NATIONAL SKI PATROL SYSTEM, INC.

AVALANCHE INSTRUCTOR'S MANUAL

SECTION 4

COMPANION AND SMALL GROUP RESCUE
(2023 REVISION)

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COMPANION AND SMALL GROUP AVALANCHE RESCUE

Course Standards

Overview

This course covers critical skills for all travelers in avalanche terrain. 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. Emphasize the importance of leadership and teamwork; it is immediate but needs to be methodical and coordinated. Emphasize the importance of the witness when searching for members of another party. Specific skills used to carry out the steps will be covered in subsequent subtopics.

This course teaches Companion Rescue skills only and is not intended to teach other critical skills such as terrain analysis, route selection, and decision making.

The curriculum in this course must be included in Modules 1 & 2 of the full Level 1 course.

Target Audience

This course may be taught as a stand-alone course or in conjunction with Level 1 Avalanche. If taught as a stand-alone course, the target audience is NSP members seeking an avalanche-related senior elective. Stand-alone Companion Rescue courses are open only to NSP members.

If taught in conjunction with Level 1, this course is open to all Level 1 students.

Intended Outcomes

Students completing this course should be able to:

- Describe and demonstrate proper use of avalanche beacon
- Describe and demonstrate proper probing techniques
- Describe and demonstrate efficient shoveling techniques
- Describe and demonstrate safe and efficient small-group rescue procedures

Prerequisites and Pre-Course Study

There are no enrollment prerequisites for this module. However, it is recommended that students complete Avalanche Awareness prior to enrolling in this course.

Pre-course reading of an assigned text and completing an IOR-supplied study guide is highly recommended. Pre-course study should be broken into separate, short assignments to allow students to pace themselves.

If pre-course study is assigned, classroom instruction should be question-based rather than lecture-based to generate discussion. If no pre-course study is assigned, instruction time should be extended to accommodate this lack of preparation.

Suggested Text

Avalanche Rescue Fundamentals (latest edition)

- Lin Ballard and Dale Atkins

Venue

This module combines both classroom session(s) and field exercises. Suitable classroom settings shall be as described in Section 2 of this manual.

Field session(s) for this module do not need to be conducted in actual avalanche terrain. If students have not completed Level 1 Modules 1 and 2, they should not be taken into avalanche terrain. Slopes of 20° with natural snow cover suitable for skills practice are acceptable.

Time Commitment and Scheduling

This course may be scheduled in a variety of formats to meet student 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 students to reasonably attain learning objectives yet not waste time. This course combines classroom and field skills. No specific times are required for either component. Estimate times: Classroom 3-4 hours. Field 5-6 hours.

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

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

Students who fail the course must repeat the entire course for certification.

Resources

- Section 2 for course and instructional quality guidelines
- Section 6 for recommended instructional references and other resources
- Section 7 for course administration and quality management resources

Instructor Requirements

The IOR and Instructors for Companion must be NSP Avalanche Instructors. The IOR must be a Professional Member of the American Avalanche Association, and assisting instructors must be at least affiliate members.

Lesson Guides

Check-in/Orientation

Overview

This completes initial administrative matters.

This section is not necessary if this course is being taught in conjunction with a full Level 1 course.

Purpose

- Complete course enrollment/check-in process
- Introduce students and instructional staff to each other
- Describe how the course will be conducted (classroom, field, etc.)
- Clarify participation/certification standards
- Explain course safety standards and procedures
- Give students an opportunity to convey personal needs/concerns

Materials/Resources

- Course syllabus, assigned text, study guides, handout packets, etc.
- Name tags, enrollment forms
- Division Instructor Activity Report (if applicable)
- Liability release
- Receipts if conducting 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 division Instructor Activity Report (if applicable)
      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
      a. Personal clothing and equipment needs
      b. Physical condition and ability to navigate in avalanche terrain
   6. Performance and certification standards

Topic 1: Principles of Avalanche Rescue

Introduction

Prior to learning the detailed procedures of avalanche rescue students must have a basic knowledge of avalanche incidences and critical principles of rescue.

Concluding Objectives

At the end of this topic students should be able to:

- Describe avalanche accident statistics
- Describe victim demographics
- Describe procedures for escape if caught
- Describe procedures for increasing survival odds if unable to escape
- Describe the importance of avoidance
- Describe the importance of rescuer safety

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

B. Response as a Victim
    1. Shout out
    2. Ski/ride to side
    3. Attempt self-arrest
        a. Grab onto rocks or trees, if possible
        b. Dig poles, ski tails into bed surface if slab is shallow
    4. 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

C. 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

D. Survival devices
1. Helmet
2. Air bag packs
3. Avalung®

E. Reality checks
1. Rapid acceleration and deceleration—little time to do anything
2. Turbulent flow—"rag doll in a dryer"
3. You inhale what surrounds you—snow
4. Any opening will be packed with snow
5. As flow slows it sets up solid—body movement of any kind rarely possible
6. Survival statists favor victims with large air pockets

F. <u>AVOIDANCE IS THE KEY TO SURVIVAL</u>
1. Appropriate terrain selection for conditions
2. Decision making

G. 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

H. Functional Objectives (ALAAST)
    a. **A** – Alert (Alert authorities)
    b. **L** – Locate (Locate the victim – transceiver, probe, etc.)
    c. **A** – Access (Dig out victim)
    d. **A** – Assess (Medical assessment)
    e. **S** – Stabilize
    f. **T** - Transport

Topic 2: Avalanche Equipment

Introduction

All people entering mountainous 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. Most of this content can be taught in the classroom or in applicable field sessions at the IOR's discretion.

Concluding Objectives

At the end of this topic students 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 and demonstrate appropriate avalanche shovels and shoveling techniques

Key Terms

- Coarse search
- Display
- Electromagnetic
- Estimated time of detection (ETD)
- Fine search
- Guide cord
- Magnetic field
- Signal strength
- Pinpoint search
- Probability of detection (POD)
- Probe
- Probe line
- Probe orientation
- Range
- Signal Search
- Spot probe
- Transceiver
- RECCO

2A: 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 vs. 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 range unknown, presume 40 m
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
    c. Fine Search
        1) Bracketing and marking
        2) Do not change transceiver orientation
    d. Pinpoint - confirmation with probe
        1) Perpendicular to slope
        2) 25cm spacing
5. Special Considerations
    a. Multiple burials
    b. Deep burials

2B: 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
   b. Usual procedure
      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
   c. Guide cord
      1) Makes spacing and advancement quicker and more precise
      2) Enables offset second pass if first pass is marked
   d. 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
   e. 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

2C: 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
      i. "Hoe" mode
   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
   5. Conveyor method

2D: Other Safety and Rescue Equipment

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. Do not contaminate search area (drop personal gear, food, urinate, etc.)
   2. Do not distract dog
      a. Continue your task and let dog continue theirs

Sample Demonstrations

- Use pictures/diagrams/models to demonstrate electromagnetic field, antenna coupling and range
- Show students 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.
- Describe/demonstrate other functions for avalanche shovels besides digging out victims (pits, etc.) and how shovel features play into them.

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?

2E: Field Exercises

Transceiver Skills

Overview

This activity should be broken into at least three separate exercises, the first being conducted before venturing into avalanche terrain for any of the other activities. Subsequent exercises may be interspersed throughout the course. Students 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—students 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 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—Deep transceiver burials
1. Setup
a. Demonstration area—same location as before
1) One deeply buried (1.5 - 2 m) burial (This may require some creativity with shallower snowpacks)
b. Practice area—same as before, but with transceivers moved and more deeply buried. If snowpack is generally too shallow it may be possible to arrange to have a groomer build a large snow berm or use a roadside deposit built up by plowing. As a final resort, a transmitting transceiver can be suspended from a tree branch and fine search phase may be conducted on the snow surface below. The main thing to demonstrate is that a deeply buried transceiver will indicate more widely spaced drop-off points, thus a significantly larger "shadow box" to be probed.
2. Demonstration
3. Guided practice
a. Have students locate deeply buried transceivers; mark fine search brackets with flags
b. Compare bracket distances between shallow and deep burial
c. Compare amount of probing required between shallow and deep burial
4. Independent searches in practice area(s)

C. Third Exercise—Multiple burial, moderately steep terrain (Note: if students are deficient in fundamental skills, repeat exercises 1 or 2 before introducing this one)
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 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 apart and 50 cm deep, each set spaced ≥30 m apart so students 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 apart
    b. Challenge with <2 m apart
    c. Highly competent students can peer-coach slower students
4. Independent practice
        1) Pairs of students: alternate hide and seek roles. One instructor per pair of students 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 the sketchiest treatment. Don't just talk about it; make sure that all your scenario set-ups include identifying catchments.

Concluding Objectives—students 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 20^{o} slope away from skier traffic (avalanche debris preferred)
    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; students 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 & debris, help students to identify and mark the last seen area LSA, surface clues and potential catchment areas.
   b. Have students demonstrate proper probe orientation.
   c. Have students describe how they would mark a probed clue or catchment.
3. Independent practice—have probe targets in simulated avalanche debris for students 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. Where to probe
3. Technique

Shoveling Techniques

Overview

This is practice for the techniques described in the classroom. Use approximately 20-25^{o} slopes (average angle of repose for avalanche debris)

Concluding Objectives—students should be able to:

- Determine where to start digging.
- Demonstrate efficient and safe digging techniques.
- Demonstrate digging as a coordinated team.

Sample Activities

A. Setup
1. Demonstration area—moderate slope (20-25^{o}), in immediate vicinity of practice area
2. Practice area—adjacent to demonstration area; at least two "victims" buried about 1.5 m deep, pre-marked with probe or buried with transceiver to allow quick find
3. Students in small groups of 2-4; for large classes, multiple stations can be set up, each with an instructor

B. Discussion/Demonstration
1. Preferred digging method(s)
   a. Side-by-side (Strategic) method
   b. V-shaped (Conveyor) method
   c. When/how to choose
2. Extrication principles/methods

C. Simple guided practice—may include locating the "subjects" by burying a transceiver with each dummy
1. Bury them in the open and in tight areas constricted by trees, rocks, equipment, etc.
2. Work with a variety of shovels; evaluate advantages and drawbacks of each

3. If students are in multiple small groups, have students in first group move and rebury victims for second group

Topic 3: Small Group Rescue Process

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—Students 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

Key Terms

- Catchment area
- Clues
- Companion search
- Flow pattern
- Group search
- Immediate search
- Last seen area (LSA)
- Likely burial area
- Residual hazard
- Spot probe

3A: Overview of Processes

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. Other party (group search)
1. Assess residual hazard
    a. Determine safe route and access to scene; if none
        1) Don't enter
        2) Try to get other party to retreat to safety
    b. If existing rescue appears organized
        1) Accept existing leadership
        2) Perform assigned tasks
    c. If taking over leadership, get compete briefing from current leader
        1) LSA
        2) Number of victims
        3) Description of victims
        4) How they are equipped
        5) Victims' position relative to each other and the slide path
        6) Time since event occurred
2. All non-searching transceivers turned off
3. Conduct immediate search as described above.

D. Activating EMS
1. If in direct communication activate early
    a. EMS response time can be slow
    b. Once activated EMS can stand down if not needed

2. If not in direct communication
    a. Reasons to delay sending a party for outside help
        1) Loss of available resources to conduct immediate search
        2) Risk to person(s) going for help

3. Consequences of delay—what if:
    a. Large search area/few rescuers
    b. Victim not found within 30-60 minutes
    c. Approaching darkness
    d. Victim found alive but:
        1) Serious injury/hypothermic
        2) Lost/damaged equipment
            a) Would have to travel on foot
            b) Includes vital party equipment (shelter, stove, etc.)
        3) Victim in respiratory/cardiac arrest
    e. Deteriorating weather
    f. Party not equipped to stay overnight
4. Means of summoning outside help
    a. Remote communications
        1) This is very rapidly changing technology
        2) 2-way radio
        3) Cell phone
        4) Reception issues
        5) When to call
        6) Personal locator beacon (PLB)
        7) Spot
    b. Signal flares
    c. Aircraft distress signal
5. Information to provide Emergency Services when contacted
    a. Time of incident
    b. Location (GPS coordinates if possible)
    c. Number and status of injured/missing persons
    d. Status of uninjured persons
        1) Ability to stay & continue rescue attempts
        2) Ability to evacuate if conditions worsen

E. Five essentials for effect 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/Student-Centered Activities

- Before beginning the lesson, have the students 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 students put it together.
- Discuss need for quick action teams. Refer to probability of live rescue vs. 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?

3B: Field Exercises

Overview

At this point, all fundamental skills have been introduced, demonstrated and practiced to some degree. Students now transition from guided practice to independent practice to refine those skills as much as possible. Students 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. Students who demonstrate difficulties can be coached to bring skills up to a passing standard.

The following Sample activities are necessarily sketchy 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 students.

Concluding Objectives—students should be able to demonstrate:

- 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 student through entire simulated rescue
   2. Time is not critical – process is

B. Independent practice
   1. Student independently manage simulated rescue
   2. Give opportunity for all to take a leadership roll

Topic 4: 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 – students 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

Key Terms

(None)

Sample Set

The growing popularity of off-piste skiing & riding, especially in the trees, has resulted in a new hazard, Snow Immersion Suffocation (SIS). 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 utilizes 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 5: Emergency Care

Overview

This is a short topic to emphasize that avalanche rescue nearly always involves medical

emergencies, not to provide initial training for handling them. Recreationists without emergency medical training should be encouraged to get some; patrollers and other SAR personnel are reminded to anticipate these problems and prepare to deal with them.

Concluding Objectives—students 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.

Key Terms

- Asphyxia
- Hypercapnia
- Hypothermia
- Hypoxia

Sample Set

Avalanche incidents are true medical emergencies. Even without burial, the ride can produce severe injury. Burial combines trauma with complications of suffocation (asphyxia). Anyone who travels in the outdoors should have CPR and other wilderness first aid skills. Here's why.

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. Can become significant within 30 minutes
    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
C. Transportation considerations:
    - From extrication site to safe site
    - Temporary shelters needed for patient care prior to final transportation
    - Options for final transportation
        - Improvised toboggan
        - Over-snow machines (snowmobiles, snow cats, etc.)

    - Helicopter

For training in improvised transportation and shelters NSP Mountain Travel and Rescue training courses are advised.

NSP does not offer training for use of over-snow machines or helicopter safety. However, the following tips may be helpful for those who have not had training in helicopter safety.

- If you know a helicopter is coming you can prepare a landing zone (LZ)
    - Identify flat, clear area of 100'x100'
    - If in powder snow attempt to compact loose surface snow within LZ
- When you hear the aircraft approaching
    - Ensure the pilot sees you
    - Move back 100' from LZ
    - Take cover if possible
- When approaching LZ
    - Move around perimeter of LZ to the front of the aircraft
    - Wear eye protection (goggles are best)
    - Ensure you have no loose articles of clothing or equipment
    - Carry all equipment below head level
    - Do not enter LZ until instructed to do so by a member of the aircraft crew
- Allow aircraft crew member to come to you
    - Do not approach the aircraft until instructed to do so by a member of the aircraft crew
    - **Follow all instructions of aircraft crew**

Sample Demonstrations/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 students that avalanche avoidance is the most important skill needed to stay safe in avalanche terrain. This course only teaches skills needed if**

things go wrong. To learn avalanche avoidance students must take a Level 1 course.

- Student 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 practice.
  - Encourage students to complete Module 1 and 2 prior to entering backcountry terrain
- Written final exam
- 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.