Mountain Bike Search and Rescue
Training Manual

Edited by:

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Welcome, Volunteer Mountain Bike Patroller!

Congratulations! You have volunteered to serve in what may well become one of the National Mountain Bike Patrol's most recognized programs.

If the mission of the National Mountain Bike patrol is to "Educate, Assist and Inform" then Search and Rescue (SAR) certainly falls under the broad category of "Assist." We hope that patrollers who offer to take part in searches for lost or missing persons will reflect the highest standards of IMBA, (International Mountain Bicycling Association) and the National Mountain Bike Patrol. This manual will serve as a adjunct to your mountain bike patroller and search and rescue training programs.

This manual has been prepared to assist you with your training as an NMBP "Search and Rescue" volunteer. Although SAR is not the primary function of a National Mountain Bike Patrol unit, it is certainly a valuable way that patrollers can serve their community, assist other people, and provide a positive image of mountain bikers and the sport of mountain biking.

I would like to thank the following people and organizations, without which this manual and training program would never have come into existence:

New York State Forest Rangers: Arguably, the finest resource and forest visitor protection force in the country, if not the world, and New York's official SAR agency.

Wilderness Search and Rescue Team of New York State: Founded in 1971 as the Tompkins County SAR Team, my first and original SAR team. Dick, Helen, Fred, Chuck, Peggy, Cyndy, D.J., Jim, Rick and Carolyn, "the Next Generation"; Jeff, Chris, Kathy, Kevin, Jason, Karen and of course the dogs of Wilderness, Kassi, Brandy, Bear, Elijah, Morgan, Shiloh, Ivan, Abner, George and Gibson. "Did I ever tell you, you're my heroes? You're everything I'd like to be. I can fly higher than an eagle; you are the wind beneath my wings."

American Rescue Dog Association: America's first, and still one of the best SAR dog groups available. In particular Don and Joyce Arner, who were, at the time, leaders of the New York unit of ARDA, who taught me Bill Syrotuck's theories of lost person behavior, and the science of scent.

Los Angeles County Sheriff's Department: Since 1971, both the paramedic deputies of LASD's Emergency Services Detail and the volunteers of their mountain rescue teams have provided me with all sorts of advice and tips on how to do SAR better.

Las Vegas Metropolitan Police Department Bike Patrol: If I ever wanted to be a Bike Cop in a big city, Vegas would be the place. Forget all the tinsel and glitz; Metro's bike unit is one of the best there is. Thanks to Sgt. Karen Pereyda for providing us with their bike patrol manual and lots of advice over the phone when we established the Anoka County Park Ranger Bicycle Unit.

IMBA and the National Mountain Bike Patrol, and in particular, all the past and present members of the North-Central Mountain Bike Patrol, and it's offspring, the National Mountain Bike Patrol of Wisconsin and the Backcountry Trail Patrol Association. Special thanks to Jon and Kevin, the NMBP National Coordinators in Boulder, CO, and to Brian P., Andy, Mike, Scott F. and Steve D., who helped make this patrol an important part of the biking community in Minnesota and Wisconsin

MOUNTAIN BIKE SEARCH AND RESCUE

by Hans L. Erdman, WEMT
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The headlights split the darkness ahead; the only sound, the heavy breathing of the cyclists as they made their way down the mountain trail. The terrain was rough, the sky as dark as 3 AM on an overcast night could be, but the four mountain bikers stuck to the task they had been given. By the light of their bike's dual headlights, helmet headlamps, and occasional pocket flashlights, they picked up the occasional footprint. However the boy they were seeking was not sticking strictly to the trail, which made the difficult night tracking even more arduous. They continued on, dropping gears to go up steep hills, hoisting the bikes onto their shoulders when there was a stream to be crossed. Gradually the sky started to lighten, and the sun slowly rose over the mountains. Now any observer could see the orange shirts and white helmets of the sheriff's mountain bike search and rescue (SAR) unit, as they pushed on through the gathering daylight. With only brief rest breaks substituting for the sleep they had missed, the SAR bicyclists continued on the trail. Then, shortly after noon, eleven hours after they started down the trail, the bikers found the boy ahead of them on the trail. Tears of relief fell from his eyes as the rescuers fed him some of the food from their bike bags, and he told them the story of his night in the woods. By this time the sky had cleared, and both the boy and his rescuers were flown out of the mountains by helicopter.

This incident actually occurred in 1995 in southern California, and marked one of the first finds by searchers using one of the newest tools in search and rescue (SAR), the all-terrain mountain bicycle, or more commonly, the mountain bike. Since 1987 mountain bikes have skyrocketed in popularity with the cycling public, and also in their use by public safety agencies. IPMBA, the International Police Mountain Bike Association, reports that over 6000 police and EMS agencies now utilize some form of mountain bike patrol, and that number continues to climb. Emergency Medical Services are using bikes to cover special events, access patients off of roadways, and provide medical coverage and safety education in large parks, beaches and recreational areas. The mountain bike has become a valuable tool for agencies in cities, suburbs and rural areas, and it's uses continue to expand.

Across the country a growing number of volunteer search and rescue teams have experimented with of mountain bikes to enhance search efforts when looking for lost or

missing persons. The incident described above took place in Ventura County, California, where the Sheriff's Mountain Rescue Team has a bike unit functioning since 1990, which is one of the first and oldest. Other groups in Oregon, Pennsylvania, Minnesota and other states have also used mountain bikes successfully in SAR. The National Mountain Bike Patrol (NMBP) program was founded in 1994, and with one of it's stated purposes is to assist in backcountry search and rescue operations.

Search operations on a bike are not a ride in the park. (Unless, of course, you're searching in a park!) Although you can probably get away with wearing a shirt or jersey and riding shorts on some missions, the rigors of riding for SAR require different clothing than are normally wear bicycling, or even while patrolling. The equipment you carry both on your bike and on your person is going to be different, also. Remember that when you ride on a search mission, you are riding for a whole different purpose than law enforcement, EMS, or trail patrol. One of the first rules of search and rescue is to not become a liability to the search effort. The other primary rule is that old Boy Scout motto, "Be Prepared!"

Preparation involves a number of things, both personal (physical conditioning and emotional preparation) and equipment. While ALL members of a search operation, be they human, canine or equine, need special training and conditioning, bike searchers are going to require more. Why? Because, more of our strength and endurance goes toward motion than any other type of searcher. For example, SAR dog handlers and grid searchers cover their assigned areas a walking pace. In some cases this may be a fast walk (open terrain) and in others it may be a literal crawl, under heavy undergrowth, through marshes or heavy blowdown, it is still done at a walking pace. Mounted searchers rely on the strength of their horse. Bike riders are moving themselves and 30-50 pounds of bike and equipment through a variety of trail conditions, and may have to climb hills on their bike, ford streams with their bike on them, or leave the bike to check

out something they spot off the trail. This requires more than a donut and coffee at search base for energy and stamina. Preparation for a search mission actually begins days or weeks before a search arises. A cyclist, should be ready physically for any trail conditions you might find in your area. You will need to be psychologically ready for the stress of a search, and in particular the emotional drain of an inconclusive mission (no find) or a search where the subject is found deceased.

With the enormous variety of "mountain-type" bikes available, it may be difficult to decide what kind of bike would best meet the needs of a SAR team. Whether the bike is owned by the unit, agency, or is property of the rider can best be determined locally, within the unit, however all bikes used for rescue should meet certain, pre-established criteria. "Mountain bikes" purchased off of the floor of a local discount store are not going to withstand the rigors of search and rescue. Experienced riders, who are familiar with local terrain and riding conditions should be consulted. Some of the best resources for bicycle information are the staffs of reputable bicycle shops, local mountain bike club members and local police bike patrol officers. They should be able to assist you with basic considerations such as frame construction, component (drivetrain, brakes, etc.) quality, and adaptability to necessary equipment. While price alone may rule out bikes built of more exotic materials, it also serves as an indication of bicycle quality. A good bike for SAR operations is going to cost a minimum of $400.00, without any extra equipment. Riders have to decide between ChroMoly Steel (Chrome-Molybdenum, a light, strong steel alloy) or aluminum. While aluminum may save a few pounds in bike construction, damage to a ChroMoly frame is far easier to repair, particularly in the field, which can mean the difference between riding your bike back to base or carrying it. Front-end or stem shock absorbers are an option that SAR-cyclists may want to give serious consideration. Fully suspended bikes (front and rear shocks) are starting to see more use in emergency services, due to the development of new, stronger racks that clamp on the bicycle seatpost, allowing the bike to carry needed search gear, and rear shocks that can be locked out for climbing hills.

One advantage of a mountain bike is that it can, within reason, carry a certain amount of field equipment on a pack rack behind the cyclist. Although saddle bags (called "panniers") and bike packs are available to carry up to ***12,000*** cubic inches of space for bicycle touring, the weight, balance and side clearance requirements of a SAR mission restrict the amount that can be safely carried to what will fit in a rack pack and a fanny or daypack worn by the rider. A growing number of companies manufacture rack bags that are available at most bike shops, which provide over 1300 cubic inches of storage space. When used in combination with a medium day pack, this provides over

3000 cubic inches to carry necessary equipment. Perhaps the two most important things that mountain bike SAR personnel should carry are appropriate and comprehensive first aid gear, and a good selection of bicycle tools or one good "multi-tool" (available at bike shops) for making emergency repairs. Personally, I have had great success with the Gerber "Cool Tool" for a number of years, but Topeak also is making some excellent tools, including the "Alien" and the new "MacGuyver", named after the "do anything with a pocket knife" TV character. Due to the rugged terrain that may be encountered, the repair kit should include an air pump, at least two spare tire tubes and an "enhanced" (double) patch kit. SAR-cyclists should also consider treating their tires with a puncture resistant material, such as "Slime" (TM) as a preventive measure. A good quality, double headlight systems will make night missions much safer, and should be used in conjunction with a helmet mounted headlamp for optimum efficiency.

SAR cyclists should always carry the "ten essentials" for any outdoor activity, including:

1. Navigation (map and compass)
2. Sun protection (sunglasses and sunscreen)
3. Insulation (extra clothing)
4. Illumination (headlamp, flashlight, bulb and batteries)
5. First-aid supplies
6. Fire (firestarter and matches/lighter)
7. Repair kit and tools (including knife)
8. Nutrition (extra food)
9. Hydration (extra water)
10. Emergency shelter

Units in technical terrain may also want to carry rope and rappelling gear, in case it is needed. Although bicyclists tend to want to wear shorts, searchers on bikes should think about wearing long pants that can be pulled over riding shorts and can be gathered,

bloused or taped at the ankles, (such as BDU fatigue pants or cycling pants,) and a bright colored shirt or jacket. The pants will protect the rider's legs on narrow trails, and keep them warmer in cool or wet weather, and the shirt will protect their arms and help other searchers, air support and (hopefully) the victim see the searchers more readily. Of course all bicyclists should always wear ANSI approved cycling helmets with good ventilation. Other equipment should include items such as cycling gloves, gaiters, sun glasses and light hiking boots. In our unit we recommend light boots used with toe-clips (foot retaining cages on the pedals) over cycling shoes, since the rigid soles of bike shoes are not designed for walking, climbing or wading that a searcher may have to do off their bike.

Emergency service cycling training programs are offered by the International Police Mountain Bike Association (IPMBA) IPMBA offers training in the use of bikes for law enforcement, and emergency medical services through a nationwide cadre of police officers and medics who are certified Police/EMS Cyclist Instructors. IPMBA instructors can put together special training programs to meet the needs of any agency. The International Mountain Bicycling Association (IMBA) administers the National Mountain Bike Patrol (NMBP) program, modeled after, and sponsored, in part, by the National Ski Patrol, and search and rescue is an integral part of the their training curriculum. NMBP member units and nationally trained and certified instructors can assist groups in both SAR training and on actual search call-outs.

As in all disciplines of search and rescue, cyclists should be fully trained in wilderness first aid, CPR, map and compass, communications, backcountry survival and search procedures, both general and mountain bike specific. Comprehensive knowledge of visual tracking, and emergency bicycle repair are also necessary for optimal utilization of bike mounted searchers. Training sessions can be as simple as familiarization with the trails in potential search problem areas, such as parks and woodlands. Informal recreational riding along such trails, gives team members the opportunity to be aware of the tracks, litter and other signs they see, in order to enhance their clue awareness skills. More involved training should consist of having someone "get lost" in a given area and then breaking into teams and searching for both clues and the subject using SAR biking skills and knowledge. Team members can further be challenged with medical or rescue scenarios once the victim is located.

One of the primary reasons to add mountain bikes to a rescue unit is the bike's ability the cover more ground, faster. A searcher mounted on a bike can travel as much as twenty-six feet with each pedal stroke (in highest gear) as opposed to two or three feet per stride, walking. Therefore, the most effective function of a mountain bike team in

SAR operations is to rapidly cover roads, trails and pathways in the search area, checking for evidence of a person's passing. Deployment of a bike team into an area that is barely passable on foot would defeat the advantages of using a mountain bike as a search tool. Working in teams of two, bike crews can be assigned to check trails during hasty search, effect containment using trails and roadways, and use their bikes as a platform for visual tracking. Bike teams will check for signs of a person's passage, (foot or bike tire prints, gum wrappers, cigarettes, etc.)and can rapidly follow footprints that may belong to the missing party. They can set up "track traps" in areas the person might pass through, to catch footprints, and then check those track traps, and follow any leads gained from them. Bikes can also be used to jump ahead on a person's track, or sent ahead to attempt interception once a probable direction of travel is determined. When the victim is located, cyclists with medical and rescue training and equipment can reach them more rapidly than a team on foot, and begin rescue and/or medical stabilization efforts. Other SAR functions where the bikes may be useful can be determined by the mountain bike team leader working with the search mission coordinator during the course of the search operation.

Mountain bikes have already made numerous inroads into search and rescue across the country. Over 70 volunteer National Mountain Bike Patrol units now exist across the country, and park and Forest Service rangers have used bikes in recent years, to assist on searches in a variety of locations. Successful deployment, combined with proper training and utilization, will allow the mountain bike to quickly take it's place along side dogs, helicopters and satellite technology as a legitimate, innovative and successful tool in search and rescue.

Further information on the use of mountain bikes in emergency services can be obtained from:

International Police Mountain Bike Association
28 East Ostend St
Baltimore, MD 21230
E-Mail: ipmba@aol.com
Website: www.ipmba.org

For more information on the National Mountain Bike Patrol, contact:

National Mountain Bike Patrol
c/o International Mountain Bicycling Association (IMBA)
PO Box 711

Boulder, CO 80306
E-mail: patrol@imba.com
Website: www.imba.com

For more information on Mountain Bike Search and Rescue specific training, contact:

Backcountry Trail Patrol Association
c/o Minnesota DNR
County Road 4
Zimmerman, MN
E-mail: SAR@trailpatrol.org
Website: www.trailpatrol.org

BACKCOUNTRY MOUNTAIN BIKE SEARCH SKILLS
VOLUNTEER TRAINING PROGRAM

The Backcountry Mountain Bike Search Skills course has been developed by the International Mountain Bicycling Association's National Mountain Bike Patrol (NMBP) and is taught by NMBP Instructors to individuals interested in becoming backcountry search volunteers.

This course has been developed to provide you with the basic knowledge and skills necessary to assist in conducting search missions and to acquaint you with how search and rescue (SAR) operations are conducted using the Incident Command System. (ICS)

The primary purpose of the training program is to organize, train, and maintain search volunteer resources and provide uniform and standardized search training for mountain bike patrollers and other search volunteers in uses MTBs in SAR operations.

Upon successful completion of the course trainees be issued a NMBP Search and Rescue certificate and patch.

Training Course Outline

(1) Search Organization
(2) Attitude
(3) Safety
(4) Communications
(5) Search Techniques
(6) Field Exercise
(7) Conclusion
(8) Written Examination

What does an Incident Commander expect from Search Volunteers?

(1) Organization
(2) Discipline
(3) Cooperation
(4) Advice
(5) High Performance Standards
(6) Proper Clothing/Equipment
(7) Self Sufficiency

What do Search Volunteers expect from the Incident Commander?

(1) Awareness & Understanding of their Capabilities/Expertise
(2) Knowledge of What They Are Expected To Do
(3) A Briefing on Overall Plan

(4) Opportunity to Provide Input
(5) Provide On-Going Information
(6) Be Debriefed
(7) Invited to Critiques

I. SEARCH ORGANIZATION

The success of any search mission depends on how well the search effort is organized. Often a search involves the utilization of many resources from a wide variety of sources. It is the incident commander's responsibility to organize and utilize these resources in a manner which will achieve a successful completion of the search mission in the shortest amount of time.

The National Mountain Bike Patrol (NMBP) program was founded in 1994, and with one of it's stated purposes is to assist in backcountry search and rescue operations. Across the country a growing number of volunteer search and rescue teams have experimented with of mountain bikes to enhance search efforts when looking for lost or missing persons. Since 1987 mountain bikes have skyrocketed in popularity with the cycling public, and also in their use by public safety agencies. *Bicycling* magazine reports that over 3800 police agencies now utilize some form of mountain bike patrol, and that number continues to climb. Emergency Medical Services are using bikes to cover special events, access patients off of roadways, and provide medical coverage and safety education in large parks, beaches and recreational areas. The mountain bike has become a valuable tool for agencies in cities, suburbs and rural areas, and it's uses continue to expand.

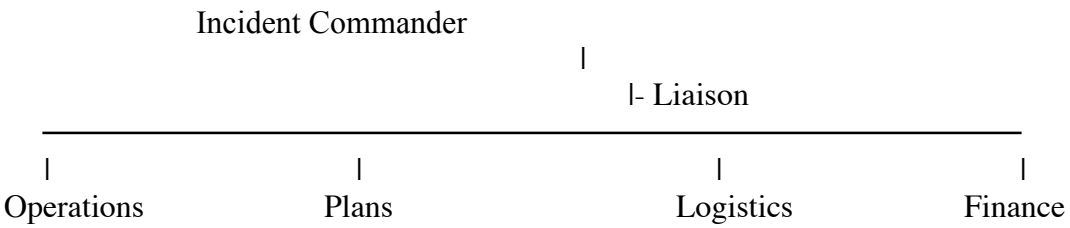
In a typical SAR operation, trained patrollers report to a "Incident Commander" named by the designated "Search Management Agency," typically the County Sheriff, State Police or state/federal land management agency. These agencies provide:

(1) Search Organization & Management
(2) Worker's Compensation Insurance
(3) Equipment & Supplies
(4) Manpower

The Incident Command System is utilized by the Search Managers to organize searches and provides an overall framework of organization.

(1) Provides chain of command
(2) Limits span of control
(3) Flexible – builds and expands as search develops

Typical Overhead Team



Incident Command Post

The incident command post may start as a vehicle during early phases of a search and develop into a major complex as the search progresses.

CHARACTERISTICS OF A GOOD COMMAND POST

(1) Located Away From Subject's Home
(2) Close to Search Area
(3) Radio/Telephone Communications
(4) Separate "Operations Room"
(5) Area for Crew Staging
(6) Rest Room Facilities
(7) Kitchen/Food Serving Area
(8) Ample Parking
(9) Provides Separate Room for Interviews

II. ATTITUDE

Looking for a lost or missing person is often a long and difficult task. Severe weather conditions, long hours, and dense vegetation places a great deal of stress on search personnel. In addition, the urgency of the mission often intensifies these factors. Search volunteers should be mentally prepared to carry out their assignments. Volunteers should also be aware that their attitude can greatly influence the success and efficiency of the entire search mission.

A search is a "true emergency" and can be an emotional experience. Family members may be present, and as a search volunteer, you should be aware that your actions, comments, and attitude can have a serious impact on them.

Keep a positive personal attitude:

(1) Assume the person is alive.

(2) Believe the subject is out there and you will find them.
(3) Remember you are working for the lost person.

Attitude around family:

(1) Be aware family members may be present.
(2) Maintain high degree of professionalism.
(3) Exercise discretion in comments/actions.

Attitude when subject is found:

(1) Determine subject's condition.
(2) Watch for signs of stress.

III. SAFETY

Like most emergency situations, looking for a lost subject can be a difficult and physically demanding job. Volunteers must consider their own physical capabilities and limitations in order to prevent unsafe actions.

Volunteers should be aware of the hazards that often are encountered when conducting a backcountry search.

The following safety factors should be considered:

(1) Physical fitness
(2) Natural hazards
(3) Physical fatigue
(4) Transportation Safety
(5) Night operations

Search volunteers, including mountain bikers, should carry sufficient personal gear to provide for their safety and comfort and to permit them to complete their assignment. The amount of gear will depend on search characteristics, weather, terrain, and job assignment. Remember, the lost subject will depend upon you when initially found.

SUGGESTED PERSONAL GEAR

The "ten essentials" for any outdoor activity

Topographic map

Reliable compass

Comprehensive wilderness first aid kit

Multi-blade pocket knife/tool

Extra clothing/Breathable raingear

High energy food

Water filter or purification tablets

Water and windproof matches

Loud whistle and/or mirror for signaling

Also:
- Flagging
- Pen, pencil, marker, paper
- Knife
- Emergency blanket
- Watch
- Toilet paper
- Bug dope

Mountain Bike Specific:

21 (or more) Speed, ChroMoly steel or aluminum frame All-Terrain (Mountain) Bicycle with good off-road tires, and:

Rock Shoks SID or equal (or better) front shock

Rear cargo rack, or high capacity hydration/day pack.

Rack Pack

Toe Clips or Power Grips (or clipless pedals and compatible biking shoes)

Flashing tail light

Dual headlight system

Cyclometer (Speedometer/odometer)

Puncture resistant tire treatment (Slime (TM))-optional, adds weight

<u>Bicycle Repair Kit</u>:

Bicycle Multi-tool

Tire levers (min. of 2)

2 patch kits

2 spare tire tubes

Spare tire

Bottle of synthetic bike lube

Headset wrench

Spoke tool*

Chain link tool*

Spare spokes

Spare chain links and pins

Tire pump

*If not part of multi-tool.

Miscellaneous:

Water (2 bottles)

Paper and pen

Flagging tape

Sunblock

Survival kit

2 Space Blankets

50 ft. 5/16" Static rope*

Figure 8 descending device*

3 Locking carabiners*

Webbing*

Climbing harness*

*Optional for technical rescue units

Wear and/or Carry:

Long cycling pants or cycling shorts under BDU fatigue pants

Long sleeve, orange or yellow shirt

Lightweight hiking boots or mountain bike cycling shoes

Gaiters

Cycling helmet (MANDATORY!)

2 way radio

Bandanna

Cycling gloves

Shatter resistant sunglasses or goggles

Hydration/Daypack or large fanny pack

IV. COMMUNICATION

A good communication system plays a key role in implementing a successful search mission. Each crew should have common communication with the incident command post whenever they are in the field.

Often many communication systems are utilized on search missions:

(1) Make sure your system is linked to the Incident Command Post

(2) Know your frequency/channel

(3) Use “plain English”

(4) Consider sensitivity of listeners

(5) Cellular phones should be used for sensitive communications, if cellular coverage is available.

a.) Each MTB team should carry at least one cell phone.

b.) Field teams should know the telephone contact number for the search base.

V. OPERATIONAL BRIEFING AND DEBRIEFING:

It is essential that there are open lines of communication between field personnel and the incident commander. Crews should be properly briefed before going into the field and debriefed when returning from a work assignment. Upon arrival at a search scene, volunteers should “check in” at Incident Command Post.

(1) Send a representative to Incident Command Post to be briefed.

(2) Assemble at staging area (you will be assigned as soon as an assignment is ready for you).

(3) Do not gather around incident command table.

(4) Be prepared for immediate assignment or be prepared to wait for assignment.

All crews should be briefed before going to the field to carry out an assignment.

Elements of Crew Briefing

(1) <u>Crew Boss Briefed by ICP</u>

(2) <u>Information Concerning Missing Person</u>

(3) <u>Crew Assignment</u>

(4) <u>Radio Assignment</u>

(5) Transportation

(6) Food

(7) Special Instructions

Upon completion of an assignment, the crew should be debriefed at the Incident Command Post.

Elements of Crew Debriefing

(1) Area Covered

(2) How Well Area Covered

(3) What You Found/Did Not Find

(4) Hazards, Difficulties, Problems

(5) Suggestions

(6) When Crew Ready for New Assignment

VI. SEARCH TECHNIQUES

"Listen up ladies and gentlemen. Our fugitive has been on the run for 90 minutes. Average foot speed over uneven ground, barring injury, is four miles an hour. Hat gives us a radius of six miles. What I want out of each and every one of you is a hard target search of gas station, residence, warehouse, farm house, hen house, outhouse and dog house in that area…Got get him!

Tommy Lee Jones as U.S. Marshall Same Gerard in "*The Fugitive*"

The search volunteer plays a significant role in the implementation of a search mission by supplying the much needed manpower to carry out various search functions. It is important that the volunteer have a basic understanding of the stages that a search goes through from the point of initial notification that a person is lost to implementing the actual search activities. It is also essential that the volunteer become familiar with the different techniques used to search for and locate the mission person.

States in the development of a search:

(1) Initial Notification

(2) Verification

(3) Activation

There are two basic modes used during the activation phase of a search mission:

(1) PASSIVE MODE
Definition: "A search technique used whereby the subject is encouraged to come to you".

(2) ACTIVE MODE
Definition: "The placement of resources in the field to find the subject or clues in the search area".

There are four different methods or techniques used during the active mode:

(1) Type I

(2) Type II

(3) Type II Modified

(4) Type III

Type I Search Technique:

Definition: "A planned, rapid search of immediate area, travel routes, drainages, etc., by small fast moving clue conscious crews with communications".

Resources used during the Type I search technique include:

1. Small clue conscious crews

2. Trackers and sign cutters

3. Mountain Bike Teams

3. Search dogs

4. Aircraft

5. Investigators

Areas to be checked:

1. Attractive nuisances (ex.: cabins, abandoned autos, open wells, etc.)

2. Travel routes/natural features (ex.: trails, streams, ponds, etc.)

Type II, II Modified Search Technique:

Definition: "A fast systematic search of high probability search area using techniques that produce high probability of Detection/searcher hours of effort".

NOTE: This search technique requires special training beyond the scope of this course.

Type III Search Technique:

Definition: "A coordinated effort, supported by a specific plan for a field organization to systematically search as designated area".

This search technique is used when:

1. The Type I or II search technique is unsuccessful

2. In conjunction with other search techniques

3. When the missing person is:

- child

- elderly

-mental/medical patient

The following steps are taken in implementing this Type II search technique:

1. Initial Type I crews, scouts, etc. are debriefed. MTB teams are reassigned to confinement and attraction functions, or may be assigned to grid (foot) search teams.

2. The search area is divided into blocks – bump lines are established using fence rows, natural barriers, flagging, etc.

3. Crews consisting of 10 – 12 people are assigned to search a designated area.

4. Crews are debriefed upon completion of assignment.

When utilizing the Type III search technique:

1. Crew starts by lining up on a road or base line.

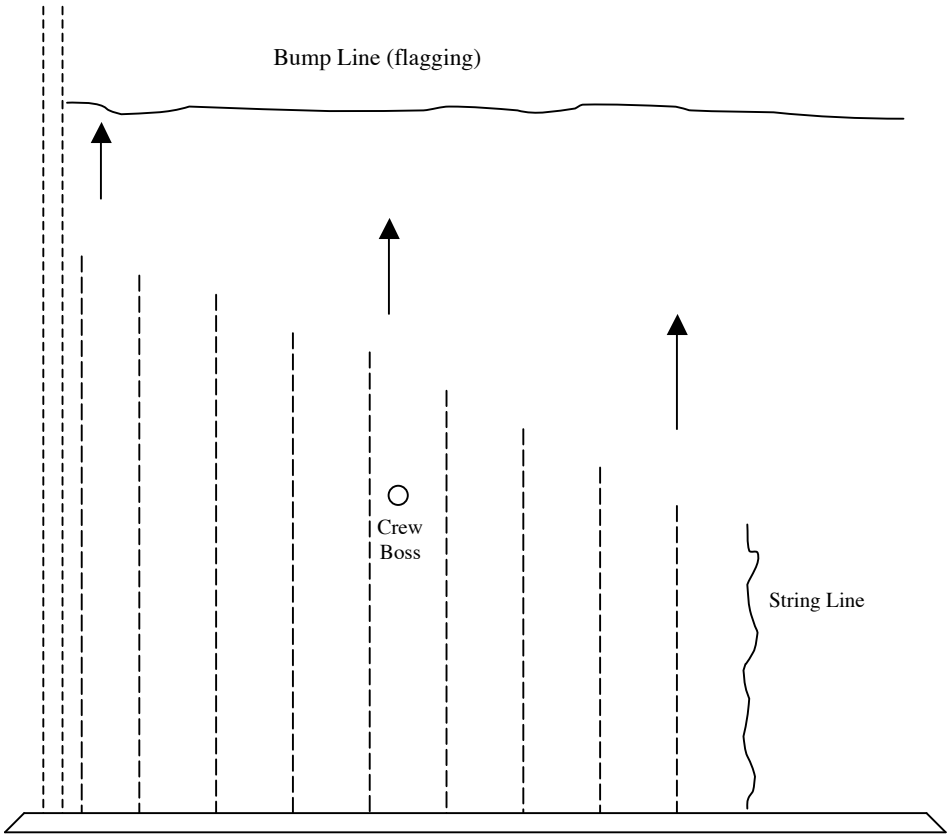
2. First person follows the guide line.

3. Subsequent searchers remain slightly behind and to one side of person they are guiding on

4. Use an oblique line (approx. 30% angle).

5. End person lays out string line.

TYPE III SEARCH TECHNIQUE



VII. HANDLING OF EVIDENCE:

Evidence on a search can include footprints, matted vegetation, discarded clothing and/or equipment, excrement and any other clue indicating that the subject is or has been in the area.

- All evidence should be reported to the Crew Boss (Bike Team Leader).
- Crew Boss evaluates evidence and reports it to the incident command post.
- The incident command post advised the Crew Boss as to how to handle the evidence.

Locating the Subject:

When the lost person is found, notify the Incident Command Post, and the subject's condition should be determined.

- If the subject is alive, the search becomes a rescue. Appropriate medical assistance should be sought.
-If the subject is deceased; the site should be secured until appropriate investigators arrive. Non-essential team members may be released to return to the incident base.

VII. CONCLUSION:

As a search volunteer you will be performing a very valuable job by providing the much needed manpower required to conduct a search mission. The training that you have received will provide you with a basic knowledge to be a more efficient search team member and improve the effectiveness of the entire search effort.

LAND NAVIGATION

"Ah'm from the fourth planet from the sun, the great state of Kintucky!"
"Yeah, we know, Red."
Leo Burmeister and John Bolger as Officers "Red" Tollin and Bobby Taverso in "*True Blue*". NBC TV, 1990

Knowing where you are is key to successful search operations, plain and simple. Unless a rider has a thorough knowledge of how to use a map and compass, and to a lesser extent, a Global Positioning System unit (GPS), all the rest of search and rescue training is useless. With a map, compass, and the knowledge of how to use them together, a person in the backcountry can determine their location, their route and the distance from and to any given point on the map.

I. Maps

A. We utilize various types of maps in the sport of mountain biking. Some are of value in SAR operations, and others are not.

1. Area Trail Maps

2. U.S. Geological Survey Topographic Maps

3. Road maps

4. National Forest Maps (USGS Topo maps with USFS addenda)

B. Reading Topographic Maps

The kind of map that will serve best in the backcountry is the topographic map. A topographic map tells you where things are and how to get to them, whether you're hiking, biking, hunting, fishing, or just interested in the world around you. These maps describe the shape of the land. They define and locate natural and manmade features like woodlands, waterways, important buildings, and bridges. They show the distance between any two places, and they also show the direction from one point to another. The most common scale used by in USGS maps is 1:24,000. Translated into feet, one-inch equals 2,000 feet. Other maps in common use are 1:37,000 and 1:50,000.

1. Each map tells the user some specific things:

a. Name of the map is found in the upper right hand margin and

contains the name of the main feature on the map.

b. Location. At each corner of the map are the numbers indicating

the degrees of latitude and longitude and *Universal Transverse Mercator (UTM)* grid. Each 1:24,000 scale map covers 15 minutes of one degree. The National Imagery and Mapping Agency (NIMA) (formerly the Defense Mapping Agency) adopted a special grid for military use throughout the world called the Universal Transverse Mercator (UTM) grid. In this grid, the world is divided into 60 north-south zones, each covering a strip 6° wide in longitude. These zones are numbered consecutively beginning with Zone 1, between 180° and 174° west longitude, and progressing eastward to Zone 60, between 174° and 180° east longitude. Thus, the conterminous 48 States are covered by 10 zones, from Zone 10 on the West Coast through Zone 19 in New England (fig. 1). In each zone, coordinates are measured north and east in meters. (One meter equals 39.37 inches, or slightly more than 1 yard.) The northing values are measured continuously from zero at the Equator, in a northerly direction.

2. Details – map symbols

a. Natural and manmade features are represented by colored areas and by a set of standard symbols on all U.S. Geological Survey (USGS) topographic maps. Woodlands, for instance, are shown in a green tint; waterways, in blue. Buildings may be shown on the map as black squares or outlines. Recent changes in an area may be shown by a purple overprint. a road may be printed in red or black solid or dashed lines, depending on its size and surface.

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(1) Hard surface heavy-duty highway is solid red, black bordered line.

(2) Hard surface medium duty highway is a red and white black bordered line.

(3) Light duty and improved dirt roads are shown by parallel black lines.

(4) Unimproved dirt roads and trails are dashed lines.

(5) Divided highways are shown by parallel red lines.

(6) Railroads are show by solid black lines with small cross marks.

(7) Buildings are black squares or shapes of larger structures.

(8) Schools are black squares with a pennant on them.

(9) Churches are black squares with a cross on the top.

(10) Cemeteries are open squares with a cross of "CEM" on them.

(11) Power lines are shown by dots connected by dashes.

(12) Open pit or quarries are shown by crossed pick-axes.

b. Water features are shown in blue, unless they are dried up or intermittent, and *may* be show as a dotted area in an outline of the water body.

(1) Lakes are solid blue

(2) Perennial streams and rivers are shown by blue lines.

(3) Marshes or swamps are shown with small blue grass clumps.

c. Vegetation

(1) Woods or forested areas are shown in solid light green.

(2) Orchards are a series of linear light green dots.

(3) Scrub and brush are shown by small green dots without a pattern.

3. Elevation features

a. Thin brown lines called contour lines show the ups and downs of an area. Every fifth brown line is heavier than the others and by following

it you will find a number on it. That number indicates that every point on that line is that many feet above the average sea level of the nearest ocean.

b. The distance in height between one contour line and the next is called the contour interval. This will vary from map to map. The contour interval on each map is indicated in the lower center margin of the map. Contour intervals are found on the bottom center of the map, under the scale rule.

4. What map direction is North?

With the map laid out in front of you the top of the map is true North. The magnetic declination may be found in the lower margin of the map.

5. Using the UTM Grid Coordinate System

The coordinates for any point on a map are a six-digit "address"

To find the address, *go right* (from the tick mark to the left of your point) *on up* (from the tick mark below your point):

* Draw a line from the point to the bottom (or top) edge of the map.

* Find the nearest grid coordinate to the ***left*** of your line. The **BIG** numbers are the first two digits of the location

* Divide the distance between the coordinate to the left of your line and the coordinate to the right of your line into ***tenths***.

* Count (or estimate) the number of tenths from the coordinate to the left of your line to your line . This is the third digit of the location.

* Draw a line from the point to the left (or right) edge of the map.

* Find the nearest grid coordinate ***below*** your line. The BIG numbers are the fourth and fifth digits of the location.

* Divide the distance between the coordinate below your line and the coordinate above your line into ***tenths***.

* Count (or estimate) the number of tenths from the coordinate below your line to your line. This is the last digit of the location.

II. Compass

To most people the compass is a small watch-like gadget that points North and shows them how to get out of the woods without getting lost.

First of all, the compass does not point to "True North" and secondarily, only through proper knowledge and use can a compass serve as an aid to navigation.

Compass readings are also affected by the presence of iron and steel objects. Be sure to look out for—and stay away from—pocket knives, belt buckles, railroad tracks, trucks, electrical lines, ***chromoly steel bike frames*** *and so forth when using a compass in the field.*

A. Declination (variation)

1. North and South are the points in the earth's surface which are the center of the earth's axis.

2. The compass does not point to true North, but points to a large magnetic field in the upper Hudson Bay area of Canada. The variance between true North and magnetic North is called declination.

3. For the Minnesota area magnetic North is approximately 4_° East of true North.

4. Declination is shown on the bottom right side of the map, between the scale and the publishing information.

B. Description

1. The compass consists of a magnetized needle, which turns on a jeweled bearing and a housing, which may be dry or liquid, filled.

2. The points of the compass are in a circle which is divided into 360° with North being 0°, South 180°, East 90° and West 270°.

C. Taking a compass bearing from a map:

1. Draw a straight line on the map passing through your location and your destination and extending across any one of the map borders.

2. Center the compass where your drawn line intersects the map border, align the compass axis N-S or E-W with the border line, and read on the compass circle the true bearing of your drawn line. Be careful to get the bearing in the correct sense because a straight

line will have two values 180° apart. Remember north is 0, east is 90, and so on.

3. To use this bearing, you must compensate for magnetic declination. If the MN arrow on the map magnetic declination diagram is to the right of the true north line, subtract the MN value. If the arrow is to the left of the line, add the value. Then, standing on your location on the ground, set the compass so that "zero degrees or North" aligns with the magnetic north needle, read the magnetic bearing that you have determined by this procedure, and head off in the direction of this bearing to reach your destination.

C. Taking a bearing with a compass

1. To find the bearing or azimuth from your location to a certain location, for example, a distant hilltop:

a. Squarely face the direction you want to determine.

b. Hold the compass level in one hand and rotate the compass or dial (depending on the type of compass you are using) until the North part of the compass needle rests over the North marking of the compass housing.

c. Now sight across the center of the compass and read the number of degrees opposite your face.

d. You now have a bearing or azimuth to a certain location expressed in degrees, i.e., 140° to the hilltop.

D. Following a bearing with a compass

1. To get from your location to the hilltop you decide to travel directly toward it, cross-country. During the travel you may lose sight of your objective due to trees, hills, darkness or bad weather. You must then re-orient yourself periodically to maintain the correct heading.

2. To re-orient

a. Hold the compass level with one hand so that the desired bearing (140°) is directly opposite your face.

b. Hold the compass in this position and rotate your body until the North on the needle and the housing are aligned.

c. You are now facing your desired direction.

E. Returning to your original location

1. After reaching your destination you may wish to return to your original location. To determine your direction or return travel, a back bearing or back azimuth, you either add or subtract 180° to or from your original bearing so that the resultant figure falls between 0° and 360°.

2. The resultant figure is your bearing back to your original location.

F. Triangulation

1. Triangulation may be used to direct search parties to a specific location or to assist in pin pointing a specific location on the base camp map.

a. For example, you have observed some sign or signal and wish to pin point it. (Mirror flashes, flares, fires, flashlights at night). Go to a known geographical point which can be located on your topographical map and take a precise bearing. Move to another known point and take another bearing.

(1) Draw the bearings on your map from points at which you took them. The point at which the two lines cross is the location with which you are concerned.

b. With this information you may now make determinations regarding elevation and accessibility, etc.

c. To pin point your geographical location and correlate it to your topographical map, take a back azimuth from two known landmarks which you can locate on your map.

(1) Draw in the bearings from the landmarks. The point where the lines cross is your location.

G. Global Positioning Systems (GPS)

The Global Positioning System (GPS) is the most significant recent advance in navigation and positioning technology. GPS is an aerospace technology that uses satellites and ground equipment to determine position anywhere on Earth. Anyone with a small receiver can use the system at no cost. GPS has drastically changed methods of navigation and is fast becoming important in everyday life.

Global Positioning System satellites transmit signals to equipment on the ground. GPS receivers passively receive satellite signals; they do not transmit. GPS receivers require an unobstructed view of the sky, so they are used only outdoors and they often do not perform well within forested areas or near tall buildings. GPS operations depend on a very accurate time reference, which is provided by atomic clocks at the U.S. Naval Observatory. Each GPS satellite has atomic clocks on board.
A GPS receiver "knows" the location of the satellites, because that information is included in satellite transmissions. By estimating how far away a satellite is, the receiver also "knows" it is located somewhere on the surface of an imaginary sphere centered at the satellite. It then determines the sizes of several spheres, one for each satellite. The receiver is located where these spheres intersect. The GPS system can tell you your location anywhere on or above the Earth to within about 30 feet

GPS units can be used to pinpoint your location on a map, to navigate to a distant, pre-set point, or to mark the location of an item or place. GPS units with maps inside them can be beneficial, but the units are best utilized if they are used in conjunction with a USGS Topo map.

Using Mountain Bikes in SAR Operations

Bicycles have proved themselves time and time again in many capacities, including Law Enforcement and Emergency Medical Services. Because of the mountain bike's versatility and adaptability, it has become apparent that they are a valuable tool, that with some modification, can be used in Search and Rescue (SAR) to aid in the location of lost and missing persons.

The Role of the Bike Team

The field use of a bike can be beneficial in that it allows searchers to cover a greater area in a shorter amount of time when doing a hasty search or setting up a containment perimeter. Due to their speed, bikes can cover more area or a contained area repeatedly over a comparatively short period of time. With a bike patrollers can travel over relatively rough terrain with supplies and move at a pace that is quick but controlled. The operation does not distract us from the environment around us (hearing noises, smells, etc.) as a motor vehicle might.

The bike search team can work in conjunction with any and all other search resources. One of the best examples is the mounted (horse) team. A bike can be partnered with mounted units if manpower needs require such. Trained horses do not have problems working with a bike that is ridden in a controlled and responsible fashion.

Bike Team Tasks

The MTB searcher should be able to cover roughly 4 (four) miles per hour on a 2.5 hour daylight assignment (or "task") and search effectively and efficiently. Rest breaks should be taken as necessary, but no less than 15 minutes every 2 1/2 hours. Night assignments, other than the manning of attraction and confinement points, will reduce the efficiency of bike searchers, and should be avoided when possible. If night searching is necessary, bike should be equipped with dual headlights as a minimum, and preferably also equipped with a helmet-mounted headlamp. Except on open trails and roadways, travel distances while searching at night are greatly reduced.

The length of a task for a bike team is dependent on the time of day and weather. During the day, a task should be one (1) to two-and-a-half (2.5) hours in length, or approximately eight to twelve miles. At night, one (1) to two (2) hours or five to ten miles is appropriate. Daytime deployment is more effective because of better light conditions and rider alertness. If teams ride at night, a decreased probability of detection (POD) should be expected

All bikes should be given at least an "A-B-C-Quick-Check" before to going into the field on assignment, and at regular intervals during the mission.

Bike Team's Role

A bike team will not be able to do all that a K-9 team or grid search team can do, nor will they be able to do what a motor vehicle can. The primary role for mountain bikes on a search and rescue mission are hasty search and containment tasks. Bikes are able to travel on trails and roads muchquicker than a foot team.

Because of this, a trail or road can be patrolled repeatedly. Bikes patrolling in opposite directions will give more coverage than a team going only one way at a time. The bikes can travel on trails more rapidly than foot searchers, but care must be taken to assure that no clues go unnoticed, while the patroller concentrates on the bike and the trail.

There are some places where bike travel is not allowed, and these must be identified at the mission level The Superior Hiking Trail in Minnesota (for example) and designated Wilderness areas in the National Forests also do not allow bike usage. Land managers or visitor protection/enforcement officers in these areas may be willing to allow bike travel in case of emergencies.

Standard Operating Procedures

Bike Teams will consist of a minimum of two riders, preferably three riders. One rider will be assigned the role of task leader and therefore be responsible for navigation and leadership. This rider should be a Senior Patrofler or higher whenever possible. Another rider will be responsible for communications. Teams should be limited to a maximum of four riders for the effective use of resources. Bike Teams will not be allowed to begin their tasks without functional radio communications.

Before leaving the Search Base on any task, the task leader will assure that each member performs a safety check on their bike as outlined basic National Mountain Bike Patrol training.

When riding on identifiable roadways, teams should ride no more than double file in accordance with applicable motor vehicle laws. When trail riding, the team, if comprised of two members, should ride in a staggered formation, with one bike approximately two bike lengths ahead of the second bike. If there are three or more members and the trail width permits they should ride in a "V" or diamond formation with the lead bike responsible for identifying obstacles and hazards while other members seek clues.

While at the Search Base, bikes must be stored away from the command and logistics areas, preferably under lock and key. Bikes should only be brought to the logistics if they are being staged for transportation to the assigned task area.

Qualifications for Bike SAR Patrollers

Bike search team members should be fully operational member of the local National Mountain Bike Patrol unit, and have, at least, taken Search Operations familiarization during their NMBP patroller training. Search team (or task) leaders should have completed the eight (8) hour "Introduction to MTB SAR" Course and have a minimum of 16 hours of Wilderness First Aid Training. Bike SAR Team managers should have completed the full twenty (20) hour Mountain Bike SAR Course, including night search and overnight deployment, and should also have a minimum of Advanced Wilderness First Aid, and CPR certification.

TRACKING AWARENESS
Adapted from the United States Border Patrol

Persons who have not dealt in tracking sometimes think it refers to following footprints. This is known as "grandma tracking". When the footprints are no longer found, a novice will discontinue tracking and tell you the tracks have disappeared, and maybe they have as far as he is concerned. You may hear "the tracks went to a paved road so it can't be followed" or "the suspect must have left in a vehicle."

Sometimes this is correct but often it is not. The suspects do not just disappear, get picked up by flying saucers and don'' always get in a vehicle when the tracks go to a road. There is more to tracking than following obvious footprints.

Tracking is not only following full foot tracks. It is observing small disturbances in the ground; broken twigs, rocks that have been turned over, dust or dirt that has been moved from one surface to another. It is an extremely small portion of a track, such as a rounded toe print or part of a heel, or a small fraction of the label of a bottom of a shoe.

SIGN

Sign is any evidence of change from a natural state inflicted on an area by a person's passage. One piece of sign is conclusive evidence, if it alone standing by itself can be said was cause by a human. Substantiating evidence or sign is that which could have easily been caused by something other than a human being. It must be found in combination with other pieces of evidence, before it can reasonably be determined to be caused by a man.

There are four basic types of signs which are dealt with in tracking: flattening, disturbance, color change and regularity.

Flattening:

Flattening is the leveling of dirt, twigs, rocks, vegetation, man-made objects or any other surface material which is out of its normal state. Flattening may occur on almost any type of soil or ground cover. The change takes place when a heavy force is exerted on a textured surface and the surface is changed no matter how slight.

Regularity:

Regularity is an effect caused by regular lines and shapes left on the ground that are not normally found in nature. Regularity would be considered as a shape of a heel or shoe, the textured surface of a shoe as it leaves a print on the ground or the print on the bottom of a shoe that transfers onto the ground when a person walks. It may be the partial print or full print of a van type tennis shoe or vibrum boot.

During the tracking process in a difficult terrain, a small section of shoe print or tread pattern may be all that is located for some distance. You may locate flattening or other signs that keep you on the right track but a small piece of regularity or tread pattern helps to confirm the sign and keep it linked together. If you're tracking a diamond van type tennis shoe and one or two small diamonds may be the only think located for sometime, this would be considered as regularity by itself. Regularity is one of the most identifiable pieces of sign that can be located.

Color Change:

Color change is a difference of color or texture from the surrounding area. Color change may be observed after a person, animal or vehicle passes through an area. The breaking of soil surface will create a color change. In most cases, the exposed soil will be different in color and texture from the surrounding area. In most cases, the surface of the soil, when exposed to sunlight and weather conditions, will allow for texture change to take place over a period of time. A person, vehicle or animal walking or traveling through that area, scuffing the surface of the soil, will expose soil underneath, creating a change of color and texture from the surrounding area.

This color change, given time and the assistance of nature, will blend in once again with its surrounding area. Color change may be observed in conjunction with flattening or regularity on the ground. Color change may be created by someone passing through ground surface type plants and turning over leaves which are darker on the top and suddenly give a lighter appearance from the underside of the leaf.

Color change may also be viewed by walking through grass or other type surface vegetation, which allows for texture change in flattening of the grass and also possibly allowing for color change to be observed.

Disturbance:

Disturbance is evidence of recent rearrangement and/or change to the surrounding area. Disturbance could be considered as a recent change to fresh vegetation, i.e., vegetation which would normally be standing if something had not changed it. An example of disturbance is ground surface, which is covered with small pebbles, all appearing to be normal and in place with the exception of one small pebble, which is knocked out of a socket in the ground. Disturbance could be considered a scuff on the ground, which exposes fresh dirt below.

Shine:

Shine is color change incorporated with flattening, a change of texture. Shine is easiest to see at a distance and occurs when the sun reflects light off a flattened or smooth surface. A flat-bottomed shoe, which creates a flat track and reflects light, could create shine. Shine may enable the tracker to observe foot tracks or tire tracks at some distance, allowing to expedite the tracking process.

Transfer: (Color Change)

Transfer is the movement of one material to the surface of another. A person or vehicle that travels through soil or other substance will carry some of that substance over to the next surface. For example, walking from dirt to an asphalt roadway may produce two to three visible tracks on the surface of the asphalt. In some cases where the surface material, such as the asphalt, cement or other hard is smoothly textured enough and the difference in color is great enough, the foot tracks or transfer tracks may actually travel on for some distance further than that.

Transfer could include gravel, vegetation, liquids or any other substance or surface material that may be carried forward.

Dew Trails:

The absence of dew or small water beads removed by walking or traveling through an area is referred to as dew trails. Walking through vegetation that is covered with dew will leave a color change that is easily observed from a distance. Commonly, dew trails may be observed on wet grass early in the morning or other surface type plants.

Interlaced Vegetation:

Interlaced vegetation is explained as the movement from the natural state of growth of vegetation. Tall grass or bushes standing together, which have suddenly been moved by the passage of a human or some other object will show signs of disturbance in the normal growth. Also, a flattening or color change may be noted with closer examination.

Scuffed Objects:

Scuffed objects such as lichen or moss on rocks, scuffed marks on fences, walls and other man-made objects may sometimes be noted. Scuffing is a disturbance or color change from the natural state. Scuffing may be observed on a textured surface of a rock, moss that grows on rocks, the bark of a fallen tree or other ground surface. It may also be observed in some cases as a scuffing on a rough surface of a wooden fence or coupled with disturbance of the scuffing of the exterior portion of a residence on a stucco wall.

Broken Twigs:

Twigs are considered to be small branches of either trees or small ground type surface plants. If a moveable type force suddenly moves through an area where healthy surface plants or small trees are located, a breaking of vegetation or small twigs or branches may occur. If on the trail of a subject through an area covered with vegetation and breakage to surface plants are located along a tracking route, closer inspection should

be done of the breakage. If the vegetation or portion of the plant which has been broken away, is found through closer examination to be otherwise healthy, it can be assumed that some force was exerted which made that break. Generally, the direction of the break or where the small limb or twig is located will indicate the direction of travel of the object creating the force.

All the past signs we have talked about, if linked together with the use of the tracking stick or tracking step-by-step method, helps greatly in substantiating all evidence in maintain the tracking trail.

Co-Habitants and Information:

The sudden movement in the areas of co-habitants, such as the flight of birds or the barking of dogs, is good information during the tracking process. For example, you hear the rustling of bushes, dogs barking or the sudden movement of something in the area ahead of you; this is information that is giving clues possibly to the whereabouts of your suspect. Also, radio information may be forwarded to you, a prowler or suspicious subject ahead of your tracking route.

Vegetation Injuries:

During tracking in difficult areas, injuries to vegetation may be the only sign.

Vegetation that has green stems or leaves when crushed beneath a shoe and hard surface may injure. The injury noted may be a bruise from pushing the vegetation against a rock, stick or another limb of the same plant.

Vegetation pressed against the ground may pick up small grains of sand or dirt. The grains stick to or injure the underside of the vegetation. The injuries may appear as a specking of small brown spots.

A fresh injury to vegetation may produce a bleeding effect of liquids from the plant.

Knowledge of the time it takes injuries to bruise and darken can be used during an aging process.

Terrain:

Another item of great importance is the variation from one area to another. The type of soil, the vegetation, and ground cover all vary. If you work at tracking in one particular area, you can become proficient in that area or in an area that is similar.

For instance, a tracker who works in the desert only would have difficulty in mountain or swamp-like terrain.

Aging:

In determining the age of tracks when searching for lost persons, you become aware of animal habits, injuries to vegetation and numerous other methods of aging tracks. For the purpose of this class, we are going to dwell on weather conditions and man-made aging processes.

Determining the age of tracks under normal conditions takes a lot of practice, knowledge of the elements and recent happenings in the area. Aging deals with the sun bleaching out a foot track that shows a color change; the returning of that color to the color of the surrounding area. Aging deals with the crispness of regularity in the track and edges as they round, settle and then finally fade away. The shine that is apparent on some fresh tracks will disappear with the normal passing of time.

Tracks will deteriorate slightly even under the best weather conditions. Tracks deteriorate through the passing of time as gravity will settle small particles of sand and other particles of sand that have been flattened or pushed down will rise or float back to the surface.

Aging takes a lot of practice and awareness of how different tracks age differently through the same passing of time. A vibrum boot track for instance in most conditions, will appear fresher than a flat bottomed shoe track made at the same time. The vibrum boot itself creates the greatest disturbance or regularity on the ground. The disturbance or regularity being more pronounced and deeper.

Effects of Wind:

Wind will obviously erase sign and complete foot tracks quickly, depending on the wind velocity and amount of time that has passed. The wind not only created by Mother Nature but all types of passing vehicles. Tracks along a major highway may be obliterated quickly in a matter of hours by passing vehicles. In law enforcement, the assistance of helicopters are sometimes encountered, a source of wind that can wipe tracks out immediately if not properly directed by the tracker. Wind can also change the tracks or trails through vegetation to the state of the surrounding area.

Effects of Rain:

Rain can obviously wash away sign completely in a matter of minutes. A good rain can return vegetation to its normal state, erasing any indication of a passerby. When tracking a subject in fresh pursuit, who keeps moving after the rain stops, rain may be beneficial to the tracker. If the tracker is lucky enough to continue tracking, the ground

will be re-textured or washed clean, allowing excellent tracking conditions and obvious indications that the tracks you are now following are extremely fresh and just recently created.

Frost and Dew:

Under what is considered to be normal conditions for some areas, the morning layer of frost or dew, which either freezes or dampens the soil, is found to deteriorate tracks. Frost or dew represents the presence of the moisture in the soil surface. The removal of that moisture, whether settling back into the earth or evaporating, tends to move tiny particles of sand or surface material as the process occurs.

Track Traps:

Track traps are areas to find tracks. They may consist of soft soil areas, including but not limited to the following: sandy areas in washes, dirt roads and berms of roadways, plowed fields or when incorporated areas are involved, flower planters or landscaped areas allowing for the location of tracks.

For example, while tracking a subject through extremely hard surface type material, and soft trackable surfaces are noted, track traps such as these may expedite the location of the suspects foot tracks as he exits from that area. Setting track traps could be a task assigned to mountain bike mounted searchers during a mission.

Jump Tracking:

Jump tracking is done mainly to expedite the criminal tracking process. Jump tracking is jumping a distance ahead to locate sign or foot tracks. Example: if you're tracking across an unincorporated area, rural or open area, and track traps are located, this technique may be used. The tracker moves ahead of his track for a distance to a track trap that crosses the last known direction of travel at a 90-degree angle. This is the ideal angle, however not always possible, a lesser angle may be utilized.

At the track trap, the tracker works the area to locate a full foot track or area of regularity or flattening. Whenever jump tracking, and upon location of a prominent track, measurements should be taken at that time. Taking measurements whenever possible does not totally eliminate the chance of confusing one track with another but it will lessen your chance of error during the tracking process.

Under the correct condition, when conducted properly, jump tracking can actually overtake a suspect who is moving ahead of the tracker. In covering a large area, the

tracker can be assisted by others to move ahead by vehicle or other mode of travel and to locate track traps and tracks. This process can continue until a track trap is located that the track does not cross. At this point, other track traps may be checked that will parallel with the track. This process will insure that your suspect did not change direction of travel. This process will insure that your suspect did not change direction of travel, and an area can actually be sealed off by track traps, insuring that the suspect who created the last track is still in the sealed area. During this sealing process, the original track should be followed to the suspect creating the track.

Jump tracking or sign cutting is also used for one other primary reason. If a track is lost during the tracking process, the track can be totally lost from view for some distance and by cutting ahead, you may locate another track. Once again, measurements should always be taken at this time, measuring stride and other measurements on the shoe track.

SUSPECT'S MOVEMENT

Walking:

Stride is the distance from heel to heel when tracking. The stride generally maintains the same distance while walking on level ground. Several things will effect stride. If a suspect tires, his stride will shorten noticeably. The subject's stride may change when walking on incline, such as uphill or downhill.

Ground cover and obstacles can also shorten a stride. If the surface ground area becomes rougher, covered with small obstacles, such as ruts or tocks, this could shorten the stride of the average person. When a person constantly confronts obstacles such as bushes in a dense area, his stride could also shorten.

Once you have established the subject's normal walking stride, anything greater than that may indicate a change in his pace of travel, indicating possibly jogging or running. For example, if a stride lengthens.

Running:

A running subject will increase his stride noticeable, possibly doubling it. The ground striking force or surface will move forward to the ball or toe area of the shoe, depending upon the speed that the subject was running. In most cases, the subject will leave very little shoe track or none at all. Deep toe digs will be observed with heavy disturbance and discoloration. The only regularity you may find would be the front shape of the shoe, depending upon the soil or ground cover. Tracking a running subject on hardened soil may leave flattened scuff patches behind and regularity of the toe only.

Following a running track in normal or sandy soil may be like following someone with a shovel digging holes. A flat-footed person while running, may change the traits of a runner's track to a full print, however the stride will increase drastically form his walking stride.

Stopping Motion:

A person who is stopped and who is standing in one position will bring both feet side by side or parallel to each other. The toes of the track will be angled out to a degree which is normal for that person. If a subject stands in one small area for any length of time, a large concentration of tracks may be observed in that area. A concentration larger than the tracks entering into or out of that area.

The direction of shoe track is almost always important to an investigator. If a concentration of tracks found with toes pointed in one direction, it may be assumed that he suspect stopped for a reason. If located behind a bush or corner of a wall, it might be considered a vantage point or place to commit a crime. It may be a place to smoke a cigarette or drink a beer and then to discard the evidence. It could be a location where the subject hid something or did something else that was pertinent tot he investigation. During tracking, keep your thought process working and your eyes open.

Flattened Areas:

At times during tracking, you may locate large flattened areas that give no distinct outline or geometric shape. This can be a good indication that the suspect knelt down, sat or laid down. Closer examinations of these areas should always be done. If the soil is sandy or extremely loose in consistency, an outline of body extremities, torso, buttocks or other areas may actually be observed upon closer examination.

At this time, your thought process and senses should be working again, questioning yourself, was the suspect resting, hiding, was there a struggle, is there any other evidence to be found. In one investigation, a location of a buttocks was found on the berm of a roadway. The print was in such detail that the texture of the material, seams and pockets, as well as label, could be diagrammed, along with measurements and also photographs could be taken. The suspect had walked tot he crime scene barefooted, walked one-half mile to the dirt berm and sat down. The suspect put on tennis shoes and walked one mile to his house carrying stolen property. The tennis shoe tracks were known to be made by the suspect because the barefoot tracks discontinued where the tennis shoe tracks originated. The suspect thought this was the slickest trick ever. The barefoot tracks were tracked, the buttocks print was sketched and photographed, the shoe tracks were tracked and the property was recovered. His shoes and Levi's were placed into evidence. He was arrested.

Numerous things can be observed during the tracking process, some of which are only assumptions or opinions on your part, but it can be very helpful during the investigation as well as interview of the suspect if one is contacted.

The tracks that you have been following during the investigation can tell you if the subject was running,, smoked a cigarette, drank a beer, hid from someone or committed a crime. The motion of the subject or indications found during tracking, coupled with physical evidence and the surrounding areas can tell you precisely what occurred.

Geometric Shapes:

Flattened areas and geometric designs may be located in soil that differs from shoe traks or those created by humans.

During criminal investigations, outlines of objects, such as stolen property may be noted in the soil. When the property taken is of any size at all and must be carried, the suspect may set that object down. Suspects carrying objects to a vehicle may set the object down to open the trunk or a door prior to loading that property.

For example: the outline left by a refrigerator or large electrical appliance may also reveal the four leveling legs, allowing for precise measurements.

Measurements and photos of evidence such as this should be contained in your investigation. The linking to the appliance print becomes important evidence to the foot tracks you are following.

Dislodged Objects:

During criminal investigations, dislodged objects from soil may become pertinent. Any object picked up from the ground, such as a rock, pipe or piece of wood, may leave an outline or impression.

Proper linking of the foot tracks, with the location of a dislodged object, could stand as important evidence.

Example: A PC 245 investigation where the suspect is alleged to have used a steel pipe to hit the victim. The location of a dislodged area is found, matching the shape and measurements of the pipe. The suspect'' tracks are found traveling to this area, then back to where the victim was assaulted.

Vehicle Tracks:

Vehicle tracks, like shoe tracks, are pertinent information to criminal

investigations. Correct processing of suspect vehicle tire tracks allow for a full understanding of the order in which events took place.

Vehicle tracks can be followed to locations where suspects can be contacted, if conditions are correct.

Wheel Width:

Wheel width is the distance from one rear wheel to the other, or front to front. Measurement of the wheel width should be taken from the center of one rear track to the center of the other rear track. The width should also be checked on the front tracks of the vehicle as widths do differ from front to rear.

Wheelbase:

Wheelbase is the distance from the front to rear wheels. The wheelbase is generally more difficult to obtain than wheel width.

Wheelbase may be determined when vehicles stop and back up, or make selective turns. Wheelbase may also be determined when vehicles come to a rapid stop or accelerate rapidly when leaving the area.

Diagrams:

Diagrams should show wheel width, wheelbase, tire track widths and design. Any wear areas should be documented as well as other abnormalities, such as bastard tires, bald tires and low air pressure.

Direction of Travel:

To determine direction of travel on tire tracks is extremely difficult and it takes frequent practice.

When vehicles accelerate from a standstill or slow speed, an obvious throwing and piling of soil to the opposite direction may be noted.

In soft sand where digging in takes place, numerous build-up of soil can form. The formations give an appearance of waves washing away from the direction of travel.

Tracks found traveling in a straight line, with no acceleration marks or turns, can be deciphered.

Close inspection of tire tracks will show small pebbles, rocks or objects pushed in the opposite direction from the direction of travel. When larger pebbles or rocks are dislodged, they may leave a small channel as they are pushed to the rear. This is particularly true with knobby mountain bike tires and dirt bike tires.

Vehicle Speed:

Vehicle tracks located on a dirt road can give indications as to the speed the vehicle traveled. When soil is dry or sandy in consistency, vehicles traveling at a high speed will leave little tire tread pattern that is clear and easy to recognize.

As the vehicle slows, the tracks left will become clearer. With much time and patience, competence in determining an approximate vehicle speed may be possible.

About the editor

Hans L. Erdman

Hans Erdman is a park ranger with the Minnesota Department of Natural Resources. For almost a decade, he was a ranger with the Anoka County (MN) Parks Department and served was the Lead Park Ranger of the mountain bike and Nordic ski patrols for five years. He is a member of the International Police Mountain Bike Association, the Adventure Cycling Association, the International Mountain Bicycling Association and the volunteer National Mountain Bike Patrol, where he serves as Regional Patrol Representative for the North-Central Region. (Minnesota-Wisconsin, North Dakota and South Dakota) He is one of the co-founders of the North-Central Mountain Bike Patrol, and the Backcountry Trail Patrol Association, serving the Chippewa and Superior National Forests in Minnesota. Hans has been active in wildland search and rescue for since J971, and currently teaches medical and transportation skills in Minnesota, in addition to his work with the DNR. In 1997, Hans also led a mountain biking missionary team to the northwestern Russian Republic of Karelia, with hopes to return there again in someday.