simple props illustrate magnetic field
         2) Effect of antenna orientation and distance on signal reception
         3) Kinds of information each make-model gives to the operator
   3. Demonstrate/practice basic function test
   4. Demonstrate reception range test
      a. Use range test results to calculate maximum search strip width
      b. Compare calculated search strip with that declared by unit manufacturer
      c. Dealing with a transceiver that has significantly shorter reception range
   5. Demonstrate four-phase search method.
      a. Signal search
         1) Patterns based on width of slide, and number of searchers
         2) Search speed
      b. Coarse search
         1) Transceiver orientation
         2) Tangent/flux line techniques
         3) Search speed
      c. Fine search
         1) Bracketing/marking signal drop-offs
         2) Transceiver orientation
         3) Search speed
      d. Pinpoint (confirmation with probe)
         1) Alignment of probe
         2) Spot probe pattern

3) Upon strike, leave probe in place
6. Discuss common errors/pitfalls
7. Guided practice
   a. Find visible or shallowly buried target transceivers
      1) Individual coaching
      2) Target board for probe strike
      3) Independent practice

B. Second Exercise—Multiple burial
1. Set up
   a. Demonstration area
      1) Relatively flat area out of traffic and out of transceiver range of practice area
      2) Two or three transceivers 5-10 m (16-33 ft) apart
   b. Practice area(s)
      1) Moderate slope, out of traffic
      2) Single, large area with sets of two-three transceivers approximately 5-15 m (16-49 ft) apart and 50 cm (20 in) deep, each set spaced ≥30 m (98 ft) apart so patrollers are exposed to different sets.
2. Demonstration (modify to suit transceivers in use)
   a. Effects of multiple transmitters on single- and multiple-antenna transceivers
      1) Number of transmitting transceivers
      2) Different beep rates
         a) Overlapping beep rates
   b. 3-Circle technique
   c. Micro-strip search technique
   d. Marking functions
      1) Vary with make and model of transceiver
3. Guided practice at demonstration area
   a. Start 4-8 m (13-26 ft) apart
   b. Challenge with <2 m (7 ft) apart
   c. Highly competent patrollers can peer-coach slower patrollers
4. Independent practice
      1) Pairs of patrollers: alternate hide and seek roles. One instructor per pair of patrollers to oversee practice.

Probing Skills

Overview

Probing is an essential component of finding any completely buried avalanche victim. To be effective, it needs to be methodical, consistent and as precise as practical. A very important part of the process —identifying a likely burial area to probe—is frequently given less-than-adequate treatment. Don't just talk about it; make sure that all your scenario set-ups include identifying catchments.

Concluding Objectives

At the end of this topic, patrollers should be able to:
- Identify likely catchment areas.
- Demonstrate effective spot probing techniques for clues and catchments.
- Demonstrate effective probe line technique.
- Demonstrate proper marking of probed areas.

Activities

A. Set-up
   1. Approximately away from visitor or guest traffic
   2. Demo sets of different types of probes
   3. Probing targets buried (with beacons) to simulate bodies in catchments
      a. Beacons used to retrieve probe targets after the exercise; patrollers should keep theirs on transmit or turn off during this exercise

B. Demonstrate probe types and features

C. Spot Probing
   1. Explain/demonstrate
      a. Where to probe
         1) Clues
         2) Catchments
      b. Probe orientation
      c. Patterns and spacing that optimize speed and efficiency
      d. Practices that increase error
         1) Standing in one spot and inserting probe at varying distances/angles
         2) Deflection of probe by applying lateral force during insertion
         3) Random probing/no pattern
         4) Losing track of starting point
   2. Guided practice
      a. Using a simulated avalanche path and debris, help patrollers to identify and mark the last seen area (LSA), surface clues and potential catchment areas
      b. Have patrollers demonstrate proper probe orientation.
      c. Have patrollers describe how they would mark a probed clue or catchment.
   3. Independent practice—have probe targets in simulated avalanche debris for patrollers to find by:
      a. Identifying clues and potential catchments
      b. Spot probing clues & catchments

D. Probe line
   1. When to use
      a. Victims with no beacons
      b. Spot probing not successful
   2. Usual procedures
         1) Start from bottom of likely burial debris; work uphill
         2) Probers line up, spaced wrist-to-wrist
         3) Wide stance
         4) Probe 50 cm (20 in) to left of center, 50 cm right of center, then center
         5) Probes kept vertical (plumb) for consistent spacing at depth
         6) Place probe 50 cm (20 in) in front and step up to probe
      b. Guide cord
         1) Makes spacing and advancement quicker and more precise
         2) Enables offset second pass if first pass is marked
      c. Probe line leadership—one member of probe line coordinates probe deployment
         1) Straight horizontal line
         2) Vertical probe alignment
         3) Synchronization of movement
         4) Uniform depth of probing (bottom or 6ft, whichever is less)

5) Watches probers for signs of fatigue, hypothermia, frostbite, dehydration, etc.
6) Maintains silence—probers listen and feel

d. Possible strike
1) Leave probe in place
2) Announce strike
3) Adjacent prober(s) may confirm strike
4) At least two rescuers begin shoveling (strategies & techniques covered in next topic)
5) Receive new probe and continue

Shoveling Techniques

Overview

Shoveling is usually the most time consuming and exhausting porting of any rescue operation. Specific techniques have been developed to reduce time and exhaustion during shoveling operations. The use of proper shoveling techniques greatly increases the victim's chances of survival.

Concluding Objectives

At the end of this topic, patrollers should be able to:
- Describe the importance of using proper shoveling techniques.
- Describe and demonstrate the conveyor method of shoveling.
- Describe and demonstrate the strategic method of shoveling.

Activities

A. Using slope, demonstrate the importance of digging in, not down
B. Guided learning of individual roles in both the strategic and conveyor method.
C. Guided learning in patient extrication.

Topic 4: Small Group Rescue Processes

Overview

When an incident occurs in the backcountry the victim's best chance of survival lies with the rescue skills of their companions. As statistics show, time is critical. Knowledge of proper search techniques can greatly improve the efficiency of a search. Although every incident is different, this topic covers recommended procedures to ensure rescuer safety and improve the efficiency of the search.

Concluding Objectives

At the end of this topic, patrollers should be able to:
- Describe principles of the immediate search.
- Identify the sequence of actions taken to conduct an effective immediate search.
- Explain the significance of working quickly, as a coordinated team.
- Describe factors to consider in deciding if/when/how to seek outside help.

Topic 4A: Overview of Rescue Processes

Overview

In most instances, survival depends on the ability of a party to find its own buried members within the first 15 minutes, sometimes augmented by nearby traveling groups that happen upon the scene.

Content

A. Fundamental principles
   1. Group safety—no additional casualties
   2. Quick response
   3. Procedures
      a. A search that starts well usually goes well
      b. A search that starts bad is difficult to get back on track
   4. All present assist with search

B. Own party (Companion Search)
   1. Select a leader (Why?)
      a. Leader should be most skilled
         1) Rescue procedures
         2) Group management
   2. Assess remaining hazard—delay entry if deemed unsafe
   3. Identify number of victims
   4. Determine what equipment victims have (beacon, etc.)
   5. Identify LSA
   6. Keep your equipment
   7. Immediate search tasks
      a. Visual inspection of site
      b. Call out and listen
      c. Perform transceiver search if appropriate (How many people necessary?)
         1) Turn off all non-searching transceivers
      d. Mark and spot probe LSA
      e. Upon finding a clue
         1) Announce to leader
         2) Mark
         3) Probe
   8. Use clues to determine likely path and catchment
      a. Spot probe likely catchments and around clues
   9. Occasionally call out and listen
   10. Communications
      a. Keep communications to a minimum – only essential information
      b. Generally – communications are vertical (to the leader) not horizontal
      c. Communicate only essential information to the leader
   11. Do not
      a. Contaminate search area
      b. Displace or destroy clues
   12. Only form probe line when all other options have been exhausted, unless a large number of rescuers is available

C. Five reasons that can cause an ineffective rescue
   1. Lack of essential equipment (transceiver/probe/shovel)

2. Lack of scene safety
3. Lack of leadership
4. Breakdown in communication
5. Lack of methodical approach

Sample Demonstrations/Patroller-Centered Activities

- Before beginning the lesson, have the patrollers break into small groups and list the steps they would take in an immediate rescue situation.
- Show images of the methods and procedures used in immediate search.
- Divide into groups and have each group draw up a prioritized list of actions for a given scenario. Discuss the various lists.
- Use case histories to discuss clues overlooked or ignored by others.
- Use an immediate search flow chart. Make a giant puzzle out of the chart and have the patrollers put it together.
- Discuss need for quick action teams. Refer to probability of live rescue versus time. Define where immediate search fits in overall rescue.

Sample Questions for Summary/Evaluation

- What did you learn from this presentation? (What else?)
- Who has the best chance of finding and uncovering an avalanche victim alive?
- What, if anything, takes priority over rescue of the victim(s)?
- Although time is of the essence, how should a companion search be conducted?
- Why is it important to establish a LSA, and mark surface clues?
- How can a search area become contaminated? Why avoid contamination of the search area?
- What equipment and skills should companions have to be able to conduct an effective avalanche search and rescue?
- If the witness is to remain with the leader, does it mean that two people are not actively searching?
- When should a group consider seeking outside help?

Topic 4B: Field Exercises

Overview

At this point, all fundamental skills have been introduced, demonstrated and practiced to some degree. Patrollers now transition from guided practice to independent practice to refine those skills as much as possible. Patrollers should be able to take turns leading effective companion and second-party rescues. Instructors should need only to select group leaders and tag along to keep things organized, on task and safe.

These exercises provide opportunities to score individual skills. Patrollers who demonstrate difficulties can be coached to bring skills up to a passing standard.

The following sample activities are necessarily vague, due to the huge variety of conditions that could be actually encountered. Instructors need to use existing conditions and their own creativity to develop meaningful practice for their patrollers.

Concluding Objectives

At the end of this topic, patrollers should be able to:

- Appropriately conduct hazard evaluation.

- Efficiently conduct a small group rescue.
- Demonstrate effective small group rescue leadership and skills.

Setup

- Groups of 3-5
- Predetermine at least two short trip destinations per group
- Sufficient number of instructors to proctor each group
- Sufficient helpers to stage an "incident"

Sample activities

A. Guided practice
   1. Instructors guide patrollers through entire simulated rescue
   2. Time is not critical – process is
B. Independent practice
   1. Patrollers independently manage simulated rescue
   2. Give opportunity for all to take a leadership roll

Topic 5: Snow Immersion Suffocation

Overview

Snow Immersion Suffocation (SIS) is a growing cause of death in North America, rivaling the avalanche fatality rate. SIS is most commonly associated with falls into wells of relatively small conifer trees loaded with fresh snow, especially those with their lower branches in contact with the snowpack, but it can occur anywhere that fresh, unconsolidated snow collects into deep deposits if the subject falls headfirst into it. Falling or sliding headfirst into such a tree well or other deep snow deposit often leaves the subject suspended upside down and unable to extricate themselves. In the case of tree wells, snow from the disturbed branches may also fall into the well around the victim's head and torso. This effectively hides the subject and adds to entrapment. Struggling also brings more snow down into the well. Suffocation and death may occur rapidly unless the victim is found and rescued quickly. SIS may occur at ski resorts where avalanche danger is insignificant and actually be a greater concern for your audience than avalanche risk.

All rescue personnel need to be keenly aware of this possibility while searching for missing persons and to maintain proper safety precautions for themselves.

Concluding Objectives

At the end of this topic, patrollers should be able to:

- Define Snow Immersion Suffocation (SIS).
- Describe the conditions and process of entrapment.
- Describe a ski/ride buddy system for keeping track of each other under SIS conditions.
- Describe a strategy for locating and rescuing a person who is reported missing while skiing/riding through snow-covered trees.
- Describe emergency care for SIS victims.

Sample Set

The growing popularity of off-piste skiing & riding, especially in the trees, has resulted in a new hazard, Snow Immersion Suffocation. Although not related to avalanche incidents, SIS produces similar outcomes. SIS hazard, like avalanche hazard, may be avoided through awareness and sensible skiing/riding practices. Search and rescue for SIS victims uses the

same principles, equipment and processes employed in avalanche rescue.

Content

A. Setting
   1. Commonly associated with tree wells
      a. Smaller trees with branches extending into snowpack produce large diameter wells
   2. Less commonly associated with inverted falls into pockets of deep, unconsolidated snow
      a. Bases of small cliffs, rock outcroppings
      b. Small transitions or openings in mature forests

B. Process
   1. Headfirst fall or slide into tree well or other deposit
   2. Disturbance shakes snow off tree branches, filling in the well, (further entrapment) and hiding surface clues of skier/rider presence

C. Consequences
   1. Inverted, unable to reach or release skis/board
   2. Unconsolidated snow provides insufficient resistance to allow victim to push his/her body up or clear snow away from face
   3. Suffocation can occur within minutes

D. Associated complications
   1. Delay reporting missing person
      a. Subject skiing/riding alone
      b. Companions not watching each other
      c. Missing person not noticed until party reaches bottom of run
   2. Improper rescue methods
      a. Releasing skis/board while subject is still inverted
      b. Attempting to pull subject out by feet

E. Safety
   1. Don't ski/ride through treed areas alone; partners use audio signals
      a. Yell
      b. Whistle
   2. Predetermine meeting points
      a. May be bottom of short runs
      b. Long runs may require multiple stop points
      c. If the last person down gets caught, can you reach them in time?
   3. Incidents can happen in-area as easily as out of bounds
   4. Avoid getting too close to small trees
   5. Carry a beacon/probe shovel (at least a shovel) and cell phone when glade skiing
   6. If caught, do not struggle and cause more snow to collapse in on you

F. Rescue
   1. Witnessed
      a. Do not attempt to pull out by feet
      b. Dig toward the head from the downhill side (same methods as for buried avalanche subject)
      c. Expose subject's head, clear the airway
      d. Clear enough snow away to remove skis/board and free the victim
      e. Drag/roll subject onto prepared snow platform
      f. Render appropriate first aid assessment and care
   2. Unwitnessed
      a. Search

1) Transceiver search
2) Visual search (follow tracks near trees)
3) Audible search (pause, shout, listen)
4) If tracks covered due to heavy snowfall, probe likely tree wells

b. When found, rescue and provide emergency care as indicated above

Topic 6: Emergency Care

Overview

This is a short topic to emphasize that avalanche rescue nearly always involves severe trauma medical emergencies.

Concluding Objectives

At the end of this topic, patrollers should be able to:

- Describe causes of injury or death associated with avalanches.
- Describe compound effects of Hypercapnia, Hypothermia and Hypoxia.
- Describe first aid care and transportation considerations for avalanche victims.

Sample Set

Avalanche incidents are true medical emergencies. Even without burial, the ride can produce severe trauma injuries. Burial combines trauma with complications of suffocation.

Content

A. Causes of avalanche death (quick review)
   1. Trauma
      a. Mechanisms
      b. Expected injuries
   2. Asphyxia
      a. Mechanisms
      b. Hypoxia
      c. Hypercapnia
   3. Hypothermia
      a. Mechanisms
      b. Still takes a while
   4. Causes are interactive
      a. Vicious cycle of hypoxia/hypercapnia/hypothermia

B. Assumptions and principles of emergency care
   1. Must be prepared to protect patient from elements prior to removing from snow
   2. Perform ABC & D's
   3. Assume head, spinal, internal and extremity injury unless able to rule out
   4. Suspect accelerated rate of body cooling
   5. Minimize exposure of body parts for examination
   6. Handle gently
   7. Precautions to minimize after-drop
   8. Always transport to definitive medical care by most rapid means possible

Suggested Demonstrations/Patroller-Centered Activities

- Demonstrate equipment and techniques outdoors, if conditions permit.

Sample Questions for Summary/Evaluation

- What did you learn from this presentation? (What else?)
- What are some possible mechanisms of injury associated with being caught in an avalanche?
- What is asphyxia?
- What is meant by the term, "ice mask"?

Course Wrap-Up

Emphasize to patrollers that avalanche avoidance is the most important skill needed to stay safe in avalanche terrain. This course is only an introduction to basic avalanche safety and rescue. Those who wish to travel into avalanche terrain should take a Level 1 course as a minimum.

- Patroller debrief
  - Summarize and compare what they learned/improved
- Closing Remarks
  - Course alone does not develop proficiency; skills are quickly lost if not used
  - Encourage independent and repeated practice
  - Encourage patrollers to complete Module 1 and 2 prior to entering backcountry terrain
- Written final exam and group review of the questions
- NSP Student Feedback Survey, if IT is not present
- IT/Instructor debrief
  - What went well
  - What could be improved
- Course closeout with National Office
- Local (division, region, patrol) record keeping, as required