PLANNING AND PREPARATION • EXPEDITIONARY AND MULTIWEEK CLIMBING TECHNIQUES • EXPEDITION WEATHER • HIGH-ALTITUDE HEALTH HAZARDS • UPHOLDING AN EXPEDITION PHILOSOPHY

CHAPTER 21

EXPEDITION CLIMBING

Expeditions give climbers the opportunity to dream big as they explore the highest and most remote peaks in the world. When climbers immerse themselves in the mountain experience, they test themselves both physically and mentally. In the words of expedition climber Mike Libecki, "The time is now. Why ration passion? Dream big . . . and climb those dreams."

What makes a climb an expedition? Expedition climbing requires significant time, commitment, planning, and preparation. An expedition may involve two or three days of air travel, followed by a day or two of land travel, and then a 10-day trek just to get to base camp. On an expedition, rest breaks may take several days as climbers acclimatize. Some expeditions can involve significant differences in climbing techniques such as ascending fixed lines, hauling sleds, performing crevasse rescues while tied to a sled, and preparing caches. Add to this the challenge of dealing with local languages and customs, climbing etiquette, and the red tape that larger objectives often entail. Successfully executing an expedition will teach you a great deal about your destination, your climbing partners, and yourself.

PLANNING AND PREPARATION

Planning an expedition involves selecting a destination, choosing the climbing party, making sure the team members are prepared, determining a climbing schedule, considering emergency preparedness and guiding services, and preparing supplies. Sometimes the objective is based around a particular team, and sometimes the team is chosen based on the objective. Larger objectives around the world, including in the United States, often entail permits and applications that may take months or years of advance notice and a significant fee to obtain.

CHOOSING AN OBJECTIVE

In deciding what peak to try and which route to climb, choose a destination that excites you. Ask yourself whether you are committed to the substantial effort involved in planning and preparing for an expedition.

Difficulty of the Route

Whatever route is chosen must be well within the climbing ability of the party because the added challenges of remoteness, altitude, changeable weather, and routefinding will compound the route's difficulties. Climbers who are considering an objective for their first few expeditions should think of those trips as opportunities to apply well-practiced climbing skills in a new environment rather than to push the limits of their technical ability.

Choosing a Climbing Style

Most modern expeditions involve a mix of alpine and expedition styles. The choice of which style of climbing to do during what part of the trip greatly influences planning and, thus, is an important decision to be made early in the planning process. The choice will affect the length of trip, amount of risk, equipment and technical gear needed, and physical training goals and conditioning for the trip.

Expedition style. Expedition-style climbing involves multiple trips between camps, during which loads (food, fuel, and supplies needed later in the expedition) are carried to higher camps and buried in clearly marked, animal-proof locations. Technically difficult sections of the route are often protected with fixed lines—ropes anchored in place to minimize danger during repeated trips up and down the route. For these reasons, expedition-

style climbing takes longer. This can be an advantage because climbers have more time to acclimatize to high altitude when they are ascending slowly in stages. Expedition-style climbing is often employed in the approach portion of the climb as the party slowly makes its way to a base camp.

Alpine style. Alpine-style climbing means moving up the mountain in a continuous push, so that the party ascends the route only once. The team carries all equipment and supplies needed for the summit with them. There is less margin of safety on alpine-style trips because climbers cannot bring as much equipment and supplies on the alpine-style portion of the climb. However, because the team moves faster, there is also less exposure to objective hazards such as storms, avalanches, or other longer-term changes in conditions. Climbers must climb "fast and light." This is often employed in the technical summit portion of an expedition as climbers climb above a base camp.

Duration of the Climb

In the world's higher regions, the duration of the climb may need to be longer than mileage and elevation gain might suggest. Climbers should not underestimate the time constraints that acclimatization requires (see the "Suggested Acclimatization Schedule" sidebar). The length of the climb may be determined more by how many "rest" days are needed at each camp to safely ascend to higher elevations.

Time of Year

Study information on seasonal temperatures, winds, storms, precipitation, and amount of daylight in the area the party is considering for its expedition. These will affect the expedition's duration and needed gear.

Costs

Expeditions can be costly because of the large amounts of time, equipment, and food required. Major costs include purchased and/or rented specialty equipment for the climb, transportation to the peak, permits and fees related to the climb, and hired porters, support staff, or pack animals. It is best not to scrimp on gear, guide services, or support services: in the big scheme of things, a slightly higher fee or slightly more expensive sleeping bag could make or break your only chance at a trip of a lifetime.

SUGGESTED ACCLIMATIZATION SCHEDULE

If the objective is at 8,000 feet or below, the party can follow a normal ascent time; if the objective is at 8,000 feet or above, they should plan on a slow ascent: 1,000 feet of daily altitude gain above 8,000 feet, with a rest day after every 3,000 feet of eleva- tion gained or at 2- to 4-day intervals. Here are some suggested ascent times, according to the US Army Research Institute of Environmental Medicine:

- 10,000 feet: 3 days
- 14,000 feet: 8 days
- 20,000 feet: 16 days

Be sure to budget adequate compensation for porters and other support staff, as well as supplies they will need for their own safety and comfort. The climbing party should be prepared to provide essential equipment, such as sunglasses and extra stove fuel, which many porters may not have. Know the going rates for support staff services, and be sure to pay and tip them accordingly. It is always best to set rates for their services before you head out on the expedition.

Location

There are so many choices for an expedition. Africa, Alaska, China, Europe, India, Kyrgyzstan, Greenland, Mexico, Nepal, New Zealand, Pakistan, Russia, and South America all boast difficult, remote peaks. After you choose a peak, research the mountain and its routes, as well as objective hazards on the mountain. Talk to climbers who have been there; look for descriptions in the journals of the Alpine Club (UK), American Alpine Club, the Alpine Club of Canada, and other climbing organizations. Seek out guidebooks, videos, and articles in climbing magazines, and research online sources. Note that in some countries, maps are considered restricted military information and may be available only once you are in the country and, even then, may not label significant mountain peaks. Select and research a backup route in case the original objective must be scratched because of avalanche hazard, bad weather, inability of some party members to continue, or any other reason. If a highly technical route up the mountain has been chosen, consider acclimatizing by climbing the standard route first and then taking on the tougher challenge.

Find out what travel visas and communication-device and climbing permits are necessary, and determine how long in advance an application must be made. Research vaccines and potential health problems for your specific travel location well in advance so that preparations can be made and vaccine series can be completed. It helps to have copies of itineraries, climbing résumés of party members, equipment lists, and medical information prepared ahead of time and available while traveling to the peak. Evidence of good organization impresses bureaucrats around the world. Consider whether anyone in the party speaks the local language. Get all possible details on logistics, monetary customs, potential problems, what types of fuel are available and where to buy it, what foods are available, whether the water is safe or if bottled water or purification is necessary, and so forth.

CHOOSING THE TEAM

Choosing a compatible climbing team is the most essential step toward an enjoyable experience. Expedition climbing is full of stress, and climbers can be taxed to their physical and mental limits. Make it a goal to head out as friends and return as even better friends.

The skill of the team must be equal to the demands of the climb, personalities need to be compatible, and team members must be able to live harmoniously with others in close quarters under stressful conditions. The climbers should agree on the philosophy of the trip in terms of climbing style, communication style, climbing goals, environmental impact, and degree of acceptable risk.

It is important to agree on how decisions will be made before the trip gets under way. Leadership should be parsed out to various members of the team to distribute the workload and to keep everyone involved. Team members can take the lead on areas such as finances, food, medicine, and equipment. A primary team leader who will step in when necessary, especially in urgent situations, should be designated.

The number of climbers in the expedition depends on the chosen route and climbing style. There are trade-offs that should be considered. A party of two or four climbers may be best in some circumstances because of the speed and efficiency of smaller rope teams and the limited space at bivouac sites. However, climbing with a very small team means that if one person becomes ill or cannot continue, the entire team may have to abandon the climb. Climbing parties of six or eight have the advantage of strength and reserve

capacity: if one climber is unable to continue, some of the rest of the party still has a chance to go on with the expedition. Larger parties are also better able to carry out self-rescue than smaller teams. As the number of climbers increases, issues of transportation, food, lodging, equipment, and environmental impact can become more complicated.

PHYSICAL AND MENTAL CONDITIONING

Because expedition climbing requires significant commitment, it is important for each climber to start physical, mental, and technical conditioning many months before the trip. Remember that this may be the trip of a lifetime. You don't want to travel to the peak only to have your ability to reach the top cut short because you didn't prepare well enough for your climb.

Be in the best physical shape of your life. Emphasize both cardiovascular and strength training (see "Mountaineering Fitness Components" in Chapter 4, Physical Conditioning). Plans can be found online, and many guide companies will provide guidelines for physical conditioning. Work with an individualized training plan or personal trainer to complement your preparation for the climb. Conditioning for a major climb can be time consuming, requiring months of daily or twice daily sessions. Train for what the planned climb will require. Will you be hauling a sled? Will you be carrying heavy loads? Will you need excellent endurance as you move to high altitude? Make sure your conditioning plan prepares you for the type and style of climbing you will be doing. Climbers on a typical high-altitude expedition, for example, may need to be able to carry 40 to 100 pounds (18 to 45 kilograms)—sometimes in addition to pulling a sled—for an elevation gain of 2,000 to 3,000 feet (600 to 900 meters) every day, day after day.

"Soft skills" such as your ability to handle decision making under stress, your comfort with uncertainty, and your ability to communicate risk to climbing partners are also essential, and they need to be practiced and mastered. Have you met with and worked with your teammates? Have you learned to communicate effectively and work together as a team? It takes more than physical strength to deal with extreme cold, sickness, cramped quarters, poor food, conflict with teammates, the stress of technical climbing, and the lethargy brought on by high altitude. Preparing your attitude by practicing your flexibility and sense of humor is important. Do not underestimate the mental component of conditioning.

Additionally, dialing in your technical skills is essential to a successful climb. Are there techniques such as crevasse rescue with a sled that you need to master or practice more? Do you need to develop skills with fixed lines or technical ice?

Work on physical, mental, and technical conditioning by seeking out experiences that come as close as possible to what can be expected on the expedition. Prepare for the expedition by going on longer trips. If possible, do these as a team so you can learn to work together under physically and mentally stressful situations.

THE CLIMBING ITINERARY

Once climbers have researched their mountain, assembled a team, and begun their conditioning and training program, they must set up an itinerary that includes a good estimate of the number of days needed for the journey. Allow for the approach to the peak, carrying loads up the mountain, climbing, sitting out storms, and resting. An average elevation gain of 1,000 feet (300 meters) per day allows for acclimatization to high altitude, and this figure should be correlated, where possible, with good campsites. Rest days built into the schedule provide time for mental and physical recuperation, equipment sorting, and a time buffer for unplanned delays caused by storms, illness, or other problems. If a storm hits, try to adjust the itinerary to allow a rest period for the same time, making the best of a bad day. Many teams plan an estimated window for arriving at each camp, showing the first possible date of arrival at each camp and a last possible date of arrival at each camp. This allows for a flexible itinerary.

EMERGENCY PREPAREDNESS FOR EXPEDITIONS AND MULTIWEEK CLIMBS

Because expedition and multiweek climbs are more committing and often more remote, the team should consider taking additional measures to prepare themselves for emergencies. They should make a comprehensive emergency response plan that includes a list of emergency contacts for each team member, each team member’s medical and insurance plan information, and relevant phone numbers for local contacts, rescue services, embassies, et cetera. The emergency response plan should be detailed, with clear

objectives and information for each team member, as well as agency and contact information for the location.

Will the team carry a personal locator beacon (PLB) or other device to contact emergency help as recommended by the Ten Essentials? What will happen if the device is deployed? (For more about these devices and self-reliance, see Chapter 5, Navigation.) Do team members have insurance that covers travel abroad, helicopter evacuation, body recovery, and mountaineering and/or climbing accidents? In some countries, climbers must carry proof of insurance coverage or ability to pay before rescue services are deployed. Research the rescue services available and rescue protocol in the region or country you will be visiting.

A photocopy or scanned electronic copy of the team's emergency response plan should be left with a trusted individual at home. This person should understand the nature of the climb and have a clear directive from the team on when and how to engage in organizing rescue efforts. That individual will then have the information for all individuals on the team and be able to coordinate communication for the entire team.

GUIDED EXPEDITIONS

Guided climbs to just about any expedition destination are available. Climbers should consider hiring a guide if this is their first expedition, if they lack capable partners, or if the prospect of organizing such a major adventure is overwhelming. Using a guide on an expedition allows climbers to spend more time enjoying the experience and less time organizing it. They will be able to concentrate on mental and physical preparation. See the "Questions to Consider When Selecting a Guide Service" sidebar. Conversely, a guided climb costs more than a privately organized venture. Climbers lose control over the selection of party members and other decisions that may affect individual safety or prospects for the summit. Also, there may not be the same unity of purpose and team spirit that characterize the best expedition experiences.

QUESTIONS TO CONSIDER WHEN SELECTING A GUIDE SERVICE

- Is the guide service permitted, licensed, and insured as required by the governing authority of the destination?

- What is the safety record of the guide service?
- What are the qualifications of the guide and the other party members?
- What reputation does the guide service have among climbers? Personal references are very helpful.
- Does the guide service engage in socially responsible environmental, economic, and employment practices?

SUPPLIES

On expeditions to the remote mountains of the world, climbers either bring it with them or they do without it. Having the necessary equipment—and having it in working order—is critical. An expedition needs a complete equipment list, agreed upon by all team members, that includes both group and personal gear. See Table 21-1 later in this section.

Food

Food is the heaviest and arguably the most important supply carried on an expedition. Food provides the necessary fuel for your body to carry loads and climb the route. It can also serve as one of the great pleasures of the trip. Every climber has food preferences, so conduct a team survey of strong food likes and dislikes, as well as allergies, before planning menus.

Will you package and bring your food with you from home, will you buy food and supplies from local markets when you get to your climbing destination, or will you use a combination of these methods? Will you prepare and cook the food yourself, or will you work with a guide, cook, or other support staff? Will you eat all meals as a group or only some meals together, or will members of the team be responsible for all their own meals? Will you cook in a pot, or will all your meals be "boil in a bag"?

If you are working with a guide or cook, be sure to communicate dietary restrictions clearly. Find out what foods will be provided so that you know what foods you will need to bring to supplement the menu. Freeze-dried and other instant foods may not be available at local markets. The foods that you expect and enjoy may not be available in remote locations and other countries. Plan accordingly by being sure to bring these items with you, if needed.

When planning food weight for packing purposes, plan on roughly at least 35 ounces—about 2.5 pounds (1 kilogram)—of food per person per day, although this will vary depending on each climber's metabolism and body

type. With no waste, 35 ounces of food would provide more than 5,000 calories. In reality—because of packaging, nonnutritive fiber, caloric density, and the food's irreducible water content—35 ounces of food will provide only about 3,900 calories per day. Most expedition climbers plan to provide roughly 4,000 to 5,000 calories of food per person per day. Experience will tell climbers whether this is just right, too much, or not enough. Too much food means carrying extra heavy loads between camps and possibly a slower trip. Too little means climbers will begin losing weight or have to abandon the climb. For advice on specific menus, see Chapter 3, Camping, Food, and Water; for a description of nutrition habits for climbers, whether in training or on the mountain, see "Fundamental Training Concepts" in Chapter 4, Physical Conditioning.

A condiment and seasoning kit with hot sauce, spices, soy sauce, butter, and mustard adds interest to bland packaged foods and perhaps will salvage inedible foods. As much as possible, try out foods ahead of time, preferably on training climbs with the team.

Early in the trip, foods can differ from those that will be eaten later. Foods for lower elevations and warmer climates during the approach can include those that are more time-consuming to prepare, such as pancakes; items that cannot withstand freezing, such as cheese and peanut butter; and some fresh items such as cabbage or carrots. Foods carried to higher altitudes should be very light and tasty and require minimum preparation, such as freeze-dried items, instant noodles, instant rice, and instant potatoes.

Packaging and organizing food is an important element of expedition planning. Measure and repackage food in appropriately sized portions—either each individual portion in a resealable plastic bag, or each meal-sized portion for the entire group (so much per person per day times the number of people) in a large resealable plastic bag—to get rid of unnecessary packaging. Label everything and keep the preparation instructions with the repackaged foods. Clear plastic bags help organize the food while keeping the contents visible.

Water

Contaminated water plagues nearly every part of the world. The expedition kitchen must be able to furnish adequate potable water for everyone through chemical decontamination, filtering, or boiling (see "Water Treatment" in Chapter 3, Camping, Food, and Water). Research your climbing destination's safe water practices to ascertain how safe the local water is in that area, and

when in doubt, treat your water. Keep in mind that in some countries, water may need to be treated in cities and towns as well as in the backcountry and that viruses can be a much bigger concern outside North America and Europe.

Stove and Fuel

In places where you will be melting snow for water, your stove and fuel choices are a matter of life and death. In high-altitude regions, choose a stove that will work efficiently in that environment. (See "Stoves" in Chapter 3, Camping, Food, and Water.) Canister stoves, while Lightweight, may not function as well in high-altitude regions. Multifuel stoves are good in regions where white gas is not readily available and function better at high altitudes. Even with a multifuel stove, check the fuel's compatibility with the stove before heading into the mountains. The cleanliness of fuel in some areas is questionable. If you are using liquid fuel, bring a fuel filter to filter all fuel before it is used, and bring a repair kit and tools for stove repair. Learn to take apart, clean, and troubleshoot repairs on your stove before the trip.

TABLE 21-1. SAMPLE EXPEDITION EQUIPMENT LIST

This checklist includes the Ten Essentials, although they are not called out as such. Refer to Table 2-4 and Table 2-7 in Chapter 2, Clothing and Equipment for more information.

GROUP GEAR

SHELTER

- Expedition-quality tent(s)
- Snow stakes and/or tent flukes
- Sponge for tent condensation
- Snow shelter construction tools: large snow shovel (for moving a lot of snow), small snow shovel (for delicate trimming), snow saw (for cutting blocks)

KITCHEN

- Cook tent
- Stove gear: stove, windscreen and stove platform, fuel containers and fuel, matches and/or butane lighters

- Cooking gear: pots, pot cozy, pot gripper, sponge or scrubber, dipping cup, cooking spoon
- Snow sack (for collecting clean snow to melt for water)
- Spices and condiments
- Water treatment: filter, chemicals

GROUP MEALS
- Food

GROUP CLIMBING GEAR
- Ropes
- Hardware: snow and ice gear (pickets, ice screws), rock gear (pitons, cams, chocks), carabiners, runners, fixed line, extra climbing equipment (spare ice axe or tool, spare crampons, spare rescue pulleys)

REPAIR KIT
- Tent repair kit: pole splices, adhesive-backed repair cloth, seam repair compound
- Stove repair kit
- Crampon and ski repair kit: extra screws, connecting bars, straps
- Duct tape
- Multitool (with slotted and Phillips screwdrivers, small pliers, small wire cutter, shears, file)
- Sewing kit: assorted needles and thread, buckles, safety pins
- Flat webbing
- Other: wire, accessory cord, extra ski-pole basket, patch kit for inflatable foam pads

FIRST-AID KIT

Most expeditions carry a comprehensive group first-aid kit. In addition to normal first-aid items, the kit may include the following drugs, plus others recommended by a physician:
- Prescription drugs vary with the destination, but should include antibiotics, strong analgesics, antidiarrhetics, laxatives, and altitude medications (acetazolamide, dexamethasone)
- Nonprescription drugs vary with the destination, but should include cough suppressants, decongestants, and mild analgesics (aspirin, ibuprofen, acetaminophen)

OTHER GROUP GEAR

- Weather radio
- Altimeter, map, compass
- GPS device
- Whichever communication devices the expedition team prefers: Satellite phone, personal locator beacon (PLB), satellite communicator, two-way radios
- Battery packs
- Solar charger with appropriate cords
- Wands
- Latrine equipment

Typically, transporting any type of fuel on airplanes, trains, and buses is prohibited. Research the regulations for the party's specific transportation needs and destination well ahead of time. Make sure the needed fuel is available at the destination and bring the stove that works with that fuel.

If you are using liquid fuel, carry empty fuel containers compatible with your stove and fuel type. Fuel containers must be new or thoroughly cleaned and aired out before transporting, as airlines will object to containers with residual vapors. Consider the environmental impact of empty fuel container disposal and plan accordingly.

Bring sufficient stoves and fuel for any porters or other local individuals who will be part of the expedition. Adequate cooking equipment will help reduce the entire team's impact on the environment.

PERSONAL GEAR

FOOD

- Personal dinners, lunches, snacks, etc.

CLOTHING

- Base layers (long underwear)
- Midlayers (down or synthetic)
- Shell layers: waterproof-breathable wind gear and raingear (top and bottom)
- Belay jacket
- Extremities: hands (liner gloves, insulating gloves, mittens), feet (liner socks, insulating socks), head (balaclava face mask, neck buff, sun hat,

insulating hat)
- Double plastic or synthetic mountaineering boots
- Expedition gaiters and/or overboots
- Other: bandannas, sun shirt, synthetic fill or down booties

SLEEP SYSTEM
- Sleeping bag
- Bivy sack
- Inflatable foam pad, insulating air mattress, and/or closed-cell foam pad
- Earplugs

CLIMBING GEAR
- Helmet
- Ice axe
- Second ice tool
- Harness with personal anchor
- Chest harness
- Belay device
- Rescue pulley
- Ascenders and/or prusiks
- Nut tool
- Personal carabiners and slings
- Large-volume pack
- Crampons
- Snowshoes or skis with skins
- Sled with associated hardware for pulling and duffel bag

OTHER GEAR
- Ski poles and trekking poles
- Headlamp, extra batteries
- Avalanche transceiver
- Avalanche probe
- Watch with alarm
- Wide-mouth water bottles
- Sunglasses, spare sunglasses, goggles
- Insulated mug, bowl, spoon
- Spare prescription glasses
- Passport

- Personal hygiene: toilet paper, pee bottle, pee funnel, blue bags, toothbrush, toothpaste, floss, comb, chemical wipes and/or waterless skin cleanser, sunscreen, lip balm, foot powder, soap leaves
- Personal electronics: camera, e-reader, MP3 player and headphones, mini projector, phone

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Calculate fuel needs before you go. Note that adverse factors such as wind, cold air, and altitude greatly increase boiling times and fuel needs. (For formulas and factors, see "How Much Fuel?" in Chapter 3, Camping, Food, and Water.) Clean the stove often while in the mountains, especially when using questionable fuel.

Group Gear

Some gear must be decided upon as a group.

Shelter. Decide beforehand as a team how many and what kinds of tents are best. If necessary, also decide ahead of time who will stay in what tent.

Kitchen. For communal cooking, take pots large enough for group meals and for melting large amounts of snow. Water bottles must be filled daily, so pots should be easy to pour from. Bring one cook pot per stove. Bring a metal gripper to use on pots that lack handles or bails, or use wool gloves as pot holders. Be careful using synthetic gloves, which will melt if they get too hot. Consider a stove platform or board, a heat exchanger, a windscreen, and/or pot cozies in cold climates to make your kitchen more efficient. Serving spoons and "dipping" cups may also be needed. Consider what type of lighters and stormproof matches are needed.

Repair kit. Be prepared for critical equipment failure under the prolonged and rugged demands of an expedition. Put together a comprehensive repair kit, keeping in mind the relative importance of each piece of equipment to the progress of the group (see Table 21-1).

First-aid kit. An expedition should assemble a comprehensive first-aid kit. Consider how isolated the peak is and the specifics of medical issues and diseases in that particular region or country. It is a good idea to make a pretrip appointment with a doctor who is a travel specialist or familiar with mountaineering. Discuss the vaccinations and preventive care needed in the destination country and ask specifically for prescriptions for medications needed for your first-aid kit.

The first-aid kit may include such specialized or prescription items as altitude medications, strong painkillers, antibiotics, a dental repair kit, and a suture kit. (See "The Ten Essentials" in Chapter 2, Clothes and Equipment, as well as Chapter 24, First Aid.) Check on any restrictions or cautions regarding transporting drugs and medical equipment to a particular destination. Find out whether different climates or altitudes adversely affect medications that will be taken on the expedition.

Know the specific medical conditions of team members and their medical knowledge. Party members should prepare by obtaining wilderness first-aid training and understanding how the contents of a first-aid kit can be used.

Electronic and communication devices. Electronic gadgets can make expedition climbing safer and more enjoyable. Devices can be used to get weather information, call for emergency help, allow communication between climbers at different locations, and communicate with family and friends back home. They can also provide a welcome distraction when the weather keeps you trapped in a tent.

Technological devices are constantly changing, getting lighter, faster, and more versatile. Some of the current useful devices include: altimeter watches, GPS units, PLBs, et cetera. Every expedition team should strongly consider carrying devices that will allow them to ask emergency responders for help, should they need it. (See more on these tools in Chapters 2, Clothing and Equipment, and 5, Navigation.) Some devices combine features, acting as a two-way communication device, sending text messages and/or emails to friends and family, acting as GPS units, and/or posting GPS coordinates automatically to a blog or website. Investigate these options to determine both the technical feasibility of using them where the party will be traveling and whether local authorities require you to secure their permission. Many excellent choices in solar chargers and battery packs are available for charging various group and personal electronic gear.

Wands. Wands, which are used to mark routes, camp perimeters, gear caches, and snow shelters, are another group gear item. The number of wands needed varies according to the specifics of the climb, such as length, terrain, and route. (See "Wands" in Chapter 18, Glacier Travel and Crevasse Rescue.)

Climbing Gear

The route and the chosen climbing style determine what climbing gear is needed. A route that involves only glacier travel may require just the basics: rope, ice axe, crampons, and crevasse rescue gear. Technical routes can require the whole gamut of equipment, from ice screws and pickets to cams, nuts, and pitons. Depending on the climbing style and organization of the trip, climbing gear can be personal or communal—or a combination. Certain pieces of climbing gear, such as crampons and ice axes, are indispensable personal gear and a large party may want to carry spares.

Ropes. Deciding the type, length, and diameter of the ropes depends on the route and its difficulty. In addition, carefully consider the length and style of rope needed for self-rescue situations. Keep in mind that an expedition can put extraordinary wear and tear on ropes with daily use in bright sunlight and that it may be necessary to inspect and even retire these ropes. The team may need to decide how much static rope to bring for fixed lines along the route.

Ascenders. The cam of a mechanical ascender permits one-way movement, gripping or squeezing the rope when the ascender is pulled downward but freely sliding upward. Ascenders make it easier to ascend fixed lines, handle crevasse rescues, and haul heavy, bulky expedition loads. Expedition climbers may prefer ascenders over prusik slings, both for crevasse rescue and for self-belay while climbing with a fixed line—the extra weight may be justified by the greater utility. A climber may choose a pair of handled ascenders or one ascender (typically the nondominant-hand ascender) plus a prusik sling or a mini-ascender. Regardless of the choice, practice operating the system while wearing bulky gloves or mittens.

Personal Gear

Clothing. Expedition climbers need clothing that can stand up to prolonged use under severe conditions. The suggestions on clothing and equipment in the preceding chapters of this book (see Chapters 2, Clothing and Equipment; 16, Snow Travel and Climbing; and 19, Alpine Ice Climbing) are generally applicable to expeditions.

Sleeping bag. Take into account each sleeping system's comfort rating based on the anticipated climate, season, and altitude of the area the party will be visiting.

Other personal gear. Each climber will likely want some or all of the following:

- **Contact lenses.** Climbers who wear contact lenses should carry an extra set.
- **Prescription sunglasses.** Climbers who require prescription glasses should carry an extra set of prescription sunglasses as well.
- **Journal.** An expedition can make climbers introspective. A field journal made of waterproof paper, plus some pencils, helps pass the time.
- **E-readers.** Catch up on reading while waiting for flights or during rest days and storm days in the field. E Ink–style e-readers can perform better in cold conditions and are generally lighter than tablet e-readers.
- **Personal hygiene items.** During cold-weather trips where water is at a premium, chemical wipes and/or waterless skin cleansers can provide a refreshing sponge bath, and talcum powder can take the edge off the often strong odors that develop over the course of an expedition.
- **Pee bottle and pee funnel.** The pee bottle eliminates those unpleasant trips to the latrine during storms and cold nights. Be sure the bottle has a secure top, is clearly labeled, and is sturdy enough to withstand freezing and thawing. Women can use pee funnels in conjunction with a pee bottle. Practice in the shower at home before the expedition.

EXPEDITIONARY AND MULTIWEEK CLIMBING TECHNIQUES

Expedition mountaineering calls for the rock, snow, ice, alpine, and winter climbing techniques covered throughout this book. An expedition may also add some new techniques to the climber's repertoire: hauling sleds and using fixed lines.

SLED HAULING

To move loads of gear and supplies on long approaches, expedition members often pull sleds behind them (fig. 21-1). Climbers may carry a normal load in a backpack and pull a sled with another pack's worth of gear. Before the expedition, practice on various types of terrain.

A commercial haul sled features zippered covers to hold the load, a waist harness, and semirigid aluminum poles connecting the sled and harness. Commercial haul sleds are typically expensive and sometimes difficult to get, as few companies make them.

A cheaper and more common alternative to a commercial haul sled is a self-made haul sled using a children's plastic sled (fig. 21-2). Drill holes in the sides and attach grommets to the holes to protect the cord. Thread the holes with 4- to 5-millimeter accessory cord for use as rope attachment points and to secure loads. Since there is no zippered cover on a self-made sled, load gear into a duffel bag or haul bag and tie it to the sled. Use accessory cord to attach the front of the sled to a haul line and as an attachment for the back of the sled to the rope. A locking carabiner or pulley helps the sled to move over the snow better. Use 5- to 7-millimeter accessory cord or create poles from common materials (such as PVC pipe) to pull the sled. Most climbers find it more comfortable to attach the haul line or poles to their pack rather than to their climbing harness using two nonlocking carabiners. If using poles, the pole material should be flexible and climbers should consider adding a shock system to the pack or harness pole attachment with dynamic material. Finally, attach a locking carabiner to the back of the sled to use as a tie in for the rope as shown in Figure 21-1.

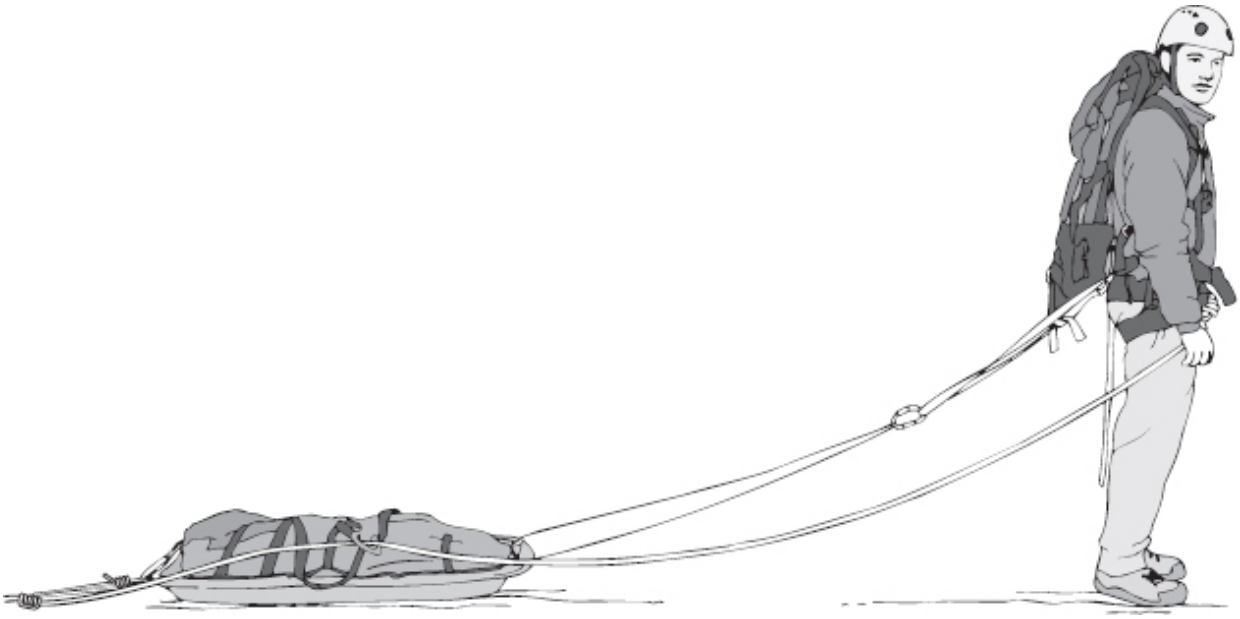

Fig. 21-1. Sled and climber rigged for glacier travel.

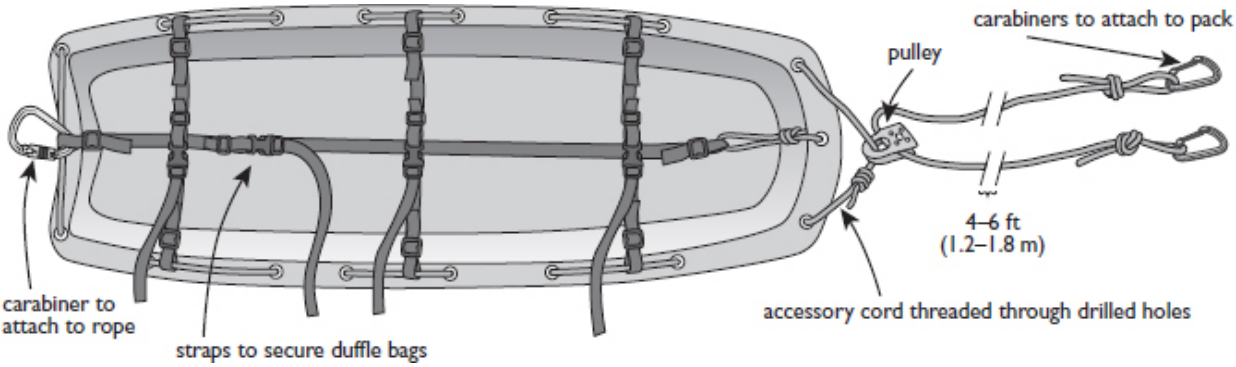

Fig. 21-2. Self-made haul sled and its components.

As the route steepens, the amount of weight that can be pulled in a sled decreases. Sleds cannot be used at all on steep, technical climbing terrain. Haul bags may then be what is needed (see "Hauling" in Chapter 15, Aid and Big Wall Climbing).

Hauling a sled can get complicated during roped travel on glaciers. A fall into a crevasse is more treacherous with a sled plunging down behind the fallen climber. Even if the plummeting sled does not injure the fallen climber, the sled's presence and added weight make rescue more difficult. Minimize the danger of getting hit by the sled during a crevasse fall by using this simple preventive technique: Where the climbing rope runs past the sled, tie it snugly with a clove hitch or prusik hitch to a carabiner attached to the rear of the sled (see Figure 21-2). If a duffel bag is strapped to the sled, be sure to clip the duffel bag to the rope as well.

In a crevasse fall, first the climber will drop into the crevasse, followed by the sled. The sled, however, will be stopped above the climber by the tie-in to the climbing rope (fig. 21-3). If the climber is using a hauling tether attached to the sled instead of semirigid poles, be sure the tether is long enough so that in case of a crevasse fall the climber will be well below the sled as it hangs from the climbing rope. If the climber is using semirigid poles to haul the sled, in a crevasse fall, the hauling poles may pull the climber toward the sled, so the climber may want to have a way to detach the sled from him- or herself while still having the sled tied in to the rope.

This technique depends on having a team member on the rope behind the fallen climber, to arrest the fall of both the climber and the sled. Therefore, it will not work for the last climber on a rope. The last person either assumes the extra risk, or the team can decide to haul only two sleds for every three climbers on a three-person rope team.

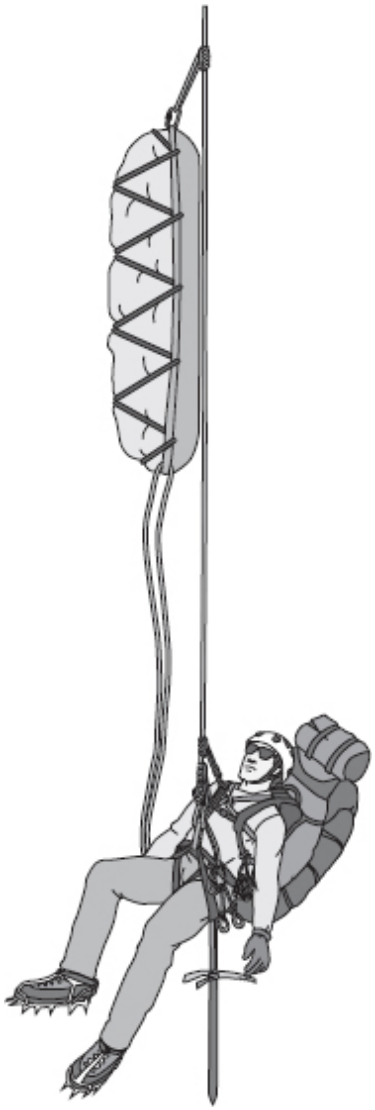

Fig. 21-3. A climber who has fallen into a crevasse, with a sled hanging overhead.

Crevasse Rescue with a Sled

Crevasse rescue with a sled requires improvisation and problem solving beyond the techniques discussed in Chapter 18, Glacier Travel and Crevasse Rescue. It is not only essential that a climber completely understand standard crevasse rescue practices, it is also helpful to practice sled-hauling and sled-falling scenarios by dangling with a loaded sled off a rooftop or tree. As you dangle in the crevasse, your weight may be on the sled haul line, or the sled weight may be completely on you. This complicates crevasse rescue greatly.

First, attach yourself to the climbing rope with your ascending system (either mechanical ascenders or the Texas prusik system; see “Ascenders” in

Chapter 18, Glacier Travel and Crevasse Rescue) if you are not already attached. Make sure you are attached and backed up by the climbing rope and that you stay attached to the system at all times.

Now you must get out of the pack-and-sled system. If a sled haul line is attached to your pack, carefully attach the pack to the climbing rope. If possible, take off the pack and let it hang below you from the climbing rope. If you are using a commercial haul sled with a waist harness, carefully tie the sled to the climbing rope and then get out of the waist-harness system, transferring the sled load onto the climbing rope. Take extreme caution in this step, as losing a pack or sled full of gear and supplies could be a serious matter.

Depending on the position of the sled, you may need to ascend around it. In this case, remove your ascenders, one at a time, and reattach them to the climbing rope above the knot securing the sled to the climbing rope. You may also need to untie from the climbing rope in order to move past the sled, as well as to reach the lip of the crevasse. To make it easier to disconnect from the climbing rope, some climbers travel with the rope clipped to two opposite and opposed locking carabiners on their harness, rather than tying the rope directly to the harness itself. If you need to untie from the climbing rope, use extreme caution to ensure that you are attached to the system and backed up at all times.

A fall into a crevasse with a sled can also mean extra effort for topside teammates if they must pull out the fallen climber and the sled. If the fallen climber cannot disconnect from the sled, or if no extra rescue rope is available, topside teammates must haul both climber and sled at the same time (see “Rescue Methods” in Chapter 18, Glacier Travel and Crevasse Rescue).

FIXED LINES

A fixed line is a rope that is anchored and left in place on the climbing route. It allows safe, quick travel up and down a difficult stretch. Climbers protect themselves by tying in to a mechanical ascender on the fixed line, eliminating the need for time-consuming belays. If a climber falls while climbing next to the fixed line, the ascender cam locks onto the fixed line to hold that person (see “Using Ascenders” and “Fixing Pitches” in Chapter 15, Aid and Big Wall Climbing).

The fixed line simplifies the movement of people and equipment, especially when numerous trips up and down the route are required. Fixed lines are

common on large expeditions to major peaks in order to provide protection on long stretches of exposed climbing or to protect porters while they make carries from camp to camp. The lines make it possible for climbers and porters to carry heavier loads than they could safely carry without them. Fixed lines are sometimes used as a siege tactic on difficult rock and ice faces, with climbers retreating down the lines each night to a base camp and then ascending again the next day to push the route a little farther.

Fixed lines are often set by guiding companies for their clients to use. There is an unofficial agreement that all climbers can use all fixed lines set by any climbing party or guiding service. Exercise caution in deciding whether to make use of a fixed line already in place on a route. Elapsed time, exposure to weather, and the ice tools or crampons of climbers who used the line before your party may have damaged the rope. Fixed lines should not be used to supplement the climbing ability of an expedition team. Fixed lines should not be added on popular routes or in violation of the local climbing ethic.

Equipment for Fixed Lines

To set up and use fixed lines, the party needs rope, anchors, and ascenders. A static rope—that is, one with low elongation under load—is best because static ropes are designed to stretch less when weighted. The diameter of fixed lines usually varies between 7 and 10 millimeters. The ideal size depends on the terrain and the amount of use the line is expected to get. Fixed lines are usually longer than a normal climbing rope. They are usually manufactured in lengths ranging from 90 to 300 meters (300 to 1,000 feet), depending on diameter.

Setting Up Fixed Lines

A variety of methods can be used to set a fixed line, each appropriate for certain conditions, climber preferences, and types of line. The key is to think through the chosen system prior to starting out and, if possible, to test and refine it before it is actually needed. Here are three possible approaches:

- **The most common way** is for two or three climbers to ascend the route, using a standard climbing rope to belay one another or to establish a running belay, and to use a second static rope to set a fixed line as they climb. The climbers carry the entire spool of fixed line with them, letting it out as they ascend and tying it off at each intermediate anchor along the way.

- **Another option** is like the first, but rather than tying the rope off at each anchor along the way, climbers just clip the fixed line in to each intermediate anchor with carabiners instead. In this method, the climbers do not have to carry the spool but can trail just the end of the fixed line with them. At the top of the route, after anchoring the top of the fixed line, the climbers descend, tying off the fixed line at each intermediate anchor on the descent. It can be difficult to pull up on the end of the fixed line and overcome the tremendous friction that develops as the line travels through the carabiners and over the route.
- **A third method** is to set the fixed line entirely on the descent. This means, of course, that all of the material for the fixed line first must be carried to the top of the route. Tie the line in to a bombproof anchor at the top, then rappel or down-climb to tie the line off at intermediate anchors.

Anchoring Fixed Lines

Every fixed line must have an anchor at the bottom and a secure anchor at the top. To anchor the fixed line to the mountain, employ attachment points that are normally used in belaying and climbing on rock, snow, or ice: pitons, nuts, natural outcrops, ice screws, pickets, or deadman anchors. (See "Snow Anchors," in Chapter 16, Snow Travel and Climbing.) Mark the location of the bottom and top anchors with wands, making it easier to find them during or after a snowstorm.

Place a series of intermediate anchors between the bottom and top of the fixed line. These can be anchors that were placed on the earlier ascent of the route, although new ones may be added just for the fixed line. Tie off the fixed line at each anchor (intermediate as well as top and bottom) so that every section of line is independent of the others. This permits more than one climber at a time on the line. Be sure that a fall by any climber would not cause rope movement, rockfall, or anything else that could endanger a team member.

To tie off the fixed line at each intermediate anchor, use a figure eight on a bight or clove hitch in the fixed line. Tie a sling directly to the anchor, and clip the figure-eight loop or clove hitch in to a carabiner attached to that sling (fig. 21-4a). To minimize the use of carabiners and have one less link in the system, tie the sling directly through the figure-eight loop or clove hitch (fig. 21-4b).

There are several considerations when deciding where to place anchors: Place them to change the direction of the line where necessary or to prevent pendulum falls. Placing an anchor at the top of a difficult section of the route is helpful. If possible, place the intermediate anchors at natural resting spots, making it easier for climbers to stand and move their ascenders past the anchors.

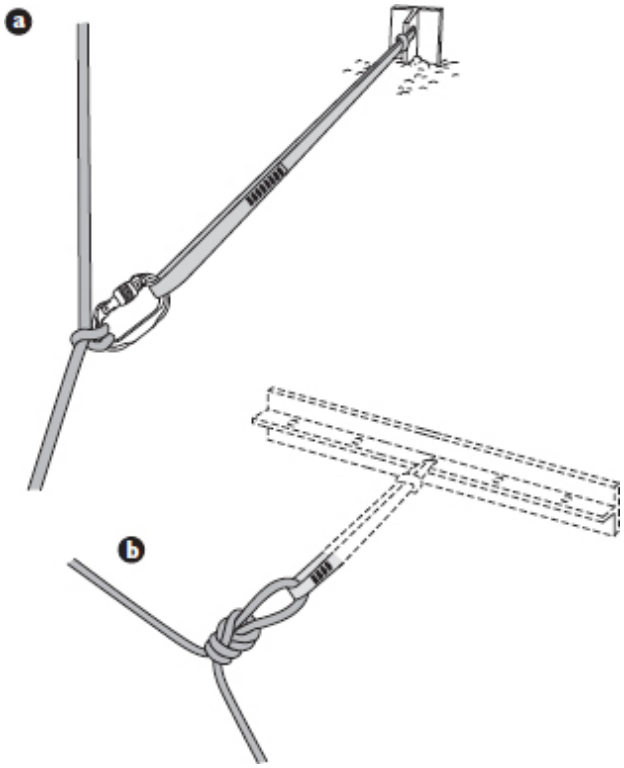

Fig. 21-4. Intermediate anchors on a fixed line: a, anchor with carabiner clove-hitched to fixed line; b, anchor without carabiner, using a sling tied through a figure eight on a bight of a fixed line.

Always bury or cover snow and ice anchors, and inspect them regularly for possible failure due to melting or moving out of place. Keep a close eye on any rock anchors capable of moving out of place or loosening. Place anchors at locations that will keep the line from rubbing on rough or sharp surfaces, or pad the line at points of abrasion. Even small amounts of wear can multiply into dangerous weak spots on fixed lines. Falls will also damage the line. After any fall on the line, inspect it for damage and check the anchors for indications of possible failure.

Ascending Fixed Lines

When ascending a fixed line, attach a sling to a mechanical ascender and place the ascender on the fixed line. Ascenders are camming units that slide freely in one direction and clamp down to hold in the other. Climbers typically use an ascender for their nondominant hand. Tie the sling to the harness where you normally tie in with the climbing rope, or clip the sling in to a locking carabiner attached to the harness. Make the sling long enough so that the ascender will not be out of reach if you fall. If you are climbing a near-vertical section or climbing with a heavy pack, you may choose to pass the sling through your chest harness as well to prevent tipping upside down in a fall.

Follow the specific directions for the brand of ascender you carry. The ascender should be oriented so that a fall will cause it to clamp the rope. It should slide easily up the line but lock tight when pulled down the line. Test it, and check the fittings on your harness, before starting upward.

Use a personal anchor (see "Personal Anchors" in Chapter 9, Basic Safety System), or a carabiner and sling attached to your harness, as a backup safety (fig. 21-5a). It might be preferable for the personal anchor to be above the ascender on upward travel so that the ascender will "push" the personal anchor along. If you fall and the ascender fails, your personal anchor will slide down the fixed line to the next anchor below and arrest the fall.

At each intermediate anchor, the climber must pass the knot or hitch in the fixed line. This is the most dangerous moment in fixed-line travel, particularly if conditions are severe and you are exhausted. It is best to move the safety carabiner first (fig. 21-5b). Unclip the carabiner, then reclip it above the intermediate anchor. Then move the ascender (fig. 21-5c). Another option is to briefly clip your personal anchor in to the intermediate anchor while relocating the ascender. Be sure that your personal anchor stays on the line when the ascender is detached. Think the procedure through in advance and practice it often so you can perform it reliably under the worst possible conditions.

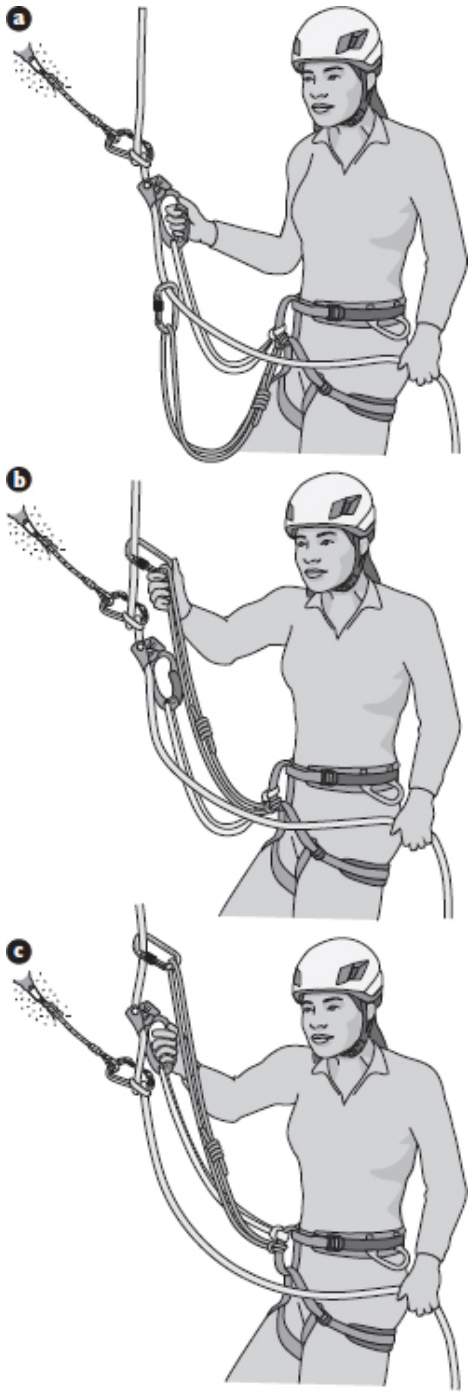

Fig. 21-5. Passing anchors while ascending a fixed line: a, set up for ascending, with carabiner-sling backup; b, move the safety carabiner above the knot first; c, then, move the ascender above the knot, but below the carabiner.

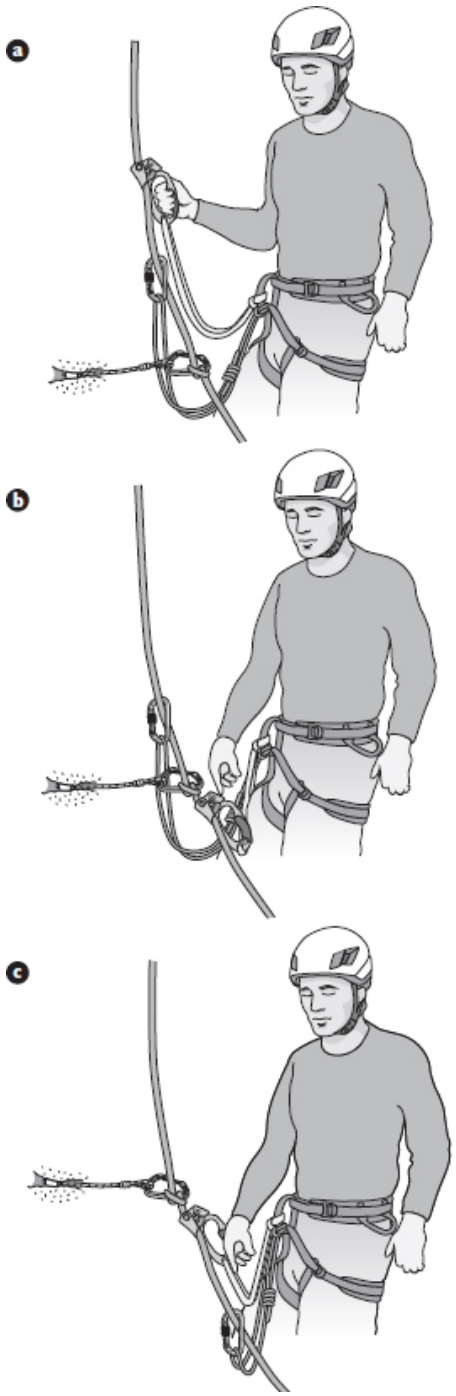

Fig. 21-6. Passing anchors while descending a fixed line: a, set up for descending, with carabiner-sling backup; b, move the ascender below the knot first; c, then, move the safety carabiner below the ascender.

Descending Fixed Lines

Climbing down a fixed line is similar to climbing up. Attach the ascender sling to your harness. Attach the ascender to the fixed line in the same way as

on the ascent. Double-check that the ascender locks onto the rope when you pull down on it and that it will be within reach if you end up hanging from it after a fall. Attach your personal anchor as a backup (fig. 21-6a).

Begin the descent using the fixed line as a hand line (see Figure 14-1 in Chapter 14, Leading on Rock) or an arm rappel (see Figure 11-23 in Chapter 11, Rappelling). While moving downward, slide the ascender down the rope by using a light grip on the ascender release. Let go of it instantly in a fall so the ascender will grab the rope. It is natural to try to hang on to something if you lose your balance, but be careful not to grab the ascender release.

As in the ascent, the most difficult part is moving past the intermediate anchors. Move the ascender (fig. 21-6b), then move the personal anchor (fig. 21-6c)—the opposite order from ascending a fixed line. Remember: Never detach the ascender and the personal anchor at the same time. Keep in mind that you can temporarily clip your personal anchor in to the intermediate anchor while relocating the ascender. On steep sections of fixed line, rappelling the fixed line may be a good alternative to down-climbing.

Passing on Fixed Lines

It can be dangerous for climbers to pass one another on a fixed line. However, if passing is necessary, it should be clearly communicated by the team passing to the team being passed, and it should be done at an anchor point. On popular routes with a fixed line intended for descent, ascending the descent line as a means of passing another ascending party should be considered only when the descent line is not currently being used by a descending party—and it should be considered as a means of passing only by small parties that can easily move aside if a team decides to use the fixed descent line to descend.

Removing Fixed Lines

Climbing rope and gear and anchor material of any type are not natural or biodegradable materials. They must be packed out. Teams are responsible for removing any fixed lines, gear, and anchor material that they have placed and then hauling them out. When setting them up, always bear in mind that they will need to be removed.

EXPEDITION WEATHER

On an expedition, climbers need to become talented amateur weather forecasters because their safety and success are so closely bound to nature's moods. When the party reaches the climbing area, talk to other climbers and to people who live there about local weather patterns. Find out the direction of the prevailing winds. Ask about rain and storms. On the mountain, make note of weather patterns.

The altimeter can serve as a barometer to signal weather changes. Take clues from the clouds. Cirrus clouds warn of a front bringing precipitation within the next 24 hours. Lenticular clouds (cloud caps) mean high winds. A rapidly descending cloud cap is a sign that bad weather is coming. If the party climbs into a cloud cap, expect high winds and poor visibility. (See Chapter 28, Mountain Weather, for more about weather.) Be prepared for the fact that big mountains typically have big storms, strong winds, and rapidly changing weather.

Wait out a storm, if possible, or consider descending before the weather gets too severe. There is risk inherent in descending under bad conditions. If the party expects to be stuck for some time, consider food and fuel cache locations and whether a storm would affect your access to them.

Fair weather poses problems too. If it is hot and sunny, glaciers intensify solar radiation. The result can be collapsing snow bridges, moving crevasses, and increased icefall. In such conditions, it is best to climb at night, when temperatures are lowest and snow and ice are most stable.

HIGH-ALTITUDE HEALTH HAZARDS

Inadequate levels of oxygen, extreme cold, and dehydration, among other things, are all potential health hazards that are intensified by high-altitude conditions. Learn to recognize, prevent, and treat potential health hazards when they occur (see "High-Altitude Conditions" in Chapter 24, First Aid). Consult a physician familiar with mountaineering for detailed information and prescriptions for preventive altitude medications.

On high peaks, temperatures drop well below zero. Although this is good for keeping snow stable, it can have a detrimental effect on a climber's body. Everyone in the expedition party must be aware of the dangers of frostbite, as well as windburn and sunburn.

Expedition climbing, like any mountaineering, takes climbers to altitudes where the human body no longer feels at home. Every climber is affected to

varying degrees by reduced oxygen at higher elevations, sometimes leading to acute mountain sickness (AMS; altitude sickness). This can lead to the life-threatening conditions of high-altitude pulmonary edema (HAPE) and high-altitude cerebral edema (HACE). These illnesses are generally avoidable, through proper acclimatization and hydration.

ACCLIMATIZATION

The best way to combat altitude illness is to prevent it in the first place. The best way to do this is to ascend slowly. The human body needs time to acclimatize to higher altitude. (See Chapter 24, First Aid and "Planning and Preparation," earlier in this chapter.)

In high-altitude expedition-style climbing, carry loads to a highcamp and return to lower altitude to recover. Then ascend again the following day. Ascend at a moderate rate, averaging 1,000 feet (300 meters) a day in net elevation gain. For example, if suitable campsites are 3,000 feet (900 meters) apart, carry loads to the next campsite (a 3,000-foot gain) on one day. Descend back to camp for the night, carry the rest of your gear and tents up to the next site the next day, and rest at the new camp the third day, for a net gain of 3,000 feet every three days. Try not to push your limits until you have become well acclimatized. Schedule rest days after big pushes.

High-altitude alpine-style climbers may spend time at a base camp, ascending the intended route farther and farther each day before returning to base camp each night.

Above 18,000 feet (5,400 meters), most people begin to deteriorate physically regardless of acclimatization. Minimize time at high altitudes, and periodically return to lower altitudes to recover. The old advice is still good: climb high, sleep low. The body recovers more quickly at a lower altitude and acclimatizes faster during exertion than during rest. Active rest days when climbers build snow walls, hike to lookouts, or practice skills can help with acclimatization.

HYDRATION

Hydration is critical in avoiding altitude illness (see "Dehydration" in Chapter 24, First Aid). Everyone should drink 5 to 7 quarts or liters of water a day and avoid alcohol and caffeine, which have a dehydrating effect. On many routes, this may mean that several hours each day must be dedicated to

melting snow. This is time well spent, however, because adequate hydration is important to the success of an expedition.

In addition to using the above recommendations for daily liquid intake, monitor urine output and color. Urine should be copious and clear. Dark urine indicates that a climber is not drinking enough water.

Climbers usually lose their appetite at high altitudes. Everyone tends to eat and drink less than they should. Consider various hot drinks—teas, hot cocoa, hot electrolyte drinks—to supplement water and calorie intake.

UPHOLDING AN EXPEDITION PHILOSOPHY

Members of an expedition need a common code to live by during their weeks of traveling and climbing together. One reliable code can be summed up in three promises that you and your teammates can make to one another: respect the land, take care of yourselves, and come home again.

Respect the land. Every day, the expedition party has the chance to put the health and beauty of the land ahead of its own immediate comfort. The easy way out might be to burn wood fires, set up camp in a virgin meadow, or leave garbage and human waste on the ground. But if all the climbers have promised to respect the land, they will be aware of their impact and be responsible. Leave no trace.

Those who follow your trail will not want to see the wrappers from your snacks or other signs that your group passed through the area. If you pack it in, pack it out. Be sensitive to local customs. Local land managers may have specific wishes about the treatment of their areas. Learn what their expectations are ahead of time and be respectful. If local practices are more relaxed than Leave No Trace techniques, however, do not follow local customs; instead, follow Leave No Trace practices.

Take care of yourselves. If you and your climbing partners have promised to take care of yourselves, you have made a commitment to group self-reliance. There may be no choice in the matter, because the party will likely be a long way from rescuers, helicopters, hospitals, or even other climbers. Prepare by thinking through the possible emergencies that the party could face and by making plans for responding to those. You will feel reassured that plans are ready if you have to use them and grateful if you do not.

In addition, foster team spirit by checking on one another throughout the day regarding adequate fluid intake, use of sunscreen, and other necessities that

will keep team members healthy and in good spirits. After all, as the late renowned climber Alex Lowe said, “The best climber in the world is the one having the most fun!”

Come home again. The third promise might be the hardest to keep, because it can conflict with that burning desire for the summit. It is really a promise to climb safely and to be willing to sacrifice dreams of the summit in favor of survival. Expedition climbing is, all things considered, about pushing limits and testing yourself both physically and mentally.

Each person and each team must decide what level of risk they are willing to accept. Keep the third promise by being sure that the team agrees upon what is safe and what is unsafe. Out of that discussion, decisions flow daily regarding how fast to ascend, what gear to carry, when to change routes, and when to retreat.

Most climbers would rather return home safely than push for the summit under unsafe conditions. Having the freedom of the hills does not just mean reaching the summit; the success of an expedition can be measured in many ways.