MODULE THREE: SEARCH

January 1982 second printing

Note: A quick reading of the SAROP will make the handout material more comprehensible.

Contents

PRIMARY READING

ASRC Search and Rescue Operations Plan (SAROP)

SECONDARY READINGS

1) Mountain Search for the Lost Victim, Kelley
2) Training Manual, NASAR: Part I, Chapter 1; Part 2, Chapters 1-5
3) Analysis of Lost Person Behavior: an Aid to Search Planning, Syrotuck
4) An Introduction to Land Search Probabilities and Calculations, Syrotuck
5) Some Grid Search Techniques for Locating Lost Individuals in Wilderness Areas, Syrotuck

SHENANDOAH MOUNTAIN RESCUE GROUP SEARCH PRETEST

Notes

1. After taking this pretest, check your answers against the key in the back of the handout. This pretest is representative of the type of written questions which may be asked about search, but is not comprehensive. Use it, along with the standards, as a guide to your reading.

2. Standard #7 (radios) is not included in this test, but will be tested during the posttest as an oral/practical station.

3. You may use anything you normally carry in your SAR pack in taking both the pre- and post-tests.

Matching (letters are only used once in all matching questions)

1. Search dogs
2. Trained searchers
3. Camp-in at a trail junction
4. Sending a team across the subject's expected route of travel

a. clue finders
b. subject finders
c. passive search
d. cutting for sign

5. Mission Data Form (MDF)
6. Task Assignment Form (TAF)
7. Base Officer (BO)
8. Searcher Registration Form (SRF) and Searcher Information Sheet (SIS)

a. SAROP Phase Ø (Alert and Mobilization)
b. SAROP Phase 1 (Quick Response)
c. SAROP Phase 2 (Scratch and Survey Search)
d. SAROP Phase 3 (Saturation Searching)

9. The Base Officer (BO):

   a. is responsible for direct liason with members of the Responsible Agency during Phase 1.
   b. need not be field qualified.
   c. serves as a relay between Dispatch Officer (DO) and Radio Operator (RO).
   d. all of the above are true

Matching

10. search of a point or linear feature
11. search of a large area from a single vantage point
12. wide-spaced line search of a small area by a small team
13. grid or contour search
14. patrol of the perimeter of an area

a. survey task
b. saturation task
c. scratch task
d. sweep task
e. containment task

15. A downed military aircraft should be approached only:

   a. from the front.
   b. from the left side.
   c. from the rear.

16. Green light (as from a flashlight with a green filter) will not destroy night vision adaptation, as will unfiltered white light.

   a. true
   b. false

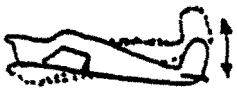
17. Wide-spaced line search is more efficient than close-spaced line search, in terms of clues found per searcher-hour.

    a. true
    b. false

18. Which of the following is the best example of good questioning technique?

    a. "Hello. I'm Joe Backpacker from the Shenandoah Mountain Rescue Group. We're looking for a red-and-white plane which has been missing since yesterday. Have you seen or heard anything unusual lately?"
    b. "Hi. We're looking for a plane that crashed yesterday. Do you know anything that could help us find it?"
    c. "Hello. I'm Joe Backpacker from the Shenandoah Mountain Rescue Group. We're searching for a plane believed to be flying low in this area yesterday. Did you see or hear anything about 3p.m. yesterday afternoon?"
    d. "Hello. I'm Joe Backpacker from the Shenandoah Mountain Rescue Group. We're looking for an airplane which has been reported missing. Have you seen or heard anything unusual the past day or so?"

19. Which air-to-ground signal means "affirmative"?

    a. 
    b. 
    c. 
    d. 

20. Which ground-to-air panel signal means "unable to proceed"?

    a. 
    b. 
    c. 
    d. 

21. An ideal helicopter landing zone in a wooded, mountainous area:

    a. should be on a flat ridge in preference to a narrow valley.
    b. should have a clear take-off lane about 300 feet into the wind.
    c. should have a touchdown pad with a slope less than 5°, and all brush should be cleared to less than 1 foot high.
    d. all of the above are true

22. Which of the following is <u>not</u> considered a major danger area near a UH-type ("Huey") helicopter?

    a. uphill from the helicopter
    b. downhill from the helicopter
    c. to the right rear of the helicopter
    d. to the left rear of the helicopter

23. Authority and responsibility for downed aircraft search in Virginia lies with:

    a. the Virginia Wing, Civil Air Patrol.
    b. the Civil Aeronautics Board of the State Corporation Commission.
    c. the Virginia State Police.
    d. the County Sheriff.

CHAPTER THREE

LEGAL AND RELATED ASPECTS

3.0 GENERAL

This chapter deals with a variety of subjects including that of authority and responsibility for search and rescue missions, and the responsibilities and duties of ground search and rescue personnel in certain specific situations (e.g. at an aircraft crash site). Since the term "search and rescue" is often used so as to encompass a great variety of emergency operations, a working definition will be offered here to be used throughout the chapter.

Search and Rescue, (SAR) as used in this chapter, refers to the finding, providing aid to, and evacuating of persons lost, stranded, or injured in areas of a substantially wild or natural area on land. Thus, operations such as searches for lost vessels at sea are excluded from this definition, as are operations related to the crash of an aircraft in an urban area.

3.1 AUTHORITY AND RESPONSIBILITY FOR SEARCH AND RESCUE

Once upon a time, there was a light aircraft crash in a large wooded area just outside a major eastern US airport. The ensuing SAR operation was badly coordinated and markedly confused. In an effort to straighten out things, one of the agencies involved called a meeting, to which all agencies involved in the mission were to send a representative. At this meeting, someone stood up and asked "Would the person here representing the agency in charge of this mission please raise his hand?" Seven different people raised their hands.

Thus the question of who is in charge of a SAR mission is not one that always has a simple answer. Quite often there are several agencies claiming authority for a mission, with actual control going to the agency on the scene first with the most resources. Sometimes the authority for a mission may fall to an agency not normally in the business of SAR through disinterest on the part of those agencies normally in charge of SAR (e.g. a Fire Department running a lost person search). In some jurisdictions, although there are many agencies that will respond to an actual mission, it is impossible to find one that admits to the responsibility for planning and training personnel for SAR.

Let us now consider for contrast the SAR situation in a state that has a well-organized SAR system. The state is a hypothetical one, but the example draws from facets of the SAR programs of several western states. Every volunteer SAR group in the state must be approved by the state, and each individual SAR team member must pass the state certification test. When any of these groups is working on a mission, they are covered by state insurance, and transportation expenses are paid by the state. The state issues a mission number for each mission, and has standard procedures for missions which are to be followed in every mission. The state requires every County Sheriff to appoint a SAR Coordination Officer to run SAR missions within the County, and every county must have a workable SAR plan. Since this ideal situation (if it is indeed ideal) will not come to be in Virginia for at least several years, we should learn what the rules of thumb are for SAR authority and responsibility in the Commonwealth, even though they may not apply in every instance.

We will begin by considering the situation of a person in distress needing aid. Who has the primary authority and responsibility for aiding this person? It is generally agreed that this aid is the responsibility of the appropriate law enforcement agency, although certain types of aid (e.g. emergency ambulance service) may be delegated or reassigned by legislation. If we agree that the responsibility goes to a law enforcement agency, to which does it go? County, State, or Federal? In general, if the mission is confined to one county, the County Sheriff is assumed to be in charge. An exception would be if the mission were within the county borders, but also within a National Park. In National Park areas, the Park Service is considered to have exclusive jurisdiction, and

the Park Superintendent would be the primary authority. National Forests are a different situation, however, as the Forest Service is not considered to have exclusive jurisdiction. Therefore, a SAR mission within Forest proclamation boundaries would still be the responsibility of the County Sheriff. If the mission encompasses more than one county, the state may become involved. The Commonwealth of Virginia Disaster Plan gives primary authority and reponsibility for SAR to the State Police, who are to be assisted by the Virginia Association of Volunteer Rescue Squads. Usually, the State Police has limited itself to providing helicopters and occasionally tracking dogs at the request of the local Sheriff, and investigating SAR incidents after the mission. These guidelines should be used as such, and should not be considered a definitive statement of the allocation of SAR authority. GSAR personnel should be able to adapt to whatever situation they find, and should concentrate on aiding the victims, rather than participating in arguments as to "who is really in charge".

If a mission cannot be localized to a particular state, but is still within the inland region, the National Search and Rescue Plan comes into play. This plan, promulgated in 1969, is designed to help provide a comprehensive organization for SAR throughout the U.S., and in other regions as necessary. The National SAR Plan is a result of a policy statement by the President in May, 1954. Concerning SAR, it states:

"It is the policy of the United States:

1. To provide a basic network of search and rescue facilities in the United States, its territories, and possessions to serve both civil and military aviation, including the discharge of United States responsibilities as a result of United States adherence to the convention on International Civil Aviation.

2. To provide an overall search and rescue plan for effective utilization of all available facilities to include provisions for the control and coordination of all types of search and rescue missions.

3. To utilize State and local search and rescue facilities to the maximum extent possible in an overall search and rescue plan, and to encourage their continued development."

The National SAR Plan assigns responsibility for coordination of all search and rescue missions in the inland region to the U.S. Air Force, which has in turn designated the Aerospace Rescue and Recovery Service (ARRS) as its executive agency for SAR. However, the last paragraph of the Plan says:

"Although Federal leadership in the search and rescue field may generally be recognized, the Federal Government holds no mandate to compel state, local, or private agencies to conform to a national search and rescue plan. The desires of state and local agencies to control their own facilities in SAR missions resulting from intra-State or local activities within their own boundaries must be respected and insured. Cooperation, therefore, must be sought through liason and agreements."

When the Civil Air Patrol is operating on a SAR mission, it is acting as a part of the Air Force, under the authority of the ARRS. However, the authority of the ARRS is restricted to prosecuting interstate missions; for all other missions, the ARRS and the CAP operate only at the pleasure of the state or locality. In Virginia, the state allows the ARRS and the CAP fairly free rein in the prosecution of downed aircraft searches. Once a find is made, the mission is no longer a search, but is now a local rescue mission. Authority is now in the hands of the local responsible agency, probably the County

Sheriff, and the authority of the ARRS and the CAP is now ended. In many cases, the local authorities will request that the CAP continue to assist. Sometimes, the County Sheriff may be unable or unwilling to take charge, and no other agency has clear authority for the mission. In such cases concern for the well-being of the victims decrees that the CAP arrange for rescue and evacuation, in coordination with local emergency service organizations. The CAP Emergency Services Manual, CAPM 50-15 (1972) says: "No evacuation of casualties should be done without the request or approval of authorities in control of the incident. No evacuation of deceased should ever be done except at the request of the appropriate authority under whose jurisdiction the incident occurred, or the Surgeon General in a military incident, or their officially designate representatives" (p. 5-3).

In the case of the crash of a military aircraft, military SAR units will often conduct the search themselves. Should CAP personnel be the first on scene at such a crash, they should first see to their own safety and to the safe rescue of survivors, and then allow military and local authorities to come to a decision as to who has the authority for further actions. It is often not clear who is in charge at such an incident; often it is whoever reaches the scene first with adequate personnel. GSAR personnel should see to the needs of the victims, then extricate themselves from the situation as carefully as possible.

The previous discussion has been necessarily somewhat indefinite, but no more so than the situations often found during actual missions. The following summary, while somewhat oversimplified, may be of some aid in clarifying the situation:

TYPE OF MISSION	PRIMARY RESPONSIBLE AGENCY
1. Downed civil aircraft	
a. search	State (or ARRS for interstate) Civil Aeronautics Board is exec. agent
b. rescue and evacuation	County Sheriff, Park Superintendent, or other local Responsible Agent, or other agency by designation or default
c. removal of remains	County coroner or medical examiner
d. guarding crash site	County Sheriff, Park Superintendent, or other law enforcement agency.
2. Downed military aircraft	
a. search	ARRS
b. rescue and evacuation	ARRS/local responsible agent (both may claim exclusive jurisdiction)
c. removal of remains	Surgeon General
d. guarding crash site	Appropriate military command
3. Lost person search	Local responsible agent
4. Local technical rescue and evacuation	Local responsible agent

3.2 AUTHORIZATION FOR C.A.P. INVOLVEMENT AND C.A.P. ALERTING AND COMMAND

The Civil Air Patrol must go through special authorization procedures prior to participation in any search and rescue or emergency service mission. Insurance and authorization for reimbursement depend on such authorization, as does the alerting and command system. CAP mission authorization may come from one of three places: the Aerospace Rescue and Recovery Service (ARRS), with headquarters at Scott Air Force Base; the Air Force Reserve Region office in Philadelphia, or directly from Virginia Wing Headquarters. ARRS and AFRR will issue a mission number, and authorize reimbursement for fuel, lubricants, and communications expenses. Virginia Wing authorization and mission numbers carry no authorization for reimbursement, however.

If an aircraft on a flight plan is 1 hour overdue for VFR (visual flight) flight plans, or ½ hour overdue when on an IFR (instrument flight) flight plan, the Federal Aviation Administration (FAA) makes a communications search of all airports and landing strips 50 miles to either side of the intended flight path. The notice the FAA sends out is known as an information request or INREQ. 1½ hours after the estimated time of fuel exhaustion, the FAA issues an alert notice or ALNOT, and actual physical ramp checks are made at each airport or airstrip within 50 miles of the intended flight path. If these measures do not locate the missing plane, selected calls to the pilot's relatives, friends, and other high-probability locations are made. If a plane is reported missing by friends or relatives of the pilot, or if a rental plane is missing, similar actions are taken by the FAA. These actions are coordinated with the ARRS at Scott Air Force Base.

If all of the above actions have been taken with no results, or if a call for assistance in a lost person search comes in, the coordinator at the Rescue Coordination Center at Scott AFB will then issue a mission number, and alert those wings of the CAP that are needed.

The ARRS coordinator at the RCC at Scott AFB has the choice of designating the CAP or other agencies or military installations as the mission coordinating organization. In the case of civil air crashes this is most often the CAP, and the individual Wing appoints an individual Mission Coordinator in accordance with Wing and CAP policies. The Mission Coordinator has ultimate responsibility for the mission until he is relieved of command by the ARRS, turns over the mission to another MC, or concludes the mission.

3.3 MEDICO-LEGAL CONSIDERATIONS

Virginia is fortunate in having one of the best good samaritan laws in the country. This law provides immunity from civil suits for those giving first aid or emergency medical care. If a person (specifically including those trained in Cardio-pulmonary Resuscitation or CPR, and those trained and certified as Emergency Medical Technicians or EMTs) is administering the aid in good faith, without compensation, then the law says that the victim cannot sue the person who administered the aid. Good faith means that the person is actually trying to help the victim, as opposed to perhaps pretending to help the victim and actually trying to kill him. Without compensation means that the law does not hold if the victim pays the person rendering the aid. Even a gift other than money could possibly be construed as compensation. However, a 1977 amendment to the law made it clear that "compensation" does not include the salaries of public service or emergency personnel who perform the aid as part of their job. A special section of the law points out that in no way does the law remove any kind of liability for operating a motor vehicle, but only covers the emergency aid given (or aid not given). The good samaritan law is section 54-275.9 of the Code of Virginia.

The good samaritan law gives protection only against civil suit, which means that it is still possible for criminal charges to be brought against a person for inflicting willful damage, or for being guilty of gross negligence. What constitutes gross negligence? This depends on the level of training of the person administering aid. A person would be held to the standard of care appropriate for his training, thus the standard of care for someone trained in standard first aid would not be the same as that for a certified Emergency Physician. If a standard first aider were to attempt to perform emergency surgery in a roadside ditch, he might very well be guilty of gross negligence, while this would probably not be so if the person performing the surgery were an experienced doctor or surgeon. Thus, the higher the level of training, the higher the standard of care one is held to in the judgement of negligence.

Many states now require that all emergency services personnel providing emergency rescue and first aid services (as opposed to first responder services, which are provided by the public or local employees or public servants) be trained at least to the basic Emergency Medical Technician level. That is, if the organization professes to provide emergency care other than in an incidental manner, it should have personnel with EMT training. Although this is not the case in Virginia, the trend towards an increased standard of care should prompt GSAR teams to do their best to include personnel with EMT training on the team.

There is no legal requirement for someone to come to the aid of someone in distress. It is perfectly legal to walk right past someone without giving first aid, even if the victim asks for help. Once a person has started to give aid to a victim, he has assumed responsibility for the care of that victim. To leave after starting to give aid is considered abandonment, and is illegal. Once you have started giving aid, you must continue until the victim is turned over to someone with better training and a better emergency medical or first aid capability, or until the victim refuses additional aid.

It is perfectly legal for a victim to refuse emergency aid. As a matter of fact, you must have the victim's consent to begin any first aid. If the victim is unconscious, or otherwise unable to make a rational decision, then you may assume implied consent. Implied consent means that, since you cannot tell whether or not the person wants aid or not, you may assume that it is in fact wanted by the victim.

3.4 CRIME SCENE AND CRASH SITE PROCEDURES

GSAR teams will often be the first on the scene after an airplane crash in which people are killed, or may find a lost person who has died. In each case, there are certain procedures that the team should follow, in order to assist the law enforcement and investigating authorities. Although this is not a primary duty of GSAR personnel, it will serve to build better relations with local authorities.

If a body is found during the course of a lost person search, the team should communicate this fact to Base Camp in a discreet manner. Unfortunately, many scanners (radio recievers) are available which will allow an owner to listen to CAP and other radio frequencies, so radio messages should be brief and should use terminology which will not alert listeners to the fact that a body has been located. The reason for this caution is that the family or relatives deserve the courtesy of being informed by the Responsible Agency of the facts surrounding the death, rather than hearing them discussed by the public, or hearing about it over a Citizen's Band radio. As soon as the body is identified (if easily done), the team should leave the immediate

area. The approach to the body and the path followed in leaving the area should be the same, and the team should walk single-file. Only the minimum number of team members necessary should approach the body, and great care must be taken not to disturb any possible evidence. If the body is moved during initial efforts to determine responsiveness, careful note should be made of the position of the body, and any other information that may be of interest to investigating officers.

When a GSAR team is the first to reach an aircraft crash site, there are procedures to be followed, many of which are not obvious to an untrained member. The following list provides a guide to actions at the scene.

1. The safety of rescuers is more important than any other consideration. If the possibility of fuel spill and fire is strong, approach should be from uphill and upwind. If the aircraft is a military one, approach should be from the left side if possible. Ahead and behind the aircraft are danger areas due to weapons. Check carefully for ejection seat controls (black and yellow) and leave them alone; if they have been moved, the ejection mechanism may be armed, creating a potentially explosive situation. Carry a CO_2 fire extinguisher if possible.

2. Gain access to the victims, ascertain if they are still alive, and begin emergency care measures; control hazards as necessary. (see also chapter 15)

3. Identify the aircraft if possible. Contact Mission Base with this information and an assessment of the situation as regards the need for additional resources.

4. If the Emergency Locator Transmitter (ELT) is transmitting, find it and turn it off. The signal may interfere with other search operations, even perhaps one as far away as in the next state.

5. Take care not to disturb the wreck any more than necessary to tend to the needs of the victims and to turn off the ELT. Make notes of any disturbance caused by these actions, and any other observations that may be of use to those investigating the crash.

6. Continue with emergency care measures for the victims. Complete extrication operations. Contact Mission Base to arrange for evacuation, as the local Responsible Agency is in charge of such operations. Give your estimate of the situation, including recommendations for evacuation modes and additional resources needed.

7. If appropriate, station a perimeter security patrol to keep out unauthorized personnel. Remember, however, that the CAP has no legal authority to perform law enforcement functions, and may not use force to prevent people from entering the scene.

All civil aircraft accidents involving serious injury or death must be investigated by the National Transportation Safety Board (NTSB), an independent Federal agency. Some non-fatal accidents may be investigated by the Federal Aviation Administration (FAA), and military accidents will be investigated by a military investigating team. These agencies would like to see that the crash site is as little disturbed as possible, and will appreciate any note taken by GSAR personnel, such as the position of bodies, location of various parts of the aircraft, etc. The Investigator-in-Charge may ask for assistance from the GSAR teams in getting to the site. If so, the teams may be able to assist by pointing out various things that might not be readily apparent to the investigator, such as instruments away from the main crash site. It is also possible that the investigator will ask a GSAR team to conduct the on-scene investigation if the area is inaccessible due to rugged terrain.

The removal of bodies and their evacuation to the road is the responsibility of the county medical examiner or coroner. If wreckage must be disturbed to remove the bodies, the coroner will need to coordinate with the agency in charge of the investigation, the NTSB in most cases. The GSAR team may assist by getting the CAP Mission Base to contact the NTSB for the county authorities. As a general rule, the NTSB will allow removal of the bodies by the authority of the coroner if an investigator is not immediately available to come to the scene. Of course, careful note should be taken of any disturbance necessary to remove the remains.

GSAR teams may participate in the evacuation of the remains only if both the county authorities and the CAP Mission Coordinator approve.

A final step in resolving the situation at a crash site is to ascertain if the wreckage will be salvaged, perhaps by the insurance company covering the aircraft. If not, or if an area that would appear as a crash site from the air will remain, a large yellow cross should be painted across the site. This will allow later identification of it as an old crash site, if another search should happen in the same area.

3.5 ASSISTANCE TO LAW ENFORCEMENT AGENCIES

GSAR teams will often be working closely with law enforcement personnel, since SAR is an important part of the duties of law enforcement agencies. However, GSAR teams (or other CAP members) should not participate in the actual work of law enforcement agencies related to the apprehension of criminals or the preservation of the public peace. There are three reasons for this:

1. CAP Regulation 900-3 prohibits such assistance to law enforcement agencies.

2. Section 1385 of Title 18 of the United States Code provides that "Whoever, except in cases and under circumstances expressly authorized by the Constitution or Act of Congress, willfuly uses any part of the Army or Air Force as a posse comitatus or otherwise to execute the laws shall be fined not more than $10,000 or imprisoned not more than two years, or both." Although it is questionable whether or not the CAP would be considered as part of the Air Force for the purposes of this law, CAP corporate policy is to avoid the possibility of such a case being tried in the first place.

3. Assistance to law enforcenent agencies in executing the laws is not considered an authorized activity of the CAP, according to Sections 201-208 of the U.S. Code, by which the CAP was incorporated.

Thus during a "guard mission" where CAP personnel provide surveillance at a crash site, CAP members have no right to use actual or implied force to keep people away from the wreckage. If force is necessary to restrict access to the site, the CAP members present must contact the local law enforcement agency for assistance.

3.6 ENTRY UPON PRIVATE PROPERTY

CAP or other SAR organization members have no special rights to intrude on private property. If private property is posted with "No Trespassing" signs, or it is otherwise made clear that one should not enter upon a given piece of property, entry may be made only to save life or property. If a GSAR team wishes to intrude on such property, but is not sure whether or not life or property is at stake, a careful judgement must be made by the team leader. The legal basis for decision as to whether or not the intrusion was

justifiable is as follows. If, under similar circumstances, a reasonable man would belive with reasonable certainty that life or property was endangered, and further, that entry upon said private property was necessary to save said life or property, then such entry is justifiable. In any case of possible entry upon private property against the wishes of the owner or person in control, a decision must be made by the team leader, weighing the possible information to be gained versus the possible legal consequences of illegal entry.

3.7 C.A.P. REGULATIONS

Wing and Unit regulations concerning emergency services change with great frequency, so no attempt will be made to enumerate all appropriate regulations here. A few general policies applicable to Virginia Wing are:

1. CAP members and vehicles are not to be used to provide emergency services at public activities. This is a job for the local rescue squad or ambulance service. (See also the National Commander's policy letter of 31 July 1964).

2. CAP vehicles should not use flashing emergency lights or sirens. Note, however, that CAP members who are members of a rescue squad, fire department, or other similar organization may display two flashing or alternating red lights on their personal vehicles. (Virginia Wing only).

3. CAP cadets may participate in GSAR activities only with adequate senior supervision. Different Wings and units may establish maximum numbers of cadets for each senior member supervisor.

4. Wings and units may set special requirements for cadet participation in GSAR activities, such as having achieved a given rank before being able to serve as a GSAR team member.

Please check with current National, Region, Wing, Task Force, and unit regulations and policy letters for up-to-date information.

3.8 REFERENCES

American Academy of Orthopaedic Surgeons: Emergency Care and Transportation of the Sick and Injured. AAOS, Chicago, 2nd. ed., 1977.

Civil Air Patrol: CAP Manual 50-15: Emergency Services. CAP, Maxwell AFB. 1972.

Grant and Murray: Emergency Care. Robert J. Brady, Bowie, 2nd. ed., 1978.

May, W. G.: Mountain Search and Rescue Techniques. Rocky Mountain Rescue Group. Boulder, 1973.

*** Note: in Virginia, you may enter property posted "No Trespassing" during a search when you are accompanied by any State or local law enforcement officer, or accompanied by a Fire Department official from the county in which the property in question lies.

Excerpts from: Annex I-AA to Volume II, Commonwealth of Virginia Emergency Operations Plan - Peacetime Disasters
Subject: Search and Rescue

IV. ORGANIZATION AND TASKS:

A. Organization:

1. The State Coordinator of Emergency and Energy Services, by direction of the Governor, is the State SAR Coordinator. Each local government designates a SAR Coordinator. The local SAR Coordinator is responsible for ground and water search and rescue operations within his respective political jurisdiction. State agencies provide SAR resources and conduct SAR operations as a supplement to local efforts. Volunteer SAR organizations participate in SAR operations in accordance with agreements with the State and Local SAR Coordinators. Federal agencies participate in SAR operations within the Commonwealth either because of direct SAR responsibilities or in answer to requests from the State to assist.

B. Tasks:

1. State Agencies
   a. Office of Emergency and Energy Services
      1. Coordinate overall State SAR effort
      2. Coordinate SAR training
      3. Arrange for SAR resources to assist in SAR operations when requested by local SAR Coordinators, or the AFRCC, or CGRCC.
   b. State Police
      1. Provide personnel and equipment for SAR operations when requested.
   c. Marine Resources Commission
      1. Provide personnel and equipment for tidal waters SAR operations when requested.
   d. Department of Military Affairs
      1. Provide personnel and equipment for air and ground SAR operations when requested.
2. Local Government
   a. Conduct ground and water search and rescue operations within area of responsibility
   b. Participate in ground portion of air search and rescue as requested.
3. Civil Air Patrol, Virginia Wing
   In accordance with the joint agreement between Virginia Wing Civil Air Patrol and the Virginia Office of Emergency and Energy Services:
   a. Provide Mission Coordinator for air search and rescue
   b. Conduct air search and rescue; conduct integral ground SAR operations in coordination with local SAR coordinator
   c. Provide personnel for ground search and rescue when requested.
4. Federal Agencies
   a. The Air Force Rescue Coordination Center (AFRCC) controls search and rescue operations for downed or missing military aircraft, scheduled air carrier aircraft, aircraft carrying persons of national or international importance, and civil aircraft on interstate flights.
   b. The Coast Guard Rescue Coordination Center, Fifth Coast Guard District (CGRCC) controls search and rescue operations in the coastal waters area.
   c. The National Park Service controls search and rescue on lands under its jurisdiction.
5. Volunteer Search and Rescue Organizations
   Provide SAR resources at the State level in accordance with agreements with the State SAR Coordinator. Provide SAR resources at local level in accordance with agreements with the local SAR Coordinator.

V. CONCEPT OF OPERATIONS

B. Ground Search and Rescue

1. Ground search will be under the control of the local SAR coordinator.
2. State and other assisting agencies will be given mission-type assignments and will remain under the control of the agency on-scene commander. Employment in the search effort will be coordinated by the local SAR Coordinator.
3. Ground search in conjunction with air search will be coordinated with the agency having control of the air search.

CHAPTER FIVE

LOST PERSON SEARCH

5.0 GENERAL

Lost person search has been neglected in many areas, including Virginia. It is often seen as a series of motions that none like, but which must be gone through to find a body in the woods. A quote from the National Association for Search and Rescue (NASAR) search management course is brought to mind: "the Unqualified have been coordinating the Unwilling to do the Unnecessary with the Obsolete!" The attitude in many areas is that of "head 'em off at the pass", or worrying about the problem only when it actually happens.

To be able to save the lives of lost people through effective, efficient search operations, several things are needed. They are:

1. Trained and experienced search managers.

2. Adequate preplanning for searches.

3. Trained and experienced searchers.

This chapter will discuss several of the facets of lost person search, with the aim of providing a basic understanding of such search operations. Details of field search tactics may be found in chapter nine, and further information on search theory and strategy may be found in Kelley's Mountain Search for the Lost Victim. Details of operational procedures may be found in the Search and Rescue Operations Plan (SAROP) and Operations Manual of the Appalachian Search and Rescue Conference, Inc.

This chapter will specifically address search theory, organization, and operations.

5.1 SEARCH THEORY

As described in the previous section, one of the requirements for effective and efficient searches is having good search managers. The title (Mission Coordinator, Search Boss, On-Scene Commander) doesn't matter, as long as the management function is being carried out. Why is such a manager needed? To provide leadership, management, critical decisions, directions for others, and to use feedback to keep the operation functioning smoothly. What kind of qualifications should he have? He should have proven ability to run searches, detailed knowledge of the theory and practice of search operations, willingness to serve when needed, acceptance by the people he will be bossing, and the humility to admit that he is not all-powerful in knowing how to find the victim. (After all, if he knows exactly where the victim is, why is everyone else out searching?)

The search manager should be able to:

Establish objectives

Establish priorities

Evaluate resources

Develop a plan of attack

Coordinate efforts

Evaluate the results, and

Develop new plans.

Another critical requirement for effective, efficient lost person search is that of pre-planning. Such pre-plans must include careful delineation of the authority and responsibility for SAR, agreements between SAR agencies and organizations, arrangements for effective communications during missions, standards of training and competence, standards of procedure, and other related items. One of the important parts of the pre-plan is the listing of SAR resources in the community, along with detailed information as to the capabilities and specialties of each.

The first stages of a search are often the most critical. Information is the key to an effective search. Things that must be found out include a victim description, circumstances concerning the disappearance, and information on which to base an evaluation of the urgency of the search, set tasking priorities, and alert searchers as to possible clues and victim behavior. Once this initial information is available, the search manager must develop a search plan. The plan must answer the following questions:

1. Where is the subject? Possible answers might be based on past case histories, statistics about lost person search, mathematical models of lost person behavior, deductive reasoning, or just plain intuition.

2. How can I find the subject? There are two main search methods:
   a. Passive, such as confinement, perimeter cutting for clues, attraction, road blocks, or camp-ins.
   b. Active, such as hasty search tasks, scratch search tasks, sweep search tasks, line search tasks, tracking or search dogs, or mantrackers.

3. How should I apply the resources I have available? These may be described as clue finders, clue and subject finders, or subject finders. Subsidiary questions are:

4. Is it better to use the resources I have available now to keep the area from getting bigger?

5. Or, should I use them to try and find the subject?

Once this plan is made, the actual searching may begin.

Why does this type of SAR planning not happen everywhere? It seems clear such an enlightened approach to SAR would undoubtedly save lives. It might be tradition ("We've always done lost person searches with long line searches before, and it always works OK. Who are you to be telling us what to do?") or inaccurate data or ignorance ("We save just as many people as all those silly search and rescue types do, but without all the fuss.") or perhaps an unwillingness to take risks ("Well, I'd like to try your new methods myself, but if we tried them and didn't find the kid, the Sheriff would probably fire me. Besides, then the Sheriff wouldn't want to take that chance and maybe not get elected next time.") or perhaps poor training ("We just don't have the time or money to train our people in all that fancy SAR stuff.").

It is up to us, as ground SAR professionals, to try to counter such attitudes, in the interest of saving lives. Do your bit to educate people as to the proper way to handle lost person situations.

Successful search is rooted in strong fundamentals: tactics and techniques, strategy, organization, and most basic of all, search theory. Several aspects of search theory were discussed above.

The crucial tenets of search theory are:

1. SEARCH IS AN EMERGENCY!
2. **Search is a classic mystery.**
3. **Search for clues, not the subject.**
4. **Concentrate on aspects that are**
   - -important to search success
   - -under the control of a search manager.
5. Know if the subject leaves the search area.
6. Use grid (line) search only as a last resort.

SEARCH IS AN EMERGENCY!

Why? because

-The subject may need emergency care.
-The subject needs protection from self and environment.
-Time and weather destroy clues.
-An urgent response lessens search difficulty.

Often, it is hard to justify urgency because of a feeling that many people, left on their own, would survive. However, many people suffering heart attacks might also survive. Does this mean they do not need urgent medical care? A Quick Response is necessary, so as to put searchers into the field at once to minimize the search area size by timely containment. (Figure 5-1) Search area directly determines the chance of success. It is the maximum possible distance traveled by the subject in any direction. Using the point last seen, a circle may be drawn with a radius of the victim mobility rate times the time since lost. Nighttime offers a unique opportunity to confine the subject while he is (usually) immobile. This opportunity should not be wasted. To respect the search subject's emergency, we must:

1. Respond urgently.
2. Search at night.
3. Mobilize and keep searchers in the field.
4. Create an atmosphere of positive urgency.

Search is a classic mystery

Search managers must act as detectives, investigating, interrogating, and assimilating information. The SAR forces must know what clues to look for. Possible subject destimations must be ascertained by investigation and points last seen must be identified. The incident must be recreated in the minds of search managers. Outside possibilities must be considered, such as the subject returning home, or showing up at a friend's house.

Search for clues, not subjects, because

1. There are more clues than there are subjects. Every subject on land leaves clues: scent and tracks or other disturbances.
2. Clue detection significantly reduces search difficulty by reducing search area size. (Figure 5-2)

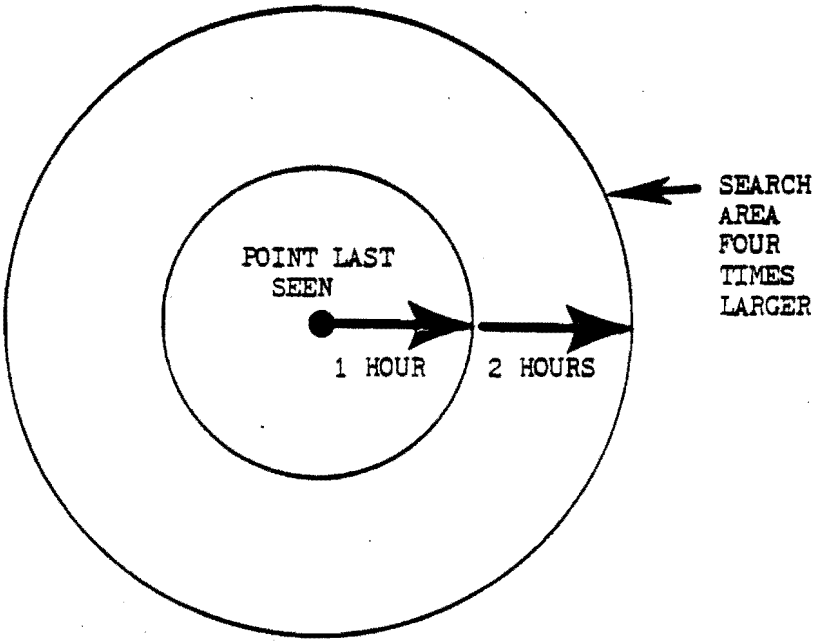


FIGURE 5-1: A Quick Response means getting searchers into the field to minimize search area size.

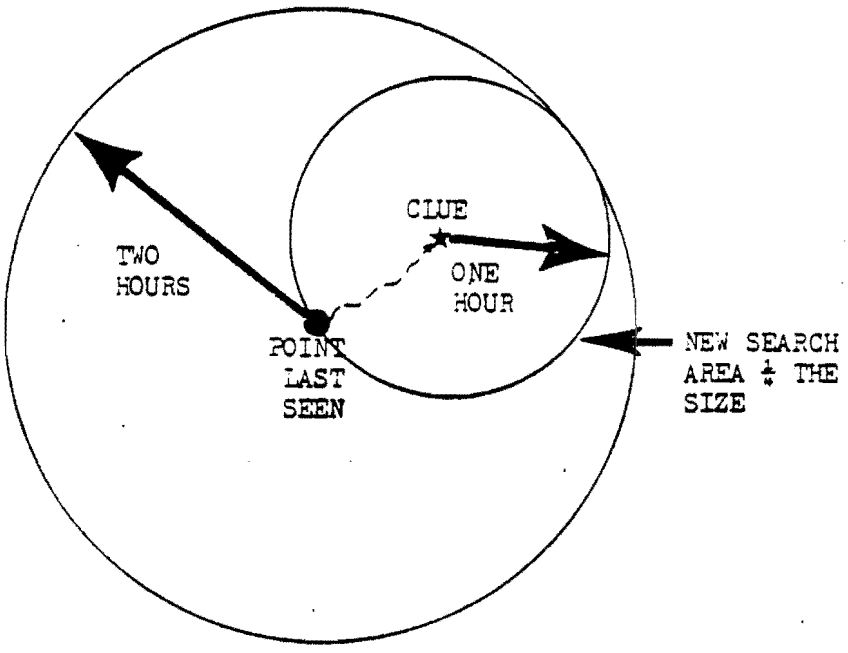


FIGURE 5-2: Search for clues, not subjects

<u>Concentrate on aspects that are: important to search success under control of a search manager</u>

Why?

BECAUSE IT IS TOO EXPENSIVE TO DO OTHERWISE!

<u>Know if the subject leaves the search area</u>

Why?

1. A search without a subject is nonsense.

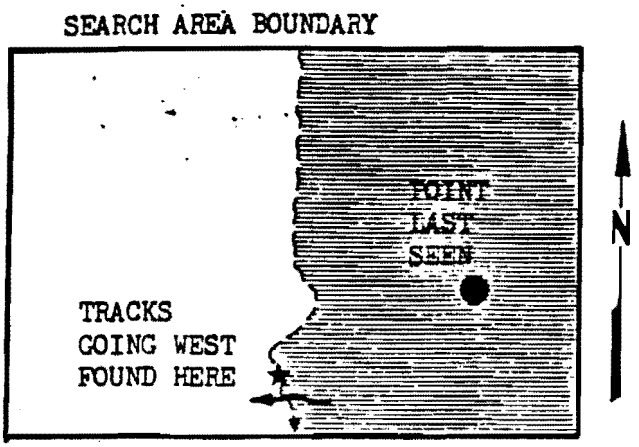
2. Search difficulty increases rapidly unless you confine the subject.

Include important places outside the search area proper (e.g. home).

Assign someone to do the "Bastard Search" to find out if the subject has left the search area.

Use the <u>binary search technique</u>, which says: "The easiest way to find someone is to determine where he <u>isn't</u>."

Send sign-cutting teams across the search area to check for tracks. By this process



large parts of the search area may be eliminated from the active search area (or at least the probability that the subject is in there is substantially reduced). (Figure 5-3)

Use saturation search (grid or line search) only as a last resort Because the cost/benefit ratio is much worse than for other methods. (More on this later)

FIGURE 5-3: Binary Search

By sending a tracking team to cut sign across the area, the eastern half of the search area is eliminated; the subject must be in the wetern half.

5.2 ORGANIZATION AND OPERATIONS

An important point for all CAP personnel to understand is that the standard CAP mission staff set-up is not designed to handle lost person searches. Attempts to blindly apply it to a lost person search are doomed to failure. However, with intelligent adaptation, the structure may be made to serve the purposes of a lost person search.

When the CAP is working with other organizations on a lost person search, it may be advantageous to combine staffs, as appropriate, to avoid duplication, and to combine ground SAR personnel, to avoid confusion. A suggested cooperative staff and team organization for the Virginia Wing and the Appalachian Search and Rescue Conference is shown in figure 5-4. This organization represents an efficient way to combine the organizations with minimum adaptation of their habitual mission staff organizations.

The positions on this table of organization refer to functions, rather than to actual people. Some problems of lost person search organization are given below, with the functions assigned to solving them noted after.

1. Strategy and planning (CAP Mission Coordinator, ASRC Mission Coordinator, representatives of other SAR organizations, and of course the Responsible Agent)
2. Tasking out the strategy; tactics; recording essential information (CAP Ground Operations Officer and ASRC Operations Officer)
3. Coordinating air support (CAP Air Operations Officer)
4. Managing people in the field and at base (ASRC Personnel Officer)
5. Communications (CAP and ASRC Communications Officers)
6. Managing equipment and providing logistical support (ASRC Equipment Officer)

CHAPTER FOUR

DOWNED AIRCRAFT SEARCH

4.0 GENERAL

Downed aircraft search missions constitute the majority of CAP Emergency Services (ES) missions. The CAP is generally acknowledged as the "expert" in air search for downed aircraft. Ground search is also an important part of downed aircraft SAR missions, but sometimes is neglected due to the strong interest in air operations at many levels within the CAP. This chapter will provide a sketch outline of downed aircraft SAR missions with emphasis on Ground Operations.

4.1 MISSION STRATEGY

A downed aircraft search may be divided into the following phases:

PHASE Ø: Alert and Mobilization
PHASE 1: Quick Response
PHASE 2: Survey Searching
PHASE 3: Locale Searching
PHASE 4: Withdrawal

PHASE Ø: Alert and Mobilization

Before a call for a REDCAP (actual mission) comes to the Wing, arrangements should be made for alerting and mobilizing the resources required in Phase 1. When the Mission Coordinator (MC) decides a Quick Response (QR) is needed, the QR resources, both air and ground, should respond without delay. It would be ideal if these QR SAR units were available on a moment's notice. Perhaps a rotating call system could be used for pilots and observers, and a similar system for GSAR team members. This would best be done on a regional, perhaps Task Force, level, rather than having one air SAR unit and one ground SAR unit attempt to cover the entire state.

PHASE 1: (Preliminary and) Quick Response

During the initial stages of the mission, the MC will usually repeat ramp checks at airports along the intended flight route of the missing aircraft. A search of the intended flight route is made by an aircraft. Even at night, the observer in the search aircraft may look for fires or lights, and check for ELT signals. A Quick Response GSAR team is alerted and put on standby at their home base, or some other appropriate location. If an ELT signal, fire, or other good clue is available, the QRT is immediately dispatched to the area. If during daylight (and sometimes at night), GSAR teams will be dispatched to do interrogation along the route.

One of the primary tenets of search and rescue is that <u>search is an emergency</u>! The probability of victim survival decreases rapidly with time. Of those who survive the crash, the great majority will perish the first night. Since many CAP aircraft will not be able to search effectively at night, search operations are often postponed until the following morning. However, night operations instituted as soon as possible offer a considerable chance of finding a victim still alive. Instrument equipped aircraft may conduct an electronic search for ELT signals; or, if weather does not permit low-level flying, military aircraft may be available for a high-altitude ELT search. Ground teams equipped with ELT locators

may be dispatched to the area to conduct ELT search, and possibly interrogation search.

Ground teams should always be dispatched to the area if there is any possibility that a find may be made. There is no point in searching unless ground teams are available for rescue and evacuation. If an MC is sure the victims are dead, the mission should be terminated or conducted on a non-emergency basis, otherwise, continue the mission properly. The primary purpose of SAR is to save lives, not to make "finds."

PHASE 2: Survey Searching

If the missing aircraft is not found during Phase 1, Phase 2 is initiated. High probability areas are selected by the MC and air and ground SAR units are assigned to individual "grids" using the Uniform Map System (UMS) (see Chapter 8). Air SAR units conduct a careful survey search, and ground SAR units perform interrogation, visual, and electronic (ELT) search.

Searching is the process of seeking information. This information, in turn, leads to finding the search object. To consider that one is searching directly for the search object may cause clues of vital importance to be overlooked. Another principle of importance primarily for lost person search operations, but also true of some downed aircraft searches, is that the search object may be mobile; lost people may, and usually do, wander; and victims of air crashes may walk away in an effort to obtain aid.

In any search, efforts should be concentrated in high-probability areas, that is, areas having a high probability of containing the search object. In addition, areas having a high probability of harboring valuable information concerning the search object's whereabouts must be searched. Note that these are not necessarily the same; there is little chance that a downed aircraft is located at a Forest Service fire tower, but the person stationed at the tower may provide valuable information.

PHASE 3: Locale Searching

If an aircraft makes a possible sighting, it may be possible for GSAR teams to be directed right to the crash site. Often, this is not the case, and the GSAR team is faced with a situation in which only the general location of the suspected crash site is known. In this case, the GSAR team must apply concentrated ground search tactics, as described in Chapter 9.

PHASE 4: Withdrawal

The mission is not complete until all SAR units are back at home base, and in Phase ∅ again.

RESCUE AND EVACUATION

One of the MC's responsibilities is to see than an adequate rescue and evacuation capability is available, should the missing aircraft be found with survivors requiring medical aid. The following table provides rough estimates of resources required for various rescue and evacuation tasks. This table indicates the difficulty of rescue and evacuation, and the large amounts of equipment and large numbers of trained personnel required. Note, however, that a single Class B team can handle search, and rescue, but not necessarily evacuation. In general, any Class B team should be able to provide medical and support aid. This aid will make it possible to suspend evacuation operations until such time as personnel and equipment are available to evacuate the victims properly (i.e. without causing severe stress to the victims).

This assumes a crash site ½ mile from a road in rugged terrain but with good weather.

Task	Personnel	Equipment
Night ELT search (from vehicle)	2	ELT-df
Locale search	4+	Radios, personal field gear
Rescue		
1 victim	2	Radios, trauma, & extrication
2 victims	3-4	"
3 victims	4-5	"
4 victims	5-6	"
Evacuation		
1 victim	9+	1 Stokes & evacuation set
2 victims	18+	2 " s
3 victims	27+	3 " s
4 victims	36+	4 " s

The MC should arrange for a Class B team to be fairly near to any high-probability area, so as to minimize the time between the location of a suspected crash site and a Class B team's arrival. Additional Class B teams, and Class A teams or ASRC teams, if possible, should be able to respond quickly to the scene to help with the evacuation.

Helicopters may be of great use in rescue and evacuation. However, helicopters are difficult to keep on standby during a long mission. Also, many crash sites are not accessable to helicopters except by hoist. Many helicopters do not have hoist capability, and those having it prefer to avoid using it if at all possible, due to the great danger involved. The best way to use helicopters for evacuation is to have a GSAR team move the victims overland to a place where a suitable helicopter landing zone can be prepared. The helicopter then lands, and the GSAR team loads the victims.

The Appalachian Search and Rescue Conference, Inc. (ASRC) has rescue and evacuation teams available for use upon request of authorized CAP Mission Coordinators by calling their twenty-four hour phone number (804) 924-7166 (University of Virginia Police). Those teams have a comprehensive rescue and evacuation capability. The ASRC would prefer the following courtesies from CAP MCs:

1. Alert the ASRC as soon after a REDCAP is called as possible.
2. If possible, try to avoid committing ASRC personnel to tasks that would render them unable to respond to a need for their skills (e.g. interrogation tasks). The ASRC's Quick Response team capability will often place a team on the scene early in the mission. The team is at the disposal of the CAP MC; however, it should be freed for locale search, rescue, and evacuation as soon as possible.
3. The training received by Virginia Wing GSAR personnel allows for easy merger with ASRC teams. An evacuation may call for a large combined team.
4. If appropriate, prearrange air transport for the ASRC team with the ASRC Mission Coordinator.

4.2 OPERATIONS AND ORGANIZATION

The organization of CAP Mission Staff for downed aircraft searches is covered in detail in the CAP Emergency Services Manual (CAPM 50-15). The organization of a CAP GSAR team is treated in detail in Chapter 2. This organization is diagrammed in figure 4-1.

Mission Base operations, including Ground Operations, are presently (1979) being studied by Virginia Wing with a view towards streamlining and improving them. Thus, little will be included in this edition of the GSAR manual. However, one

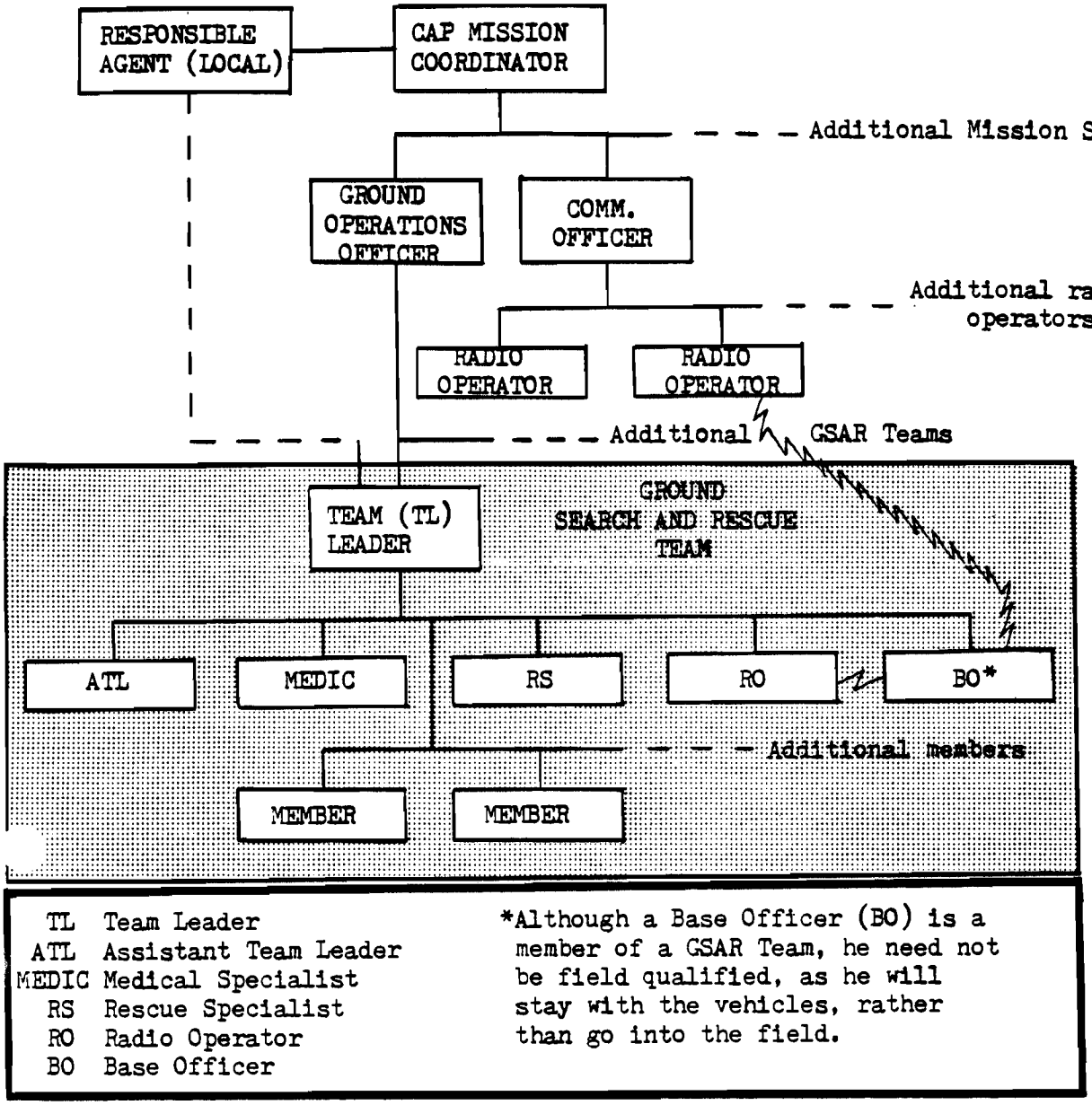


FIGURE 4-1: CAP Ground Team Organization

vital concern is the proper assignment of tasks to GSAR teams. The present Vehicle Clearance Forms are woefully inadequate for this purpose. A draft replacement form is shown in figure 4-2. This form provides additional room for task-related information, and for the equipment checks that are supposed to be a part of the Ground Operations staff duties.

4.3 REFERENCES

Civil Air Patrol: ELT Search, CAP Pamphlet 2; Maxwell AFB; December, 1973.
---Emergency Services, CAPM 50-15; Maxwell AFB; September, 1972.
---Mission Coordinator's Training Manual, CAPM 50-21; Maxwell AFB; November, 1971.
National Association of Search and Rescue Coordinators: Stormy Weather Search for ELTs, SAR paper no. S 76-107; Salt Lake City; 1978.

FIGURE 4-2 23

CLEARANCE FORM FOR GROUND TEAMS

DRAFT

MISSION_____ TEAM NUMBER_____ CALLSIGN_____ FREQ._____

Vehicle Data

Veh. 1	Veh. 2	Veh. 3	
			TYPE
			LIC.#
			Mileage (Start)
			Mileage (End)
			Vehicle Operator
			Fire Exting.?
			First Aid Kit?
			Spare tire and Jack?
			Chains and Flares?
			Radio?

Communications Data

	Frequency	Callsign(s)
1		
2		
3		
4		

Base telephone numbers

1	( ) -
2	" -
3	" -

Check-in schedule

CHECK IN EVERY_____ STARTING AT THE TIME YOU LEAVE MISSION BASE. RETURN IF YOU CAN'T MAKE YOUR INITIAL CHECK-IN OR IF YOU MISS_____ CHECK-INS.

Assignment

Team equipment

HF Radio?		Oxygen?	
Field Radios?		ELT Loc.?	
Exposure Eqpt?			
Trauma Kit?			
Surv. tape?			

Team personnel (Name, rank, CAPsn)	(EMT?)	(GSAR?)	(ASRC Cert.?)	
Tm. Ldr.				
Asst. Ldr.				
Medic				
4				
5				
6				
7				
8				
9				
10				
11				
12				

CHAPTER NINE

SEARCH TACTICS

9.0 GENERAL

This Chapter discusses a variety of search tasks that appear to be quite different. There are, however, some general principles that apply equally well to most types of search tasks, and it is worthwhile to consider these at the outset. First, the team leader must assure that his team is actually performing the task that was assigned to them. There have been instances in the past where a team spent six hours searching the wrong area; perhaps the east side of a ridge instead the west side of that same ridge. The best cure for this is, of course, to pay close attention during your briefing and to carefully consult the assignment section of your Vehicle Clearance Form or Task Assignment Form when in doubt, or even when not in doubt. Second, your team should have a good idea of their search objective, and you must ensure proper searching in your assigned area. Not only should your team have a description of the person or plane, but they should know the type of clues for which they are to search. For example: trees with their tops clipped off when on a downed plane search; tracks, trash, or evidence of a bivouac site when looking for a lost person. Searching for these things thoroughly means looking in the correct manner, for example turning around and looking backwards occasionally on a line search; it also means giving each part of the search area equal attention, with special attention in those places where clues might be especially evident (e.g. checking stream beds and swampy areas for tracks, or stopping at country stores in an interrogation search). There is a tendency among most searchers to search the easy areas thoroughly and to skimp when the team comes to more difficult conditions. Teams must be on the alert for this constantly. In a large line search with untrained searchers, it is not unknown for three or four search lines to search the same area and go right past the victim, merely because he is in a large clump of brush. An area that has been searched badly is an area that must be searched again. Third, the area your team searched must be accurately recorded in a manner that is meaningful to the Mission Staff; this assumes particular importance in the later stages of lost person search. An accurate drawing on a map is probably the best for lost person searches, but this is often difficult unless your search area is bounded by natural boundaries that are easy to identify on a map. For line searches, an alternative is to mark the area with paper or plastic tape, as described in the line search section. A search team that does an excellent job of searching but cannot accurately tell what area they searched isn't much more use to the mission than a bad search team. Fourth and final is the proper reporting of information. Anything which might be a clue should be reported to the Mission Base. Do not evaluate the item yourself as being important or unimportant--that is the Mission Coordinator's job. You should take care to separate the objective and subjective parts of your report. For instance: "We found an area next to the stream where the grass is matted down and branches are broken off some bushes." (Objective). "It looks like someone spent the night here last night." (Subjective). Unless you have some way of knowing that someone did indeed spend the night there, and of knowing that it was the person you are looking for, DON'T say "We just found where he spent the night last night!"

To sum up, we have identified four important principles that apply in general to search tasks:

(1) Perform the task assigned to you.
(2) Search properly, and search for the right things.
(3) Record accurately your search area.
(4) Report properly anything that might be a clue.

As a team leader these items, along with the safety of your team, are your responsibility. The Mission Staff and the victim depend on you to do your job well.

9.1 LOST PERSON SEARCH TACTICS--GENERAL

A general understanding of lost person search strategy will aid in the understanding of lost person search tactics. The initial step in any search is the gathering of important information, and part of this process in a lost person search is termed a "hasty search". This refers more to the duration of the search task than to any particular tactic; a hasty search is usually conducted by law enforcement agencies before any search and rescue organizations are called in. A hasty search includes a quick check to see if the person is really lost, for example by checking obvious places such as friends' homes, hospitals, and other law enforcement agencies. A quick check for clues may be made at the last reported location of the person, a parked car, or other obvious place. Often the initial actions of a Quick Response Team (QRT) during a search may be considered a continuation of the hasty search, even though the team may be employing various search tactics.

The first priority after the hasty search is to limit the area to be searched by containment. The usual procedure is to calculate the maximum distance the victim may have traveled in the time since lost, and to surround this area in such a way as to prevent the victim from leaving the area unknown to the search effort, and thus expanding the area to be searched. Often, features such as wide rivers and lakes, and distinct roads and trails, may be used for containment. Other times, it is necessary to have road or foot patrols regularly traverse the perimeter of the area. Sometimes, in heavily wooded areas, string with markers pointed towards base camp may be used with success.

The first phase of major search effort is termed scratch searching after the primary tactic employed. During this phase, efforts are directed at finding a victim who is still alive and very well may be moving around. Small, fast Field Teams are sent out to search high probability areas. The team may be assigned to do a scratch search, that is, to search a point or a linear feature such as a trail, ridge, or stream. The team might also be assigned to do a sweep search, that is, a loose line search of a small area; or, the team might be assigned to do a combination of the two. During this stage, a tactic known as survey searching is also utilized. This refers to the search of a large area from a single vantage point, for example, visual scanning from a firetower. Attraction may also be employed (e.g. building a large fire on a prominent ridge at night to attract the lost person).

If scratch searching fails, or if there are enough searchers to allow use of them in the next phase without pulling out the scratch search teams, the saturation searching phase is instituted. During this phase, the entire search area is methodically searched by large line search teams. As each small area is searched, it is marked in the field and on a map at Base Camp, so that the extent of the search may be accurately judged. Saturation search usually takes such time and effort that it is usually reserved for situations in which scratch searching seems not to be productive of clues.

If at any time a good clue is found, the Mission Coordinator will seriously consider the employment of trackers, either dogs or human man-trackers. Dogs will have trained handlers and will usually require little assistance, but trackers will usually ask for two searchers (preferably with some tracking knowledge) as assistants. Thus, tracking may be considered a type of search task.

Search dogs, as contrasted to tracking dogs, do not follow a scent on the ground. They are trained to follow airborne scent; any person in the search area will be found by these dogs. Unlike tracking dogs, they do not need a "key" or characteristic scent article for the victim.

Searchers in lost person searches will be looking for the same type of things, no matter what type of task they have been assigned. Any type of clue may be useful as a starting point for a tracker, or may serve to cut the search area down dramatically by providing a more recent location for the victim. Clues may include (but are not limited to) distinctive footprints, trash, a track when found in a fairly remote area, evidence of an overnight stay by someone, items of clothing, threads of clothing caught in a piece of barbed wire, or movement or lights seen on a distant hill. Searchers must take care to look backwards as well as forwards, and to

pay careful attention to areas that may be especially conducive to clues, such as a muddy spot on a trail. Usually, search teams will alternate calling the name of the lost person with periods of silence and listening. All clues should be marked with flagging: the standard is to place three separate flags next to each other in the vicinity of the clue for future reference. The flags are usually placed at eye level on a tree limb. As each clue is found by a searcher, the assigned Field Team Leader (FTL) makes a preliminary evaluation whether or not the clue may apply to the current search. For instance, a rusty beer can which has been in place for at least several weeks is not worthy of being considered a clue in the real sense. Only those clues which bear upon the present search are tagged and reported. Obviously, this puts the burden of this evaluation on the shoulders of the team leader. Team leaders should carefully consider the consequences of disregarding a real clue, and should make decisions accordingly. When in doubt, mark and report a clue. When a clue is found, the FTL must make sure that his team does not destroy tracks that may lead to and from the clue. If an obvious track leads from the clue, this fact must be mentioned in the report.

9.2 HASTY SEARCH

A hasty search, if carried out by a QRT, must be planned "on the spot", and usually the initial instructions are given by the Mission Coordinator, with the Quick Response Leader consulting with the MC and modifying the initial assignment based on new information. Since the type of tactics to be employed are chosen by the MC from among the other types of search tactics, no one tactic can be singled out as being a "hasty search tactic". However, one type of tactic mostly used for hasty searches, the expanding square (or expanding circle) will be described. The expanding square search is used to search an area around a point for clues; for instance, the point might be the victim's car or truck parked along a backwoods road. Searchers form a loose line and pivot around the point. As they reach their initial position, they move out and search in a circle surrounding the circle initially searched: (see figure 9-1)

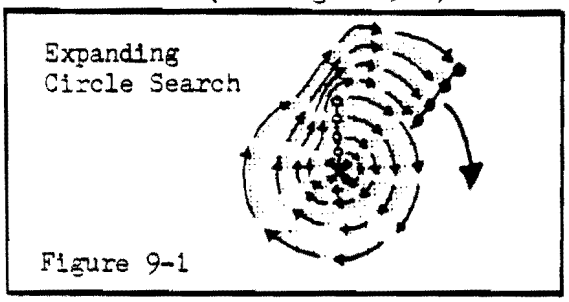


Figure 9-1

This search tactic is only useful for small search areas, as it quickly becomes cumbersome as the circumference of the circle increases. A variation of this known as "cutting for tracks" involves searching in a wide circle around a clue, and checking for tracks crossing the circle. The principle of "cutting for sign (tracks)" also may apply to other types of search tactics. For example, a scratch search (see below) may be sent across the victim's probable line of travel, rather than along it.

9.3 SCRATCH SEARCH

A scratch search is usually carried out by a small, quick Field Team; it is a search of a point or a linear feature. If a point is to be searched, an expanding square or circle is usually appropriate. (See section 9-2) The team does not mark search area boundaries, but marks the center of the small swathe they have searched. Of course, if the linear feature is a well-defined feature (e.g. a trail) that is marked on the map and easily followed in the field, there is no need to put up flags. However, if there is any chance that a second Field Team might have difficulty following in your team's footsteps, put up an occasional flag, especially at places (e.g. forks in a stream, a wide ridgeline) that may be confusing. The usual procedure for a scratch search is to have one searcher (quite often the FTL) guide on the center of the feature, and to have the other searchers just within visual distance on either side of the feature. The FTL should continually monitor the team's progress on a map, so he can instantly locate a clue, trail, etc. accurately on the map.

9.4 SURVEY SEARCH

Survey searching generally refers to the visual scanning of an area from a vantage point. Survey searching may be effective during the day or at night. Considerable perserverance and stamina are required, as long hours of watching may be necessary; however, the occasional joy of sighting an obvious distress signal makes the eyestrain headaches of little consequence.

Day survey search is relatively more simple than night search, but searchers should generally wear sunglasses or goggles, and trade off shifts. A regular routine of scanning should be adopted. In general binoculars or similar devices should be used only to investigate suspicious areas, rather than for continual scanning.

Night survey search requires a basic knowledge of eye physiology. A simplified account follows. The human eye contains two types of light sensors, rods for black and white (night) vision, and cones, for color (day) vision. Vision is created by the breakdown of a substance known as rhodopsin or visual purple by incoming light. This substance is gradually recombined; strong light may break it down a great deal, resulting in temporary blindness.

In bright light, most of the rods (black and white vision) are "washed out" and ineffective; the cones provide us with our visual ability. It takes a while for the rods to build up rhodopsin and become effective; thus the requirement for "dark adaptation" when entering a dark room from bright sunlight. Dark adaptation takes roughly twenty minutes. Obviously, using a flashlight to read a map, etc. will ruin night vision; however, rods are quite insensitive to red light, so red filters on flashlights are quite appropriate; these lights may then be used with minimal destruction of night visual ability.

The fovea, or optic pit, is the most "accurate" part of our eyes; this is the area at the center of our visual field, where vision is clearest. However, this area is devoid of rods. Therefore, night vision is better toward the edges of the visual field. Staring at an object at night may actually cause it to 'disappear'.

When straining to see in very dark conditions, the eyes exhibit a motion known as involuntary nystagmus; that is, the eyes "twitch" back and forth slightly without the searcher's awareness. This phenomenon is the primary reason constant red lights have been replaced with blinking ones on aerial obstructions.

See Chapter Fourteen of May's Mountain Search and Rescue Techniques for a more detailed treatment of night searching.

9.5 SWEEP SEARCH

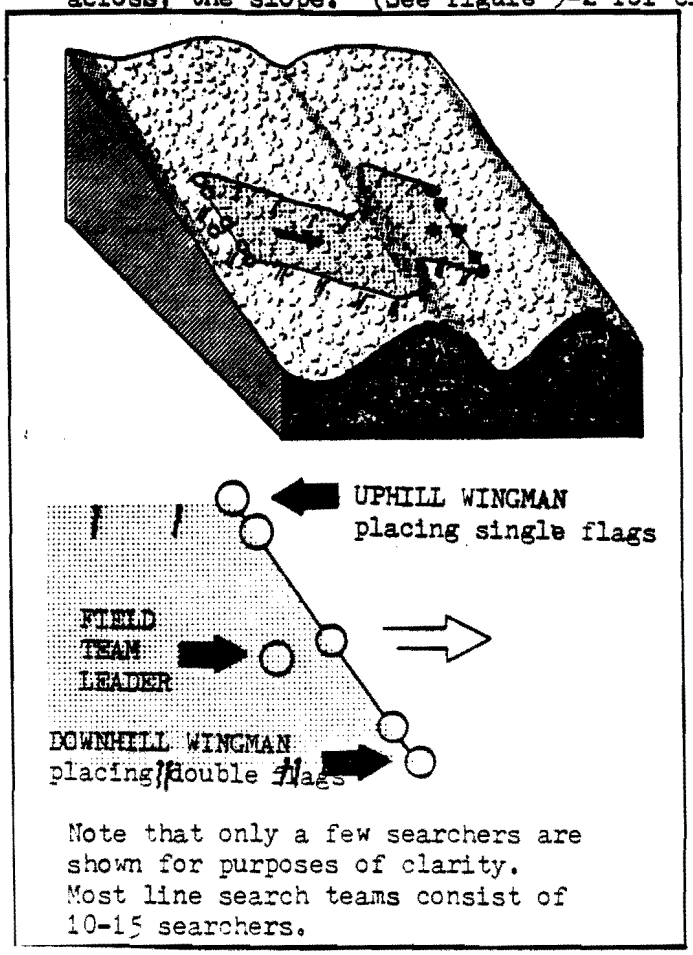
A sweep search is a saturation search of a small area by a small team. The search is wide-spaced (often beyond visible range, but within hearing range) as it is a quick search for obvious clues or a responsive victim. If the area does not have clearly defined natural boundaries that may be indicated on the map, the boundaries should be flagged with double flags, as with a line search. A Field Team will most often be assigned to do either a sweep search of a small area or along a particular section of a linear feature where more concentrated search than that of a single scratch search is desired. The beginning and end of the sweep should be marked along the linear feature with double flags, as should the boundaries of the area. It has been found by experiment that several wide-spaced searches are more efficient than a single close-spaced search. In wide-spread searches, searchers can not cover every square foot of terrain, nor should they.

9.6 LINE SEARCH

A line search is a saturation search of a large area by a large team. The team is lined up with all searchers equally spaced (see below for information about spacing) with the exception of the FTL, who stays out of the line, and two wingmen, who stay next to the end searchers. The FTL is responsible for line straightness and spacing, and the wingmen are responsible for marking the boundaries of the search sweep with flagging. The wingmen do no searching; they will have their hands full with the flagging. There are two primary methods for line searching an assigned

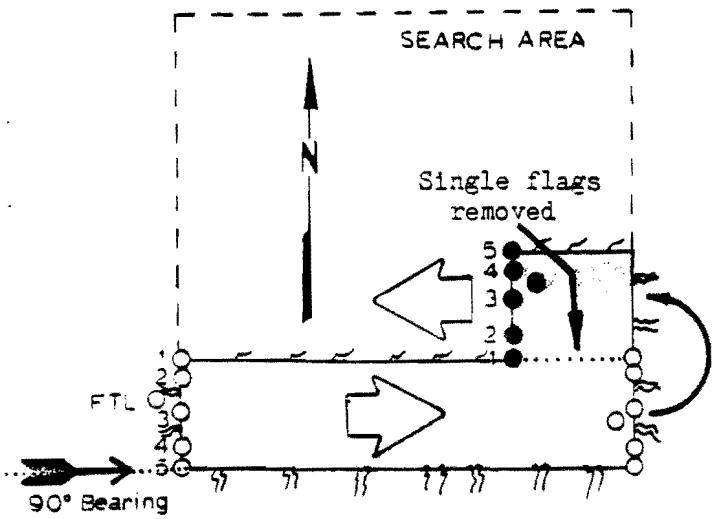
area: contour search and grid search.

Contour search is most commonly used with irregular search areas and in mountainous or hilly terrain. To use this method, the team is lined up along one boundary of the search area. For the purpose of discussion, we will assume the search area to be a square area on a mountainside, with pre-established boundaries. Adaptation to a different shape or topography is usually fairly simple. To return to the example, we have our team lined up and down one of the boundaries, with one wingman on a corner. The team is lined up so as to be up and down, rather than across, the slope. (See figure 9-2 for clarification). The team works its way across the slope, with the downhill wingman placing double flags (this is the search area boundary) and the uphill wingman placing single flags. (See figure 9-3). When the team reaches the opposite side of the area, the team pivots and searches the next higher swathe. This puts the old top wingman in the bottom wingman position, where he can take up the flags he placed on the earlier sweep. When the team pivots, the wingmen put double flags at the end of the sweep to mark the boundary. This continues until the entire area has been searched. On the last sweep, the uphill wingman places <u>double</u> flags. Thus all of the single flags are taken up by the wingman having placed them, and the entire search area is outlined with double flags. Should the search task be interrupted for any reason, it is a fairly simple matter to pick up where the task was stopped. This is called a contour search because the team works its way across the hillside, rather than up and down. When the bottom boundary is irregular, the team can "contour" across the hillside, staying at the same elevation.



Note that only a few searchers are shown for purposes of clarity. Most line search teams consist of 10-15 searchers.

There are two primary problems that are encountered with this type of search: first, the team always tends to compress downhill; the FTL must constantly work against this. The second problem is managing the pivots between sweeps. There are two main methods for accomplishing this manuver. The team may either pivot around the end wingman, or may file past the stationary wingman and reform in reverse order on the other side. The problem of pivoting grows larger with the size of the Field Team, as does management in general. For this reason, a line search team usually consists of ten to fifteen searchers, rarely more.



When the terrain is level enough so that contour searching will not result in a significant saving of energy for the searchers, or when there are few available landmarks for search area boundaries, a slightly different saturation search technique, known as grid search, may be employed. This method uses azimuths (bear-

ings determined by compass) as the search area boundaries and for the guidance of wingmen. Otherwise, the procedure is the same as for contour search.

The spacing between searchers is determined by the visibility within the search area. If your area consists of two or more distinct sections with different types and densities of brush, it may be profitable to search each sub-area separately with a different spacing. If only one or two small sections are more brushy than the rest, it will probably be best to deal with these as you come to them by stopping the search line and running a mini-search through the brush, then re-forming the line where it stopped. When setting a spacing, you should be guided by your briefing at Base Camp. If this is a line search early in the mission, you will probably be asked to use wide spacing; that is, to have your searchers just within visual range, or perhaps beyond. This represents the most efficient use of manpower when you must search a large area quickly for a victim or obvious clues. In later stages of the search, it may be necessary to resort to close spacing, where all of the ground between each searcher can be scanned by one or possible two searchers. Usually, the FTL will merely be given a search area, a group of searchers, and will be told to use wide spacing or close spacing. The rest of the decisions are left up to the FTL; it is his responsibility to see that the entire assigned search area is searched with the assigned degree of thoroughness, is properly marked, and all clues are properly marked and recorded.

When moving the search line along the sweep, a set of standard calls is used to facilitate control of the line. When the line is ready to go, the FTL calls "FORWARD!", the command is echoed by the searchers up and down the line, and the line moves forward. If, for any reason, a searcher wants the line to stop, he merely calls "STOP!". Any searcher may call "STOP!", but only the FTL may call "FORWARD". Once the line has stopped, the FTL ascertains the cause for the stop (usually a possible clue for inspection) and, when he is ready for the line to continue, calls "READY RIGHT?". This command is echoed, searcher by searcher, down to the right wingman. If he is ready to proceed, he calls "RIGHT READY!" and this call is passed, searcher by searcher, back to the FTL. If, for any reason, a searcher on the right is not ready, he merely does not pass on the call. In a few minutes, the FTL will start the sequence again. The same procedure, with the calls "READY LEFT?" and "LEFT READY!" is followed for the left side of the line. The FTL may then move the line forward.

9.7 CONTAINMENT

Containment tasks may involve foot or vehicle patrols, depending on whether or not roads are available as boundaries. The purpose of containment is to keep the search area from expanding, and this is done by continually patroling the boundaries of the area in such a way as to make sure that the victim will not cross the boundaries without being picked up, or at least his passage being noted. The Mission Coordinator's evaluation of the victim's mental condition will affect the type of containment that must be done; a seasoned hunter will not cross a road and continue back into the wilderness; a small child or mentally unstable person might do so. Containment patrols will be checking for the victim himself walking down a road or trail, and will be looking for evidence that he may have crossed or entered the road or trail. Leaving notes giving directions to Base Camp may prove useful, as may staying at a prominent trail junction in the midst of a wild area (a camp-in). If few roads or trails are to be found, long strings with arrows pointing to base camp on them may be used for containment. The exact type of containment will be determined by the Mission Coordinator or Operations Officer, and the team leader will be given specific instructions by the Mission Staff officer who briefs him.

9.8 MAN-TRACKING

Man-tracking is a task requiring special skills, and any member who will be acting as a tracker will receive special training in the tactics to be used. When accompanying a tracker on a tracking task, the important thing to remember is to not

mess up the tracks. Unless instructed otherwise, you should follow in the tracker's footsteps (literally), and be careful not to touch the tracks he has marked. The tracker will usually brief you in detail as to what he expects.

Should you come across a track during the course of some other type of task, do your best to protect it from your team and others in the area. Report any distinct tracks to Base Camp immediately, if in a relatively untraveled area.

9.9 TRACKING DOGS

Tracking dogs rely on ground scent to follow the track of a lost individual. Usually, a "key" or uncontaminated item of the victim's clothing is required, in order to allow the dog to follow the proper track. Scent tracks may be destroyed by dry heat, rain, or other tracks. The effectiveness of tracking dogs varies widely with training and search conditions. In general, the use of tracking dogs requires a "hold" on all other search operations, so as not to destroy the track.

9.10 SEARCH DOGS

Search dogs, as contrasted to tracking dogs, sense airborne scent. Although they may be able to "key" on a particular scent, most search dogs will find <u>any</u> person in the search area. Search dogs are usually used in a type of very wide grid-type search, with search paths perpendicular to the prevailing wind. Any dog finding a scent "cone" (see figure 9-4) will follow it to the source.

Figure 9-4 Search Dog Use

According to the American Rescue Dog Association (ARDA), only German Shepherds are suited for this type of work, and considerable care must be exercised in the selection and training of a candidate puppy. Search dogs have two main advantages over tracking dogs:

(1) Other search tactics may be used at the same time, with little or no decrease in efficiency, and

(2) Search dogs have an extremely high find rate, compared to tracking dogs.

9.11 DOWNED PLANE SEARCH TACTICS--GENERAL

Search on the ground for downed aircraft can be divided into two main classifications: large area search and close-in search. Ground search of a large area usually involves the simultaneous use of three distinct ground search tactics: interrogation, visual, and electronic. The team usually drives through the assigned area in a search pattern, scanning the visible terrain for signs of an aircraft crash, monitoring for Emergency Locator Transmitter (ELT) signals with a directional receiver, and stops at appropriate houses, stores, etc. and requests verbal information from the residents (interrogation).

Once the approximate location of the crash site has been determined by observation from an aircraft, by an ELT signal, or by visual sighting by a team, the job of actually getting to the crash site remains, and if the site is far away from roads, can be quite difficult. Often special ground search tactics (locale search) are necessary to come upon the actual crash site, even though the general area has been indicated.

9.12 INTERROGATION SEARCH

Interrogation search is the questioning of people throughout an assigned area,

in regards to unusual occurences which may relate to the search. It is usually carried out in conjunction with visual and often with electronic search. The search is usually conducted with the use of a vehicle and a small team; the team travels through the area, stopping at selected locations and questioning the people there.

Several important principles apply to interrogation search:

(1) Identify yourself. Don't get yourself shot. At night, shine a light on yourself; wear your ASRC patch (or your CAP uniform) to reassure your informant.
(2) Beware of animals.
(3) Close any gates you open; letting cattle escape is bad public relations.
(4) Do not volunteer information. It is difficult to sort out the unrelated leads and hoaxes from true leads. Comparing lead information with known facts is the primary method of selecting good leads; giving out information to informants destroys the effectiveness of this selection process.
(5) Get details of the informant: name, address, phone number, etc. A CAP Form 106 (Ground Interrogation Report) is useful for this.

Normally the interrogation function is thought of as the process of asking questions to obtain information to be fed to the base. When a team finds an interrogation lead they often are not sure what to do following the lead except to continue to ask questions in the local area. Time and effort can be saved by utilizing search techniques employed by ground searching in the field and by aircraft.

When directed to interrogate in a given area the team leader has a number of decisions to make. Among these are: How often should the team stop and question people? How far off the given roads should the team proceed (MC's will almost always direct a search from road maps and will choose main or secondary roads that bound a given area.) And, what does the team do if a lead is found?

The number of stops should be determined by the likelihood of gaining information. Stores, taverns, gas stations, and quiet residential areas would make good stops. Choosing every quarter mile or every fifth house, is an arbitrary way of making the selection. It is sometimes necessary to make this kind of choice in a suburban area with a multitude of houses, however, the team should not be so set on finishing the assigned area that they fail to consider going back to question a potential lead.

When a lead is located the team reports to base the information and then must consider its next move, unless other orders come from Base Camp. If no such direction is given then the team leader should plot the lead on his (preferably topographic) map. It is then wise to interrogate on either side of the lead to see if verification can be obtained. Having obtained the direction of travel of the lead, it is possible to extend the line of flight and see where it might lead. The team may choose to proceed to the next closest point the flight path might cross a road, and proceed along that road from their present location to see if further information might be gained. This technique has been used in the past to find other leads and track the aircraft, resulting in a find.

If this method does not produce additional leads, an aircraft may then search the terrain between the roads that have been interrogated. If nothing is found the team may then employ an expanding square search pattern (see section 9.2), interrogating for additional information away from the initial lead. It is important that the lead be evaluated by the Mission Base before the above procedure is begun as much time might be wasted using this method if the informant gave information that is not compatable with other teams' inputs, or with data the base has that is not available to the team in the field. On the other hand, a good lead will often indicate more in the same area.

When a lead is located team members should not become so excited about it that they fail to obtain exact as possible information. For example, in a recent search, a team discovered a hot lead, but it wasn't until a second thought by the team leader sent the interrogator back to discover the person who gave the lead lived in another area and was visiting the house for Sunday dinner.

Additionally, the team leader can conduct careful visual searches from high points, call in aircraft, and as a last resort employ a scratch search through a suspect area. The latter is a last resort due to the extensive time required. Any search on foot will consume great amounts of time and energy, and thus should not be used unless a high certainty exists that will justify this expenditure.

9.13 VISUAL SEARCH

As mentioned previously, visual search is often combined with interrogation search. Visual search is a survey search carried out from a vehicle. When driving along a road providing a good view of the surrounding area, the driver should slow so that riders may scan the terrain. Usually a rider should be assigned to one side or the other, and team members should alternate turns at scanning. Occasional stops at particularly good views are often warranted.

Possible visual clues include:

(1) Pieces of wreckage (large or small).
(2) Presence of smoke by sight or smell.
(3) Unusual sounds.
(4) Broken or disturbed trees or underbrush.
(5) Presence of scavengers (animals or birds).
(6) Fuel, oil, brake fluid, etc., by smell or sight.
(7) Decomposition odors.
(8) Signs of human passage or occupancy of an area.
(9) Landslides.
(10) Horsetails caused by the wind blowing loose snow or sand over an obstruction.
(11) Unexplained break in terrain contour or conditions.
(12) Personnel (especially those obviously dazed, wandering, or not dressed for the terrain).
(13) Blackened areas (even a single tree among green trees).
(14) Local discoloration of foliage.
(15) Signals. Remember that survivors may use many ways to signal possible rescuers depending on their training, physical condition, and signaling devices on hand. A vehicle (especially one in rough terrain) can be heard for many miles. Some other signals to be alert for include banging or thumping on metal or fabric, shouting, whistles, signal mirrors, flags, kites, etc. Be alert for anything that might be a clue.

Clues should be reported; often, an aircraft may be able to provide resolution of a possible sighting with ease. This should always be considered before striking out on foot.

9.14 ELECTRONIC SEARCH

Electronic search, also known as ELT search, is the use of radio receivers and directional antenna systems (known as direction-finding or DF equipment) to provide as to the location of the aircraft. Every aircraft has an Emergency Locator Transmitter (ELT) designed to start sounding a distinctive signal after a crash. Teams with ELT-DF capability may combine it with interrogation and visual search, to carry out triple-mode ground search tasks.

During vehicle travel, the ELT locator should be attached to an omni-directional antenna mounted on the vehicle. Failing this, an antenna may be held out a window, but this is much inferior to a good mobile antenna. One team member should continuously monitor the ELT locator, using earphones and no squelch. Often the signal is deep in the noise. Stops at high points may be productive; a directional antenna array may be used, and the ELT locator taken away from the vehicle.

If a signal is heard, a compass bearing should be taken on the signal direction. This should then be called in to the Mission Base. An interesting fact is that initial readings tend to be very accurate, more so than many subsequent ones. The team has two choices:

(1) The team may move a good distance (at least ¼ mile), take another bearing, and do so again. These three bearings should be carefully plotted onto a (topographic) map. If they intersect fairly closely, the team should then take the shortest route to this area.
(2) The team may go in the general direction of the first bearing, taking additional readings along the way. This process is, in general, more tedious than (1).

One problem often encountered is that of reflection from nearby mountains. A topographic map may aid in interpretation of bearings, by indicating possible reflec-

tions.

There are many references available with details of ELT search; see section 9.16.

9.15 LOCALE SEARCH

Locale search is concentrated ground search for an aircraft crash site. Many tactics may be appropriate, depending on the situation. ELT search may be continued into the field if indicated. If a bearing and distance is provided by an aircraft, a simple scratch search along the azimuth may work. If the site is not located within the distance indicated by the aircraft, an expanding square search may be indicated. If the team can make itself visible to aircraft, the aircraft may be able to direct the team right to the site. No matter what tactic is employed, the team must provide directions for additional teams; a trail marked by flagging is often appropriate.

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Acknowledgements

Much of the material in this Chapter is adapted from information provided by Keith Conover, David Carter, and the Appalachian Search and Rescue Conference, with permission.

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NEW SEARCH METHODS

--Keith Conover January 1982

As the body of scientific lost person search theory grows, our search tactics must change. "Scientific search" affects not only the Mission Coordinator and the Operations Officer, but the Field Team Leader and grunt searcher as well.

One new concept is the statistical approach to strategy. When we are faced with a lost person situation and we know the Point Last Seen (PLS), we may use several strategic approaches to select high probability areas for urgent search. For instance, we might inquire into the past history of the area: where do lost people around here usually end up? Is it on one particular trail, down in a certain ravine, or along a specific riverbank? If so, we have used a type of historical approach for our strategy. On the other hand, we might investigate the past behavior of this particular search subject. Is he likely to go downhill, uphill, to follow a trail, or to head cross-country? If he has been lost before, what happened then? Is he fascinated by waterfalls? Again, we are using a type of historical approach to search strategy.

Obviously, both types of historical approach will be used in arriving at an ultimate search strategy, as will information from other approaches and from deduction, just plain intuition, and experience. A problem sometimes arises during planning the strategy, the problem of how exactly to balance out the different information, and sometimes how to balance out the strategic opinions of the members of the Mission Staff. A formal method of balancing out the different opinions has been developed by Bob Mattson, called the Mattson Consensus Method (not by Bob). Briefly, it works like this:

The Mattson Consensus Method in Brief

We have divided our search area into five subareas: A, B, C, D, and E. Each of our three Mission Staff members (MC, OO, and Responsible Agent) assigns a percent probability to each subarea, with the proviso that his five probabilities (A through E) total 100 percent. We add the three probabilities for each area, and divide by three (for three Mission Staff members); all we do is calculate the average probability for each area. The final average for each area is the basis for our search priorities, and we assign teams to the high priority areas first.

	MC	OO	RA	Total	Average
A	10%	25%	20%	55 ÷ 3 =	18%
B	20%	20%	15%	55 ÷ 3 =	18%
C	20%	25%	15%	60 ÷ 3 =	20%
D	30%	25%	40%	95 ÷ 3 =	32%
E	20%	5%	10%	35 ÷ 3 =	12%
	100%	100%	100%	300% ÷ 3 =	100%

I started out a couple of paragraphs ago promising to talk about a new approach to strategy, the use of statistics. Various search and rescue organizations, notably the National Association for Search and Rescue and its affiliates, are gathering information on lost person searches. Grouped by category of person lost, this information tells whether the lost people tend to go uphill, down hill, or on the same elevation, and how far they went in that direction, measured "as the crow flies." Thus, rather than relying on subjective impressions of what our search subject might do, we have objective data about what people like our subject actually do when lost. These statistics give us a firmer base on which to theorize. For instance, the original set of statistics, gathered and processed by the late Bill Syrotuck and presented in Analysis of Lost Person Behavior: an Aid to Search Planning, give us the following prediction. If we are looking for a small child (1-6 years old) in relatively flat terrain, the highest probability zone is not near the Point Last Seen, but is a "doughnut" or circular strip between 1 and 1.6 miles from the PLS in all directions. If the child were older, between 6 and 12, and in mountainous terrain, the highest probability area would be between 1 and 2 miles downhill; the probability he is near the PLS is similar to the probability he is 2 miles downhill from the PLS. Thus the statistical approach gives us some rough idea to start from, and may help modify our "common sense" by what really happens to lost people. Understanding this idea may perhaps help you understand the rationale behind some futile-seeming task assignments.

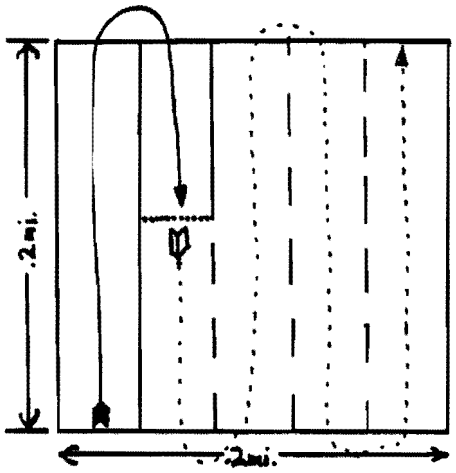
The most important new search concept for you to appreciate is that of non-thorough search, and why it is important not to use thorough search tactics except as a last resort. This may seem counter-intuitive, because common sense tells us to search hard and meticulously. Whenever we are trying to do something which is vitally important, especially a life-or-death matter like search and rescue, we tend to do our best to give our all, and to do the very best job we can. This usually means taking time to do things right, to double check all the knots, and to make sure all our vertical rescue systems have backups. However, for efficient search, we must search quickly and superficially, especially early in the search. The reasoning behind this is logical:

1. Early in a search, we are looking for a responsive victim who wants to be found, or at least one who will make his location visible.
2. We have a limited number of trained search teams.
3. A given team can cover a small area thoroughly with close-spaced line search, or a larger area with wider spacing or scratch and sweep tasks.
4. A responsive victim, or an obvious one, can be found as easily by a non-thorough search as by a thorough one (or almost as easily).

If you will grant that this reasoning is acceptable, then early in a search, we should use non-thorough methods such as scratch and sweep tasks to cover a large area quickly. Phase 2 of the SAROP, Scratch and Survey Searching, reflects this orientation. Anyone who has been on a mission with the ASRC probably appreciates this.

Good examples illustrating the importance of scratch searching abound; just recently, a search at Mount Rogers began with a big line search, rather than with scratch searches of high probability areas. The subject was found, but she was dead by that time. (Or so I heard; if I am wrong in saying this, my apologies to all concerned. However, I could cite other, but less recent, examples from my own experience.)

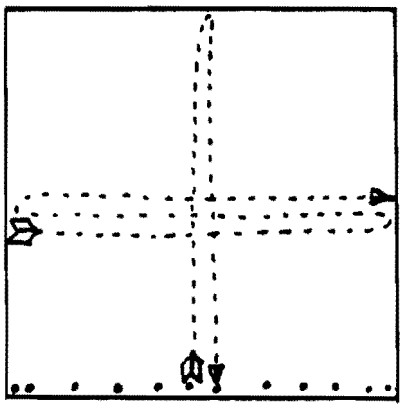
We may extend the idea of non-thorough search a bit further, and reach a result even further from "common sense" search ideas. Let's say we've sent scratch teams to the PLS, and along high-probability trails and ravines, but these teams have turned up nothing. At this point, traditional search methodology would have us start close-spaced line searches (saturation search) of high probability areas. However, the best, most efficient strategy is to use our manpower in very wide-spaced sweeps/line searches through the high probability. Of course, close-spaced and wide-spaced are ambiguous terms, but close spaced generally means 3 to 10 meter spacing (10-30 feet) depending on brush, and wide spaced means 10 to 30 meter spacing. A close-spaced line search expects to pick up every clue in its search area, whereas a wide-spaced line cannot possibly view every square meter through which it passes. It is more efficient to search an area several times with wide spacing than once with close spacing, given that the number of searcher-ours expended in each are the same. This true for finding clues as well as bodies, and the calculations below are based on finding small clues. If we assume a responsive victim, then wide spacing looks even better. As with scratch searching, you have the additional advantage of searching the entire high probability area or areas "once over quickly" during the early stages of the search, increasing the chances you will find a responsive subject while the subject is still responsive. To help you visualize and appreciate this concept, look at Figure 1:



12 SEARCHERS AT 20' SPACING

POD: 90% after 3 hrs. 45 min.
(one sweep of area)

A.



12 SEARCHERS AT 100' SPACING

POD: 50% after 45 min.
(one sweep of area)
75% after 1 hr. 30 min.
87.5% after 2 hrs. 15 min.
93.7% after 3 hrs.
96.7% after 3 hrs. 45 min.

B.

Figure 1: Probability of Detection (POD) of an unconscious subject vs. time for thorough and non-thorough sweeps of a .2 mi. x .2 mi. area.

The great advantage of wide-spaced (non-thorough) searching, as in 1(B), is not that a team will really search the same area 5 times in succession, but that the team may search once with wide spacing and 50% POD, then move on to repeat this in four other areas; the non-thorough team can cover much more terrain. If we consider that the POD for a responsive or obvious victim is probably about 95% for both close and wide-spaced teams, the advantage of wide spacing is even greater.

If you would like to delve into search theory some more, please go to some of the secondary refernces. The treatment of these concepts here is brief, and much has of necessity been left out.

Close-spaced line search is a last ditch effort, and should only be employed after much scratch searching and non-thorough sweep searching. However, is there any advantage to the immediate use of close-spaced line searching at the beginning of a search? Yes. It is possible for you to take a large number of totally untrained searchers, to form them into a long search line, and to shepherd them down a mountain; with luck, only a few will get lost, and they might find something. However, due to searcher inattention, and due to breaks and varying spacing in the line, the POD is not as high as might be predicted for a close-spaced line search. Are their any disadvantages to wide-spaced line searching? Again, yes. It takes well-trained searchers to keep a wide-spaced line going, and the chance of losing searchers is greater. It takes better Base Camp organization to keep track of the progress and search area boundaries of many wide-spaced search teams, compared with just one or two large line search teams. The wide-spacing/scratch search tactics sound ideal for the type of search management the ASRC practices (no accident, that) but a problem crops up. We are in the position of coming in, telling the Sheriff that his traditional methods are no good, and that he has to use us to make the search work well. It's a sticky situation, and the problem is one of politics and PR rather than search tactics. The long-range solution is simple: education. The fundamental message, that there are far better ways than close-spaced line search, is a simple one. Pass it on; and maybe, you'll have saved a life.

To summarize:

1. The historical approach to strategy looks at the past behavior of those lost in the search area, and at the past behavior of the present search subject.
2. Deduction, intuition, and experience are major influences on search strategy.
3. The Mattson Consensus Method is a formal way of averaging different Staff members' evaluations of probabilities for search subareas.
4. The statistical approach uses information about the behavior of past search subjects to predict probable behavior of lost persons.
5. Scratch and survey searching is generally the first type of search task which should be used.
6. After scratch and survey searching, searches of all high-probability areas should be done with non-thorough, wide-spaced sweeps, with repeat sweeps through the same areas, if necessary.
7. Close-spaced line searching should be a last resort.

DRAFT

TASK ASSIGNMENT

A. Introduction

A major problem facing the coordinator of any search operation is the organization of a large mass of people into teams and the assignment of the teams to appropriate tasks. Although this is simple in concept, the actual logistics can become quite complex, confusing and time consuming, especially in a large search. Disorganized task assignment procedures can result in teams ill-equipped, both in personnel and equipment, for their tasks. In order to reduce the confusion associated with task assignment, the ASRC has developed a standard operating procedure (SOP) for task assignment, which is described below.

The ASRC task assignment procedure, along with other SOPs, is designed to aid search and rescue efforts, not hinder them. Where an SOP is useful, it should be fully exploited; where a less elaborate procedure is sufficient, the SOP should be adapted and abbreviated. The procedure described below is designed for use in a large scale search, and should work if followed exactly. It is expected that the sequence will be suitably abbreviated in small scale searches. However, each departure from the SOP should be carefully evaluated as a source of error. By itself, the task assignment SOP is merely a clerical procedure; it is useless unless intelligently applied.

B. Task Identification

With the help of the Operations Officer (OO) and the Responsible Agent, the Mission Coordinator (MC) plans his search strategy and displays it on the Strategy Map. The MC's notations on the Strategy Map should show well defined search areas, priorities, and search modes compatible with the operation's manpower and material resources so that the OO can identify individual, specific tasks.

For each task, the OO initiates a Task Assignment Form (TAF) by numbering the task and entering the task number and description in the appropriate spaces. The task description includes

1) Geographical Feature: Ridge, stream, valley, fire tower, road, etc.
2) Map Name: Include type of map.
3) Type: See SAROP, page 20.
4) Difficulty: Sierra Club Scale:
   1. Level, easy walking
   2. Steep trail, boots required
   3. Use of hands required
   4. Use of rope required
   5. Continuous belay required
   6. Direct aid required.
5) Assignment: A clear, concise, complete description of what is expected of the team assigned to the task.
6) Time: This is the time the task was initiated. It serves as a check on the efficiency of the task assignment process and as an Operations Log reference.

Finally, the OO assigns the task to a field team. This is done by entering the team's letter designator in the "Team" space. If the team is already in the field, the TAF goes to the Communications Officer (CO) for dispatching. If the OO wishes to personally brief the FTL, he need only consult with the CO regarding dispatch. If a new field team is called for, the OO passes the TAF along to the Personnel Officer (PO) who then executes the "Personnel" section.

C. Personnel Assignment

The Personnel Officer (PO) uses the card-file Personnel Roster to assign appropriate searchers with appropriate personal equipment to the new field team. Close coordination with the Equipment Officer (EO) and Communications Officer (CO) is essential to the assembly of an effective team. (This is the reason that the PO and EO positions should often be handled by one person.) Use of the Personnel Roster is described below.

1) The Roster contains one card for each person on the operation. Each searcher's card is filled out (and cut) to indicate his skills and personal equipment. (See SRF in Section X.) *NOTE: THIS STYLE SRF IS NO LONGER IN USE.
2) To assemble a team, the PO selects appropriately skilled and equipped people from the "Base Camp" section of the roster and pulls their cards.
3) These cards are clipped together along with a piece of paper labeled with the team letter.
4) The names of the searchers selected are entered on the TAF along with the total number of people on the team. The card stack is kept out of the file.
5) The TAF is then passed along to the EO along with the card stack (indicating personal equipment).
6) When the TAF is completed and returned to the PO, he summons the FTL and gives him the original of the TAF. The carbon copy goes to the OO. The FTL assembles his team and its equipment and reports to the OO for briefing.
7) After the team is dispatched, the OO returns the TAF carbon to the TAF File. The card stack is filed under its team letter in the field section of the Personnel Roster.
8) When the team returns to base camp and is debriefed by the OO, its card stack is removed from the "Field" section and the cards refiled in the "Base Camp" section.

D. Equipment Assignment

The Equipment Officer (EO) uses the card-file Equipment Inventory to assign appropriate equipment to the field team. He must coordinate with the PO and CO on personal and communications equipment. Use of the Equipment Inventory is described below.

1) The Inventory contains a card for every piece of group equipment and every available vehicle on the operation. Each card should also be annotated to show damage done and repairs made during the operation.

2) When the EO recieves the TAF from the PO he selects the necessary equipment from the "Base Camp" section of the Inventory and pulls cards for it.
3) These are clipped together with the team letter and kept out of the file.
4) The group and individual equipment going out with the team is noted on the TAF.
5) Appropriate transportation is arranged for and noted on the TAF (the PO should have supplied a driver, if necessary).
6) The TAF is then passed on to the CO for communications arrangements and back to the PO for team assembly. Once the FTL has assembled his team he will assemble his equipment according to the EO's instructions.
7) After the team is dispatched, the EO files the card stack under the team's letter in the "Field"section of the Equipment Inventory.
8) When the team returns, the FTL must check in all his team's equipment with the EO. Cards for equipment returned in good condition are refiled in the "Base Camp" section of the inventory. Cards for damaged or lost gear are filed under "Out of Service."

E. Communications Instructions

The Communications Officer (CO) uses the Communications Systems Chart to help him coordinate the communications network. Each new task requires that a new link of the net be worked in without upsetting any others. When the CO recieves the TAF from the EO, he consults the Systems Chart to decide upon a communications check-in schedule, callsign, frequency, and mode assignment and appropriate traffic route, and enters these instructions on the TAF. Callsign, frequency, mode, and relay or repeater are entered in the "COMMO" block at the top of the form. Schedules and other instructions are entered under "COMMUNICATIONS."

F. Snags

If, during the course of task assignment, one of the Mission Staff determines that he cannot meet the requirements of the task description, he returns the TAF, along with his suggestions, to the CO for a solution to the problem, and the procedure begins again. The exception to this procedure is the case of a communications insufficiency which can be remedied with a communications task. In such a case, the CO holds the TAF until a suitable communications task can be assigned. Once the difficulty is overcome he reactivates the TAF, finishes his instructions and passes it along to the PO as usual.

G. Briefing and Dispatching

Briefing procedures should be kept as simple as possible consistent with the requirement that they also be complete. The OO is responsible for all briefings, but he may find it convenient to delegate parts of the briefing to other Mission Staff officers. FTLs must insist upon adequate explanations of their tasks and communications instructions.

Briefings are carried out either face to face in Base Camp or through the communications network. The mode is specified be the OO on the TAF under "DISPATCH MODE" and the person actually doing the briefing marks the time and his initials below. The time serves as a check on assignment efficiency and as a reference for the OPSLOG.* The initials serve as a record of who did the briefing so that later clarifications may be made.

After the briefing, the TAF is returned to the PO for filing in the TAF file. TAFs for tasks assigned to pre-existing teams are attached to the team's first TAF.

*OPERATION LOGBOOK

H. Task Execution

The FTL is responsible for carrying out the assigned task completely and safely, and for keeping the communications schedule. If any difficulties arise or clues are found, a report is made as soon as possible. All team reports are entered in the OPSLOG and on the Status Map by the OO.

As each task is completed, the team may recieve a new assignment while still in the field, but eventually the team will return to Base Camp. The FTL must then see that all equipment is checked in with the EO, and that all his people are accounted for to the PO. He then reports to the OO for a final debriefing. The OO enters the time and his initials on both copies of the TAF (the FTL keeps his for a souvenir) to show that the team has been dissolved. If the OO wants to keep the team assembled without an assignment, he does not initial the "FINAL DEBRIEF" block, but simply instructs the FTL to keep his team together, and makes a note to this effect in the OPSLOG and in the TAF file.

APPALACHIAN SEARCH AND RESCUE CONFERENCE, INC. TAF

TASK ASSIGNMENT FORM

TASK NO.	TEAM	COMMO	DISPATCH MODE		FINAL DEBRIEF	
			TIME	INIT.	TIME	INITIAL

GEOGRAPHICAL FEATURE

MAP NAME

ASSIGNMENT

TYPE

DIFCLTY: 1 2 3 4 5 6

TIME

PERSONNEL

TL

FTL		SR	
MEDIC		SR	
RO		SR	
RS		SR	
DR		SR	
SR		SR	

EQUIPMENT

GROUP	INDIVIDUAL

TRANSP

COMMENTS

J. Searcher Registration Form (SRF) * THIS FORMAT SRF IS NO LONGER IN USE

1 2 3 4 5 6 7 8 SRF

NAME_____

PHONE NUMBER( ) -

EMERGENCY CONTACT_____

PHONE NUMBER( ) -

APPALACHIAN SEARCH AND RESCUE CONFERENCE, INC.

SEARCHER REGISTRATION FORM

EQUIPMENT

1. PERSONAL? (SEE POSTED LIST) Y N

2. CB HAND-HELD 2 OR 5 WATT? Y N CHANNELS:
2-METER HAM PORTABLE? Y N POWER:
FREQS.:

3. VEHICLE AVAILABLE FOR SEARCH? Y N 4-W DRIVE? Y N
LICENSE NO.: MOBILE RADIO? Y N TYPE:

OTHER EQUIPMENT:

(OVER)

8 7 6 5 4 3 2 1

SKILLS AND TRAINING

4. EMT? Y N ADVANCED TRAINING:

5. HAM? Y N CLASS: CALL:

6. 5th CLASS CLIMBER? Y N YEARS EXPERIENCE:
CAVER? Y N YEARS EXPERIENCE:
VERTICAL CAVER? Y N YEARS EXPERIENCE:
IF YES, DO YOU HAVE YOUR OWN COMPLETE VERTICAL RIG HERE? Y N

(7) BACKPACKER? Y N YEARS EXPERIENCE:

7. C.A.P. GRND. TEAM? Y N TYPE: CURRENT CAPF 101? Y N
ASRC TRAINEE? Y N

8. ASRC BASIC? Y N
ASRC RESCUE? Y N
MTN. RESCUE ASSN.? Y N

OTHER:

SRF Explanation * THIS FORMAT OF SRF IS NO LONGER IN USE.

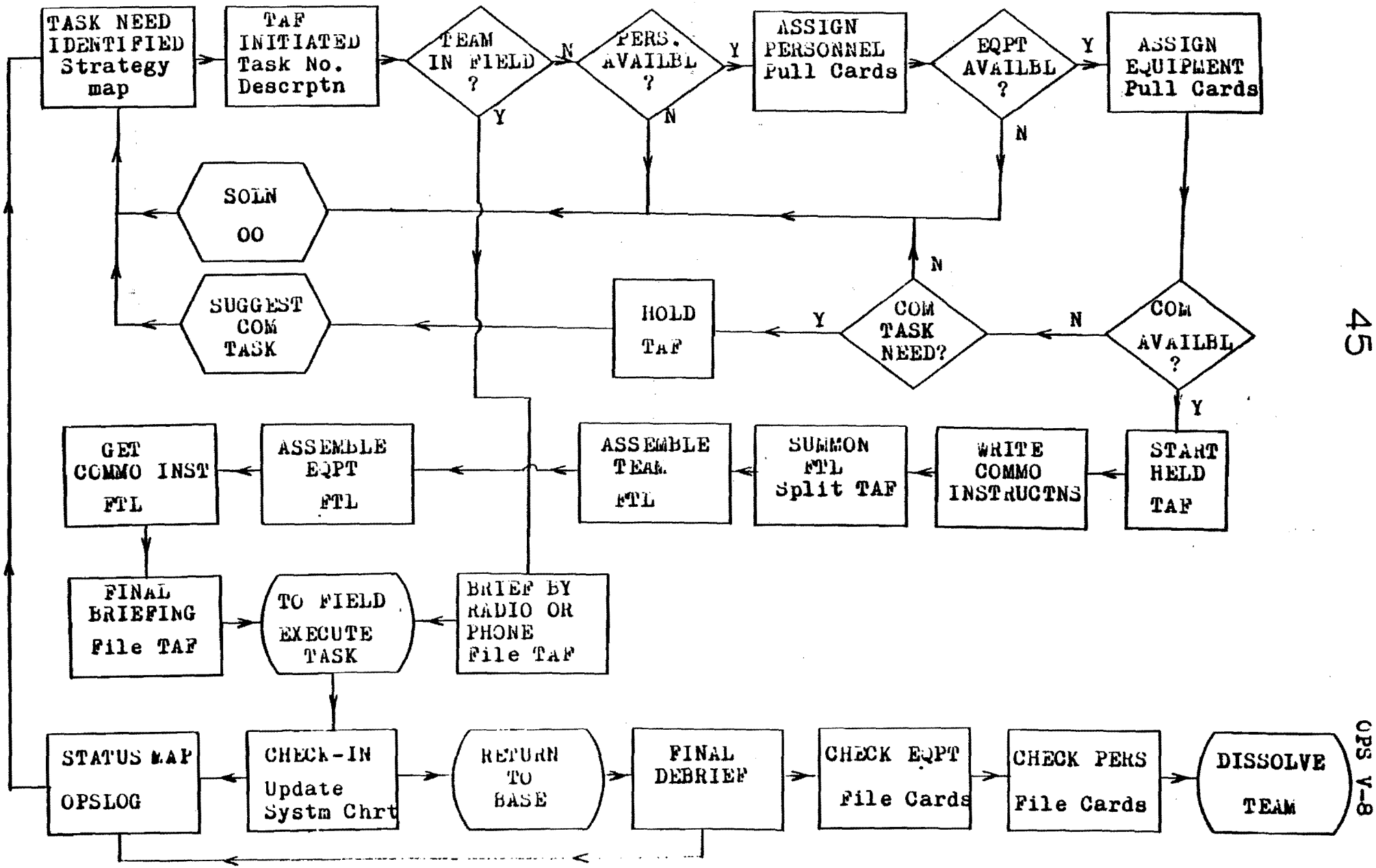
The Personnel Officer (PO) sets out a plentiful supply of SRFs, pens (hopefully tied down) and puts up in prominent view two acetate covered boards. The first gives general instructions to incoming searchers, and the second details the minimum personal equipment as set by the MC or OO. As each searcher brings a completed SRF to the registration desk, the PO or an assistant checks it quickly. If the searcher appears to have some outstanding qualifications, the PO may wish to quickly interview him and send him to one of the Mission Staff. For example, the Communications Officer (CO) might appreciate any hams available (who are not field qualified) for use in the Communications Center. After his SRF is checked, the searcher is issued a Searcher Information Sheet (SIS), a Hypothermia folder if appropriate, and given a piece of paper or a sticker stamped with an ASRC rubber stamp as proof of having registered. The searcher is then allowed into Base Camp.

The PO or an assistant "codes" each SRF card by cutting out the holes (dashed lines on front view on previous page) according to the following code:

1. The searcher has the specified minimum personal equipment.
2. The searcher has a field-portable radio.
3. The searcher has a vehicle he is willing to use on the operation.
4. The searcher is an EMT.
5. The searcher is an amateur radio operator (ham).
6. The searcher is a caver or 5th class climber.
7. The searcher is an ASRC Trainee, CAP Ground Team member, or an experienced backpacker.
8. The searcher is an ASRC or Mountain Rescue Association Certified member.

Once the cards are cut and stacked, persons falling in any one of the above classifications (or any combination thereof) can be selected by pushing a pencil through the appropriate hole(s). Cards for ASRC members should be available in the file. As members check in, cards for them are pulled from the file, checked, and added to the stack.

TASK ASSIGNMENT FLOWCHART



L. The Status Map

The Status Map is a graphic summary of search operations. Physically, it consists of a topographic map of the search area mounted on a board with several acetate overlays. On the board beside the map is an acetate-covered table for notation of team letters and corresponding task numbers. The map proper is marked with the following information:

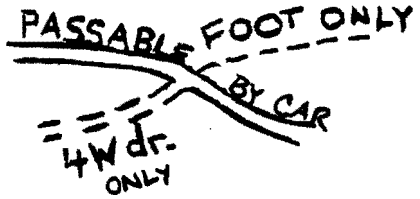
1) Victim's last known position and direction of travel. LOST

2) Prominent points and attractive hazards. (e.g. CLIFF, MINESHAFT)

3) Base Camp. BC

4) All known road conditions.

5) All known helispots.



The Operations Officer (OO) uses the Strategy Map to begin assigning tasks. As each Task Assignment Form (TAF) is initiated, the OO notes each task on the map overlay by use of a capital letter indicating the general type of task, and a unique number designator as a subscript, which is the task number found on the TAF. Teams may be located by reference to the table of task numbers and corresponding team letters alongside the map.

As each team checks in with the Communications Center, the OO updates the Status Map by noting the team's progress using graphic symbols (see below). As much as possible, these should indicate the actual reported position and area searched for each team. As each task is terminated, the task designator on the map should be "boxed" to indicate completion. (e.g. S_4) At regular intervals, a fresh overlay will be started; active tasks will be copied onto the new overlay. NOTE: The old overlays should always be saved, as they provide a succinct summary of search operations. *NOTE - XEROX COPIES ARE NOW USED IN PREFERENCE TO OVERLAYS.

TASK SYMBOLS

Containment

Road Patrol

Foot Patrol

Road or Trail Block

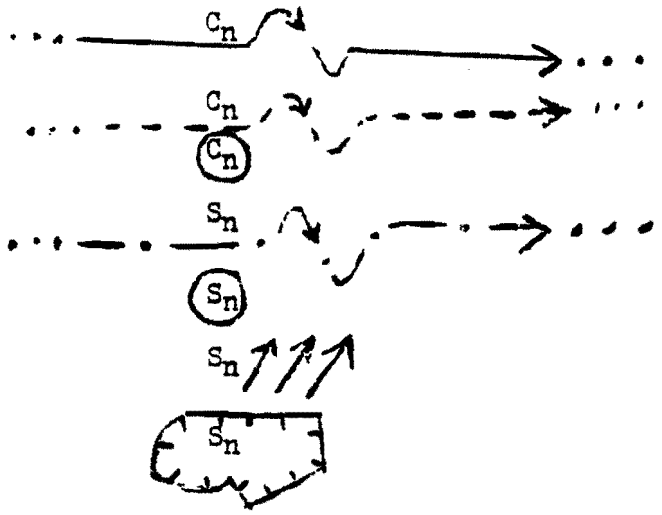
Search

Scratch

Survey

Sweep

Saturation

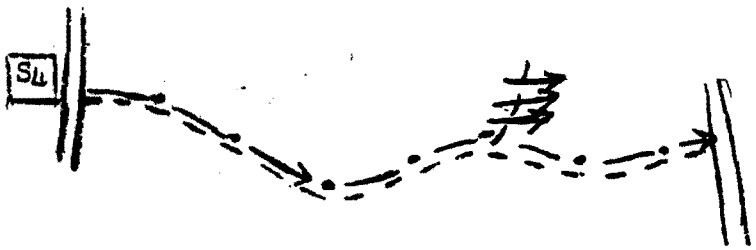


Tracking T_n

Evacuation E_n

Relay or Repeater R_n

Note: a task may combine two or more symbols. Example:



CHAPTER FIFTEEN

EXTRICATION

15.0 GENERAL

One of the primary responsibilities of a GSAR team is to render life saving first aid to the victim of an aircraft accident. Unless the victim was thrown clear or crawled clear of the wreckage, the team will probably find him entangled in the wreckage. It will then be necessary to use some or all of the forcible entry and extrication procedures described in this chapter.

The techniques described below were originally developed for use on automobiles, but will work equally well, if not better, on light aircraft. This is due in part to the lighter metals and construction used in the manufacture of light aircraft frames.

15.1 EXTRICATION STAGES

Extrication is divided into four basic stages:

1. Assess and stabilize the situation
2. Gain access to the victim
3. Treat the victim
4. Extricate the victim.

These will be described in detail below.

Assess and stabilize the situation. The first thing to do upon arriving at a crash site is to look and see what the situation is. It may be difficult to keep from doing something right away, but a minute or two spent in planning will save much more time in the long run.

For example, if there is a life-threatening hazard, like the plane being on fire, you may want to pull the victims out as fast as possible, regardless of their injuries. Or if there is a small fire nearby, started by spilt gasoline, you may want to put it out right away, before it becomes a life-threatening hazard, and before you attempt to rescue the victims.

Putting out the small fire is an example of stabilizing the situation. If the aircraft itself is not stable, such as it is in danger of sliding down into a ravine, it should be supported with blocks and cribbing under the frame, or even lashed down with ropes and guy lines, such as tying the aircraft to a tree so it won't slide any farther. NEVER, EVER flip an aircraft over or let it shift abruptly while the victims are still inside. This could cause more injury to the victim than the crash itself. Stabilizing the aircraft not only protects the victims from further harm, but the team as well. Someone could be injured very easily if the aircraft were to shift suddenly.

Gain access to the victim(s). Again, the first thing to do is to assess the situation. At this stage, you are not trying to disentangle or remove the victim, but to get close enough to him to render life-saving medical care. This may be accomplished by opening a door, breaking a window, or cutting through the roof--the fastest, least complicated method being the best. A later section will give specific techniques for forcible entry.

Treat the victim. After you have access to the victim, he should be given as much treatment as possible before any attempt is made to remove him from the aircraft. A cervical collar and a short back board should usually be in place before any extrication is attempted. Some treatment will not always be possible while the victim is still in the aircraft, but as much as possible should be done. Rigid splint-

ing of the extremities may not be feasible or may make removal difficult, but any fractures should be stabilized before moving. For example, a fractured leg can be strapped to the other leg to support it and make removal of the victim less painful. Rigid splints should be applied anywhere they will not be in the way and should always be applied as soon as possible after removal. Again, this does NOT include the backboard and the cervical collar, which should always be in place before moving the victim. He should be attended during extrication to make sure he stays stable, and he should not be moved any more than necessary. You should also insure that the victim stays as comfortable as can be expected during all of this. If something you are doing is hurting the victim, stop and try something different.

Extricate the victim. The ideal way to extricate someone is to remove the wreckage from around the victim, not remove the victim from the wreckage. Obviously this is not feasible in most situations; however, a large portion of the wreckage can be moved out of the way before any attempt is made to remove the victim. The victim should be disentangled completely before moving him. Enough wreckage should be removed to allow the victim to be removed easily. If the victim has to be twisted excessively, stop, and remove more wreckage. It is far better to spend a few extra minutes clearing the way and spare the victim further pain and injury. A victim should never be taken out through a broken window. There is a very great danger of cutting the victim on the splinters of glass or plastic.

15.2 TOOLS FOR EXTRICATION

Since CAP squadrons do not usually have the funds to buy power tools, and since power tools are bulky, heavy, and hard to carry, this section will only cover hand tools. These are usually inexpensive, readily available, and easy to carry. If the squadron wishes to buy power tools, they should receive special training in their use. All tools should be marked with bright colors or reflective tape to make them easier to find if lost in the dark.

(Extrication tools marked with an asterisk (*) are those required for a Class B GSAR team.)

Pry bars (24"*) are probably the most useful tool for extrication. Two types that are available are common goose neck wrecking bars and rip bars, the latter having a sharper angled end and a thin chisel point to get into narrow spaces. The rip bar is available from Sears and the other almost anywhere.

Leaf spring tool.* This tool is used to cut sheet metal and small supports. It is made from a 12" section of automobile leaf spring. One end is cut on a diagonal and the long edge is sharpened to a knife edge. The other end is taped to form a handle, the end is left exposed. (See figure 15-1.) The tool is used by driving the point into the sheet metal with a hammer, and then striking the back edge with the hammer causing the tool to cut the metal like a large knife.

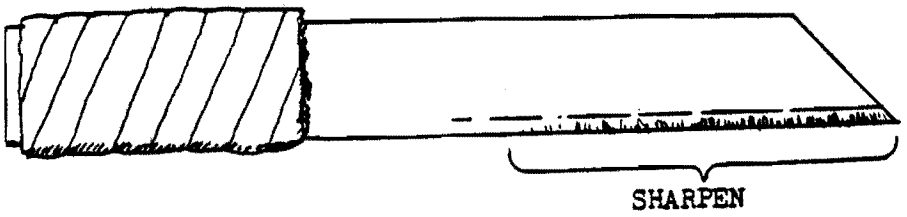


FIGURE 15-1: Leaf Spring Cutting Tool

CHAPTER FOURTEEN

HELICOPTER OPERATIONS

14.0 GENERAL

Helicopters can provide the means to quickly reach and evacuate victims from even the most remote portions of a wilderness. However, helicopter operations can be extremely dangerous or even fatal to untrained personnel. Strict adherence to the guidelines in this chapter will help minimize that risk.

14.1 DANGER AREAS

As with all aircraft, helicopters have certain intrinsic danger areas that all personnel should be aware of and avoid. These are:

Main Rotor Blades. The main rotor, which provides lift for the helicopter, also provides a major source of danger to ground personnel. Under normal circumstances, the blades travel above head level. However, under some conditions (i.e. gusting wind, etc.) the blades can dip to less than five feet in the front. This would strike the average person at the shoulder level, killing him instantsly. For this reason, the area directly in front of the helicopter should always be avoided, and approach and departure made in a crouch.

Tail Motor. Located at the rear, this rotor provides the other major source of danger to the personnel. It has a minimum clearance of four feet in some models. When it is turning, IT CANNOT BE SEEN! Never duck under the tail boom or walk around the end of a helicopter.

Engine Exhausts and Intakes. On some helicopters, the engine intakes or exhausts may be positioned so as to make it possible to get close to them. The intake could possibly suck in any loose items or even a person, and the jet exhaust may cause severe burns. Normally these will be well out of the way, but in any event, they will be well marked and should be avoided.

Antenna. Most military helicopters and some civilian models have an assortment of antennas on the fuselage. If an antenna is touched while the transmitter is on, burns can result. The best practice is to avoid the antenna altogether.

Rear Half of the Helicopter. The entire rear half of the helicopter, from the doors back, is a blind spot to the pilot; consequently, he may not know that anyone is back there. If the pilot should move the helicopter, there is a very great danger of someone being injured. Stay where the pilot can see you.

14.2 CHOOSING A LANDING LOCATION

Contrary to popular belief, it is difficult for helicopters to take-off straight up. An analogy can be drawn to starting an automobile from a stop light in fourth gear. It can be done, but it is hard on engine and pilot both. If the pilot can make a take-off run or take-off at a shallow angle, the extra air moving through the blades gives extra lift called translational lift.

The ideal spot for a landing zone (LZ) is a flat open field where the pilot can land or take-off in any direction. If such an area is not available, an LZ must be constructed.

A ridge can make a good LZ. Trees should be cleared along the approach lane and the take-off lane (see figure 14-1). The drop off allows the pilot to trade

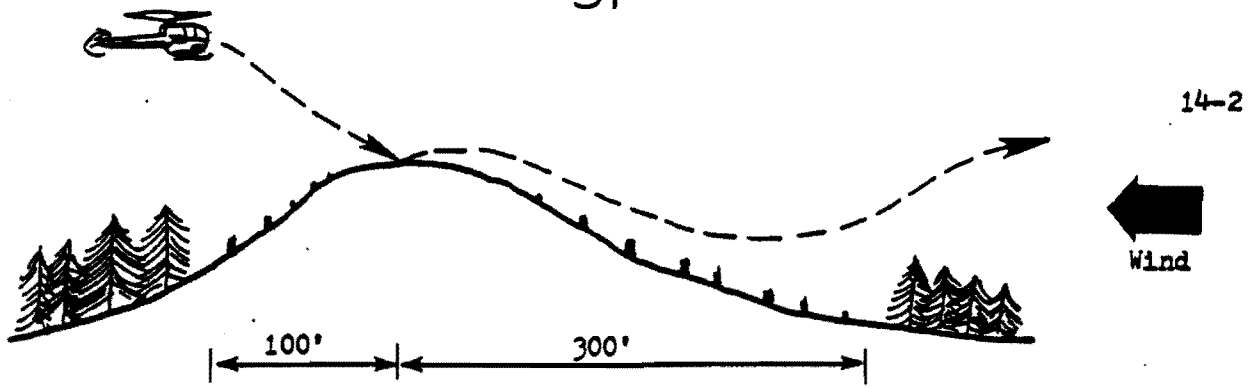


FIGURE 14-1: A ridge approach lane and take-off lane.

FIGURE 14-2: The proper take-off angle into the wind.

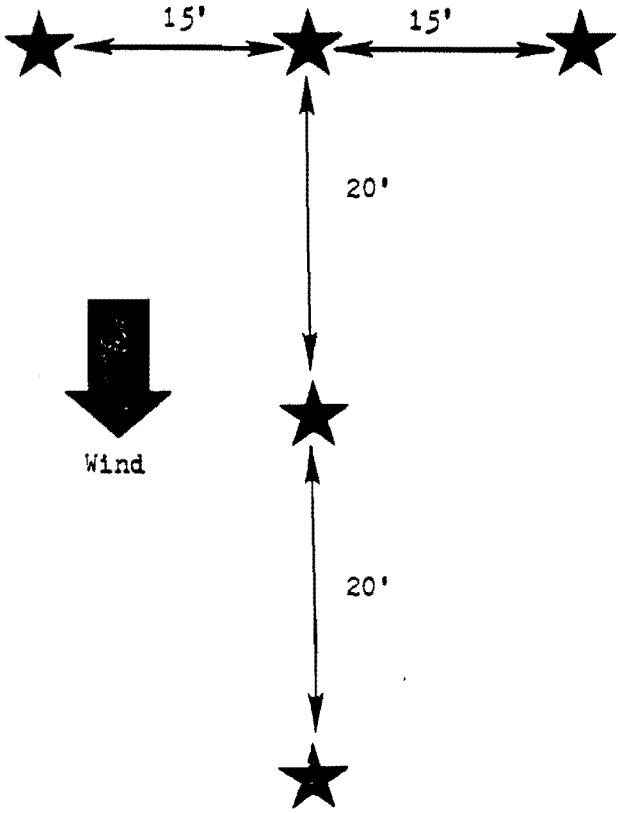


FIGURE 14-3: Marking the wind direction.

altitude for speed to gain more lift.

Corridors are the other choice. They should be thirty-five or forty paces wide, and, ideally, one hundred twenty paces long. They should also be aligned as much as possible with the wind. The sharper the angle of the crosswind, the less desirable the corridor, although the situation may require using it anyway.

Whatever LZ is used, it should be cleared for enough to allow a fifteen degree take-off angle into the wind and still clear any obstacle at the end by ten feet (see figure 14-2).

Touchdown Pad. This is the area that the helicopter accurately lands in. It must be thirty paces by thirty three paces minimum. It should be cleared of all brush and obstacles down to one foot tall. The ground slope must not exceed five degrees. The pad should be at least sixteen paces from tree lines, cliffs, etc. Wind spilling over the edge of these into the LZ will cause turbulence, making hovering very difficult. Remember thirty by thirty three paces is not large enough to even turn around in; the pad should be larger if possible. The pad should be marked with an "H" in the middle. This should be formed with signal panels or some other easily seen material and should be staked down well, to prevent the helicopter from blowing it around. At night, the four corners can be marked with road flares. All loose brush and debris must be cleared well away.

Marking the Wind. The best way to mark the wind is with a smoke bomb. Other ways are bright streamers or a "T" with the long leg showing the wind direction. The "T" can replace the "H" on the touchdown pad (see figure 14-3). At night, a "T" should be made with flares or (better) flashlights. Whatever wind indicator is used, at no time should it obscure the touchdown pad.

14.3 LOADING THE HELICOPTER

When approaching a helicopter, always approach the helicopter in full view of the pilot. Ideally, approach forty-five degrees to the nose, but approach from the side is satisfactory. Always keep your head down, and never approach a helicopter from higher ground. All personnel not working directly with the helicopter should stay well clear of the pad.

14.4 HOIST OPERATIONS

Whenever possible, the helicopter should land for loading, but if this is not possible, a hoist will be used. Hoist operations are dangerous so great care should be used. Never touch the hoist cable before it touches the ground. Helicopters can build up a large static charge and you could receive a severe jolt. Never secure the cable to a fixed object, as a gust of wind would tear the helicopter apart. Be ready, so as not to make the pilot hover longer than necessary.

14.5 SAFETY RULES

1. All personnel should stay at least fifty feet from small helicopters and one hundred feet from larger models, unless directly working with the helicopter.

2. Always approach the helicopter from the side, so the pilot can see you at all times.

3. Keep your head down at all times! Remember, the slower the blade is moving, the lower it will dip.

4. Never approach or leave a helicopter from any side where the ground is higher than where the helicopter is standing, or you might walk into a rotor.

DANGER

14-4

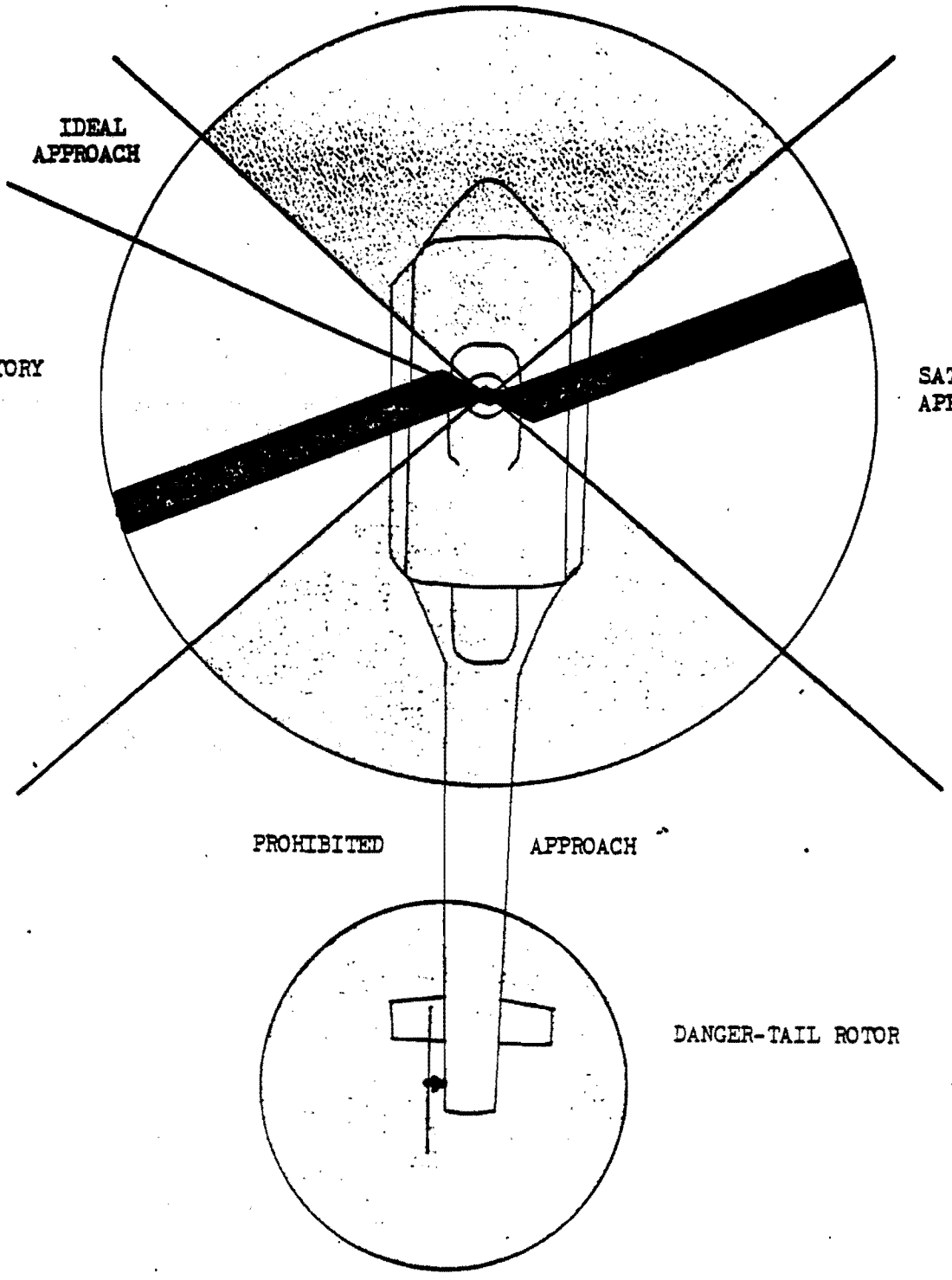


FIGURE 14-4: Approach zones.

5. No smoking within one hundred feet of the helicopter.

6. Remember that the tail rotor cannot be seen when it is turning. Maintain a wide clearance of the tail area and NEVER stoop or walk under the tail boom.

7. Personnel working with the helicopter should wear their hardhat with the chin strap fastened, and should wear bright colored vests if available.

8. Keep long handled tools, ice axes, skis, litters, radio antennas and similar items parallel to the ground when approaching a helicopter.

9. Ropes and loose ends should be coiled and secured. Loose items should be tied down before nearing the helicopter.

10. NEVER load without the pilot's signal and supervision. Load carefully so not to interfere with controls, cables, and the pilot. NEVER approach the helicopter until the pilot gives the OK, as he may want to change the position of the helicopter after he has touched down.

11. Stay well clear of the helicopter on take-offs and landings. The pilot may swing the chopper around or dip the blades to one side.

12. Remember that a touchdown area of thirty by thirty three paces is only large enough to land in; it is not large enough to turn around in.

13. Always attempt to find an area that will permit a fifteen degree approach and take-off angle.

14. Remember, the taller the barriers at the ends, the longer the landing zone must be.

15. Attempt to find a landing zone that is generally oriented to the wind.

16. Remember that wires are difficult to see when approaching a landing zone.

17. Clear the touchdown area of all obstacles taller than one foot, and remove debris and brush out of the area.

18. Be sure to mark the landing zone properly.

19. Use the proper hand signals for assisting the pilot in landing.

20. Do not try to get more aircraft in the landing zone than it will safely accomodate.

14.6 REFERENCES

Fear, Gene: Helicopter Operations and Personnel Safety. Washington State Department of Emergency Services, Tacoma, WA: second revision, 1976.

MacInnes, Hamish: International Mountain Rescue Handbook. Charles Scribner's Sons, New York, NY. 1972.

ASRC OPERATIONS MANUAL
SECTION VII

COMMUNICATIONS POLICIES AND PROCEDURES

A. Introduction

Communications will make or destroy a search and rescue mission. Trained searchers, rescuers, or medics are of little use unless they can be directed to the proper area, or redirected, if necessary. In order to have proper communications, there are two essential types of equipment and associated problems: hardware and software. First, the pieces of hardware (radios, field phones, etc.) require care, maintenance, proper usage, and repair. Secondly, the software must function correctly. The software consists of people and paper, and also require care, maintenance, and proper usage. Each person who will or might be involved in communications must be aware of, and follow, Standard Operating Procedures (SOP).

B. Radio SOP

1. When passing traffic (i.e. whenever you are handling a message to be recorded or passed to another) always write it down. . . . don't trust your memory. Some emergency might intervene, and the message might be lost. If you will not be handling the message to the person it is directed to, put "to" and "from" on it, with the date and time. Putting this on every message is probably a good idea.

When receiving a message, write it down, then always read it back for confirmation. When you are sending a message, remember that some person has to write it down; be concise; if possible, write it down first yourself.

2. Callsigns

Citizen's Band: KIU 0954 plus a number designator or the team letter designator.

VHF Emergency Band: KU 6516 plus number or team letter designator.

Amateur: Radio operator's callsign in the field or Communications Officer's callsign at COMCTR.

3. Phonetic Alphabet (ICAO)

ALFA	NOVEMBER	ZERO (NOT "OH")
BRAVO	OSCAR	WUN
CHARLIE	PAPA	TOO
DELTA	QUEBEC	THREE
ECHO	ROMEO	FOWER
FOXTROT	SIERRA	FIVE (NOT "FIVER")
GOLF	TANGO	SIX
HOTEL	UNIFORM	SEVEN
INDIA	VICTOR	ATE
JULIETT	WHISKEY	NINER
KILO	X-RAY	
LIMA	YANKEE	
MIKE	ZULU	

A. Standard Phrases

1. Do not use Ten-Codes
2. Do not use Q-Signals on fone

CW	FONE	MEANING
C	AFFIRMATIVE	Yes
N	NEGATIVE	No
R	ROGER	I understand your entire previous message. Does not mean "yes", "okay", "I agree", "I'll do it", or anything else.
K; $\overline{KN}$	OVER	Invitation to transmit.
$\overline{SK}$	CLEAR	This is my last transmission but I am still monitoring.
$\overline{CL}$	OUT	I am leaving the air (do not say "Over and out."
	PLEASE SPELL	Use phonetics.
	I SPELL	Spelling will follow.
	GO AHEAD	I am ready to receive your message.
?	SAY AGAIN	Repeat your entire previous transmission.
?AA...	SAY AGAIN ALL AFTER ...	Repeat the portion of your transmission following ...
?AB...	SAY AGAIN ALL BEFORE...	Repeat the portion of your transmission preceding...
$\overline{AS}$	STAND BY	Wait a minute.

The use of other standard phrases is discouraged. Plain language is perfectly adequate and will be more easily understood by inexperienced Radio Operators. CW operators should use standard Q-Signals if the other operators are familiar with them.

CODE 1: Victim found, alive and well.
CODE 2: Victim found, needs emergency medical care and evacuation.
CODE 3: Victim found, dead on arrival of searchers.

5. Identification

1. Always put your call or name last.
e.g. (100 mW CB) "Chip, this is Carol, over."
e.g. (Ham) :WB4Kxx/4, from WB4VGI/4, go ahead."
e.g. (CB) "KIU0954, Base, this is team Alfa, over."
Note that "this is" and "from" mean the same thing, but that under good conditions nothing needs to separate the call signs at all.

2. It is not necessary to identify every transmission, however you must identify at least once every ten minutes during a transmission and all exchanges must be identified. Always identify before saying "clear" or "out", and identify every ten minutes during a long transmission. Be conservative: it is better to sign too much than not enough. Under difficult conditions you may want to sign every transmission.

6. Relays.

A relay is a manned radio station which relays messages between stations which could not otherwise communicate. When using low power VHF in the mountains, relays will be very common. The trick to ensuring accuracy of a relayed message is to listen to the relay transmit your message and then correct his errors.

Sample (Team Bravo is in Weakley Hollow, Relay Delta is on Old Rag summit and Base Camp is on Route 231 at Etlan. Team Bravo has some

Instructions to work through the relay):

KIUØ954, relay Delta, this is team Bravo, over.
KIUØ954, team Bravo, this is relay Delta, go ahead.
I have a message for base. Can you relay? Over.
Affirmative. Go ahead.
We have completed a sweep of the Weakley Hollow Fire road as far as the Robertson Mountain Trail. We found nothing. I say again, we found nothing.
KIUØ954, team Bravo from relay Delta. Roger. KIUØ954, Base from relay Delta, over.
KIUØ954, relay Delta, this is Base, go ahead.
I have a message from team Bravo, over.
Roger, go ahead.
Team Bravo has completed a sweep of the Weakley Hollow Fire Road as far as the Corbin Mountain Trail. They found nothing. I say again, they found nothing. Team Bravo, is that correct?
KIUØ954, relay Delta, this is team Bravo. Negative. Change Corbin Mountain to Robertson Mountain, over.
Roger. KIUØ954, base this is relay Delta. Change Corbin Mountain to Robertson Mountain, over.
KIUØ954, relay Delta, this is Base. I have: Team Bravo has completed a sweep of Weakley Hollow Fire Road to Robertson Mountain Trail. Nothing found. KIUØ954, relay Delta from Base, clear.
Roger, that is correct. KIUØ954, team Bravo from relay Delta, your message is delivered, over.
KIUØ954, relay Delta from team Bravo. Roger, thank you. KIUØ954 relay Delta from team Bravo, clear.
KIUØ954, team Bravo and base from relay Delta, clear.

Note that the relay transmitted the sense of team Bravo's message rather than passing it on word for word. Under normal circumstances this is perfectly acceptable, however under severe conditions word for word retransmission should be the rule. One might well wonder if the error of transcription illustrated above crept in for this reason.

RADIO COMMUNICATIONS

-Keith Conover

Any ASRC member who has been on a mission probably has had occasion to curse at a radio, at someone on the other end of the radio, or about radios in general. Efficient search management, in which we of the ASRC take so much pride, tends to break down most commonly when the radio net malfunctions: e.g.: Field Team Alpha is on the wrong frequence and doesn't know it; the RO for Field Team Bravo forgot the spare battery and now his team's radio is dead; Field Team Charlie's radio only transmits at random intervals and messages seem never to get from MC to FTL Delta and back properly until the third or fourth try. Most radio problems may be solved by someone who knows just a little about radios and about radio communications. This essay is designed to teach you just that little bit, plus some useful information that is usually hard to find.

The most common problem with radio communication is related to an audio transmitter and receiver -- you. Like anything else, getting information smoothly through a radio takes some practice, but there are a few things you can do even if you don't have a radio to play with for practice. For example:

1. Keep copies of the 2 ASRC Crib Sheets in your pack. (Save the copies in this handout, because we have lots of spares for your pack.)
2. Learn the ICAO (ITU) phonetic alphabet and the standard ASRC prowords. (See sections 5.2 and 5.3)
3. Know how to communicate effectively in marginal conditions. Know how to compose a succinct message, how to repeat each phrase, and how to spell and use "figures". You will seldome need to do this, but when communications are marginal, your ability to communicate effectively will endear you to the CO. (see section 5.2) You will probably find this will help you communicate more comfortably even in the best of conditions.
4. Hold the microphone properly: keep it a couple of inches from your mouth, perhaps at an angle (to reduce breath sounds) and talk in a normal to quiet voice. A loud voice may weaken your radio's power (RF output) with a FM radio and may cause distortion with an AM or side-band (SSB) radio. (More about the types of radios later.)

Now we'll detour to consider radio in general, then return to some details about radio hardware.

You need to know about two major characteristics of radios: mode and frequency. The mode of a radio refers to the way your voice (audio frequency, "AF", or simply "audio") is encoded onto the (radio-frequency or "RF") electromagnetic radio wave carrier output. We say the RF carrier is modulated by your voice audio. The two main modes we use are frequency modulation (FM) and amplitude modulation (AM). There is also an improved version of AM known as single side-band (SSB), but you probably won't have to deal with any side-band radios. Another mode you may hear about is continuous wave (CW), where an unmodulated carrier is turned on and off via a telegraph key, to produce Morse Code. Often, we (somewhat incorrectly) use CW to refer simply to any kind of Morse Code. The only things about the different modes you need to know are:

1. FM radios have less interference problems than AM, and FM gives you more "talk power" (RF output) for a given bettery life. Listen to CB Channel 19 (CB's AM) for a good example of AM interference and noise.
2. The louder you talk into an FM radio, the louder the audio sounds at the other end, up to the point where you get distortion. But, the louder you talk, the weaker your RF output gets. The effect is slight, but may be noticeable in marginal situations. If the other guy says you're breaking up, talk softly.

The other concept is of frequency of the RF carrier. Some radios have preset frequencies called "channels"; the frequency in a particular channel depends on which crystal, or frequency reference, is plugged in for that channel. Other radios tune across their frequency bands (range) with a dial, and some use fancy electronics to allow keyboard entry of frequencies. For instance, some amateur (ham) 2-meter VHF-FM radios have microprocessors so that the radio will put frequencies into "memories"; one may then switch between memories much as one switches channels on a crystal-controlled radio. Some of these radios may scan through the memories (or through the band) if properly set.

Frequency may be measured in MegaHertz, or millions of cycles per second; the following names are applied to different bands:

15 Hz - .02 MHz	Audio Frequency (AF)
3 - 30 MHz	High Frequency (HF)
30 - 150 MHz	Low-Band, Very High Frequency (VHF)
150 - 300 MHz	High-Band, Very High Frequency (VHF)
300 - 3,000 MHz	Ultra-High Frequency (UHF)

Sometimes, amateurs refer to frequency bands in terms of wavelength; wavelength is just another way of specifying frequency. For instance, the amateur VHF band 144 - 148 MHz is often called the "2-meter band." (If you'd like to convert, here are some of the radio services you might have heard of. DON'T BOTHER TO MEMORIZE ANY OF THIS!)

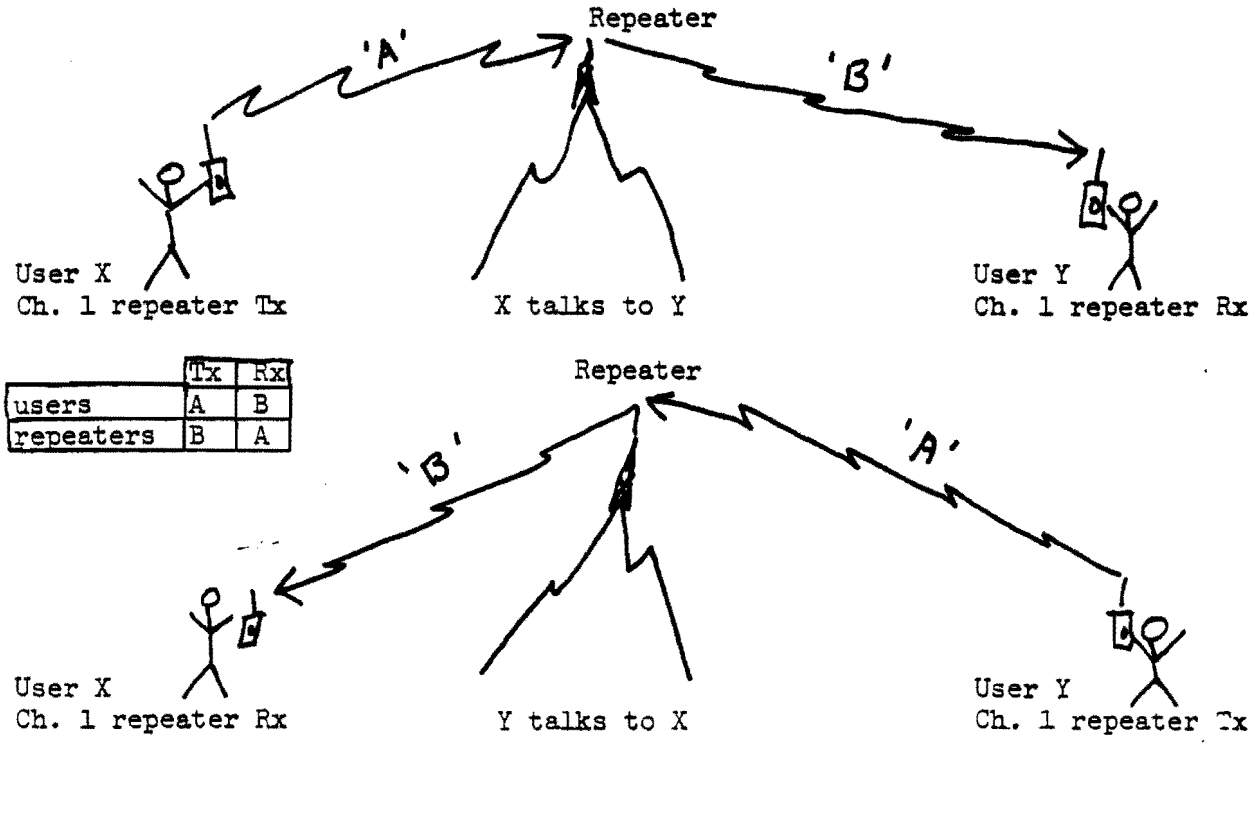
NAME	FREQUENCY	MODES	NOTES - useful distances
Amateur 80-meter band	1.5 - 1.8 MHz	CW & SSB	several hundred miles
Amateur 40-meter band	3.0 - 3.5 MHz	CW & SSB	" & longer (3000 mi)
Civil Air Patrol HF "4585 & 4582" etc.	approx. 4.585 MHz	SSB	" & longer (1000 mi)
Amateur 20-meter band	7.0 - 7.15 MHz	CW & SSB	long distance
Amateur 15-meter band	approx. 14 MHz	CW & SSB	long distance
CB "11-meter" band	approx. 27 MHz	AM & SSB	local, some "skip"
Amateur 10-meter band	approx. 28 MHz	CW, SSB, FM	local, some "skip"
Sheriff "Lo Band" "39-5"	approx. 39.5 MHz	FM	local
Fire Service "Lo Band"	approx. 44 MHz	FM	local
Amateur 6-meter band	approx. 50 MHz	SSB, FM	local
Aircraft VHF	100 - 130 MHz	AM	line-of-sight
Amateur 2-meter band	144 - 148 MHz	FM	line-of-sight
CAP VHF	approx. 148 MHz	FM	line-of-sight
Hi-Band VHF Public Service	150 - 170 MHz	FM	line-of-sight
ASRC/MRA	155.160 MHz	FM	line-of-sight
Amateur 70cm "220" band	220 MHz	FM	line-of-sight
"Med 1-8" UHF medical telemetry		FM	line-of-sight
Amateur UHF "450"	approx. 450 MHz	FM	line-of-sight

Note that the HF frequencies are used for long-distance communications; this is because tha HF radio waves bounce off the ionospheric layer of the atmosphere, back to the earth, and are thus propagated to far-away places. VHF and UHF, on the other hand, don't bounce off the ionosphere, and are thus limited to line-of-sight communications. The low-band VHF frequencies will bend somewhat over hills, but not as much as HF will. Hi-VHF and UHF are strictly line-of-sight, however.

You should be asking by this point "Why don't we use HF for SAR?" The answer is in several parts. First, FH handhelds are very difficult and expensive to make. Second, the frequencies are very crowded, with the long range of HF. Third, efficient antennas must be a sizeable fraction of the wavelength; for 40-meter HF,

a quarter-wave whip antenna would be 10 meters (about 30 feet) long, a bit unwieldy to carry around on your handheld in the woods.

There are several important advantages to VHF, as well. First, VHF-FM handhelds are relatively easy to build. Second, you don't have to worry about accidentally talking to someone in California when you're trying to talk to Base Camp. Third, good antennas are easy to handle. For instance, a quarter-wave whip at 2-meters is only 18" long. Finally, the problem of talking around mountains and over long distances can be solved by the use of repeater stations. A repeater is a powerful rebroadcasting station, usually on a mountain or radio tower. If you can get close to line-of-sight communications with the repeater, you can talk to anyone else similarly situated, even if you are not line-of-sight with them. It works like this:



	Tx	Rx
users	A	B
repeaters	B	A

Everyone transmits on 'A' and listens on 'B'; the repeater listens on 'A' and transmits on 'B'.

Fig. 1 REPEATERS

A repeater listens in frequency 'A' (the input) and retransmits what it hears on frequency 'B' (the output); repeater users transmit on 'A' (the repeater input) and listen on 'B' (the repeater output).

All users have the same transmit and receive frequencies, so many users may use the same repeater. Often, the channel switch on a radio is set so that Channel 1, for example, is transmit (Tx) A/Receive (Rx) B.

Since everyone is listening on 'B', what if someone were to transmit on 'B', the repeater output? Everyone within line-of-sight could hear this person, if the repeater didn't cover him up; but, he wouldn't be going through the repeater. This could be handy for sensitive or local communications. Channel 1 (Tx A/Rx B) only works if everyone can get into the repeater; two people who can't get into the

how to compose a succinct message, how to repeat each phrase, and how

repeater, but are standing 100 feet apart, can't talk to each other on Channel 1 (Tx A/Rx B). If they could switch to Channel 2 (Tx B/Rx B), called simplex (because everyone transmits and receives on the same frequency), they could easily talk together. (see Fig.3)

Channel 3 (Tx A/Rx A) is another possible simplex channel, but suffers the disadvantage that the users may 'bring up' the repeater without knowing it (why?), and thus we shouldn't work simplex on a repeater input. A final possibility is Channel 4, which transmits on B (repeater output) and receives on A (repeater input). Most mobile and handheld radios, of course, cannot receive and transmit at the same time (full duplex), but must be switched by means of the push-to-talk (PTT) or transmit switch. However, if you wanted to talk to a Field Team with a radio only having Channel 1 in an area outside of the repeater coverage area, you could switch to Channel 4. A good example of this type of system is part of the Civil Air Patrol (CAP) VHF-FM repeater net (see fig. 2).

Radio Channels	Tx	Rx
Repeater	143.900	148.150
Simplex	148.150	148.150
Reverse	148.150	143.900

fig. 2

User Radios

	Channel	Tx	Rx
repeater	1	A	B
simplex	2	B	B
don't use	3	A	A
reverse repeater	4	B	A

Fig.3

In public service bands, the interval between repeater inputs and outputs are not fixed, but on the amateur 2-meter band, "offsets" of 600 kHz (.6MHz) are standard. Many 2-meter radios allow one to set the receive frequency on a dial or channel switch, and provide switches for "+600, -600, simplex". On "+600" for instance, the radio automatically shifts the frequency up .6MHz when you press the PTT. The general rules for offsets are:

Rx	Offset
145.21 - 145.49	-600
146.61 - 146.995	-600
147.0 - 147.39	+600

fig.4

Many public service frequencies are shared by several users/agencies. A particular agency doesn't want to listen to the other people on the frequency; he wants to hear only his own people. A way to do this, knows as continuous subaudible tone squelch, "CTCSS", "private line", but best known as "PL", has gained wide acceptance. With this system, a particular subaudible tone (below normal hearing range) is added into the audio of each transmitter, by an encoder. Each receiver is provided with a decoder attuned to that particular PL tone. When a signal with the proper PL tone is detected by the decoder, it turns the receiver's speaker on; if a signal without the proper PL is detected, the speaker stays off. Thus the annoyance of having to listen to everyone else on the frequency is overcome. It would be easy, however, to pick up the mike and interfere with the others you can't hear. (This is an important point: different PL tones are not the same as different frequencies.) Therefore, you should always disable the "tone squelch" or "PL decode" (by turning it off) before transmitting. This way, you will hear anyone else on the frequency, PL or not, so you will be sure to not interfere with them. Some mobile radios are provided with a mikeswitch which disables the tone squelch (if it is on) when you pick up the microphone from the mike clip. This way, if someone else is on the frequency, you'll hear them as soon as you pick up the mike.

Now, with a general understanding of how radios work, you should have fewer problems such as being on the wrong frequency or having your PL decode turned on.

Let's finish up with some practical details about handling radios on a mission. The first and most important aspect of radio use in the field is antennas. Say you have a handheld with a rubber duckie antenna on it, and you have a "Low-1W/High-4W" switch for the power output. You will stay on the low power setting most of the time to save power, as the high power setting uses about 4 times as much power. All other things being equal, going to high power gives you about twice as much 'talk power' to get back to COMCTR. (You have to increase power by 4 to increase talk power by 2.) When you got from 1W to 4W, you double your power twice (1W → 2W, 2W → 4W), and we say you increase signal strength by three decibels (3dB) each time it doubles; thus, going from 1W to 4W is a 6dB gain (3dB + 3dB). Now, it turns out that a rubber duckie is not very good as an antenna, and one of the reasons is that it sends a lot of RF energy straight up in the air, and all of this energy is wasted. It turns out that if you switch from a duckie to a quarter-wave whip ($\lambda/4$) (an 18" long piece of wire), COMCTR hears you just as if you had doubled your power; the $\lambda/4$ antenna concentrates the RF energy in the horizontal plane. So, 1W with a $\lambda/4$ whip sounds like 2W with a duckie. There are two great advantages to the $\lambda/4$ whip, however - you still actually put out only 1W of power, thus saving your batteries; it also turns out that you hear COMCTR as if they had increased their power by two! A 1/4 wave whip gives you 3dB gain both transmit and receive, without increasing battery drain. It gets even better - if you use a 5/8 wave whip (48" of wire plus a loading coil at the bottom) you signal is even more directional, and you get 6dB (both Tx and Rx) over a duckie! So low power with a 5/8 wave whip is the same 'talk power' as high power with a duckie, plus 6dB of gain on receive. Ther is also a "flexible J-pole" antenna available which is midway between the 1/4 wave and 5/8 wave antennas in performance, is made of flexible wire, and stuffs easily in a pocket. So if you want to carry something to make your team's radio work better, grab a couple of extra antennas.

Just a few more things about antennas. Now that you know that antennas are directional in the horizontal plane, you know to hold your antenna straight up and down (unless you're talking to an airplane overhead). Also, antennas on handhelds work best with a ground plane underneath; that's why a 1/4 wave antenna on a car roof works better than one held in your hand. The handheld and your body provide a ground plane, but not a very good one. Setting the radio on a metallic object like a car roof might improve your antenna's performance. And, since VHF is almost line-of-sight only, a few feet of additional elevation may make a world of difference. Since even the wavelength of VHF (2-meters) is comparable in size to bridge struts, trees, boulders, and human bodies, many reflections may superimpose to produce "dead" spots or good spots. A few seconds experimentation with moving your antenna this way or that may easily make a 10dB difference in communications.

The two radio controls you will fiddle with most often, volume and squelch, deserve some quick comments, even though you probably know how to use them. The volume control knob controls the audio amplifier feeding the speaker, but nothing else. By changing the volume setting, you change the loudness of the sound issuing from the speaker, but the radio receiving qualities of the radio are unaffected. During transmit (when you depress the PTT switch), the volume setting has no effect whatsoever on the radio. The loudness of your outgoing signal is affected only by the loudness of your voice and how you hold the microphone. The transmit "volume" control is on the circuit board inside the radio. It is set when the radio is serviced, and is almost impossible to adjust in the field without really screwing up the radio.

The squelch control is similar to the volume control in that it affects the sound issuing from the speaker, but otherwise does not influence the operation of the radio circuitry. The squelch circuit turns the speaker off; it will then turn the speaker back on only under certain conditions. For instance, the PL decoder "tone squelch" explained earlier will turn the speaker back on only when it hears the proper PL subaudible tone. The standard squelch on most radios, known as carrier squelch, turns the speaker back on only when it hears a strong enough signal. How strong is "strong enough"? You set that by turning the squelch control knob. The next time you have a chance to play with an ASRC or Ham 2 meter radio, do the following:

1. Turn the squelch all the way down (counterclockwise on most radios). You should hear white noise from the speaker; this is normal background noise. At this squelch setting, even background noise is "strong enough" to cause the squelch circuit to turn the speaker on. The squelch is now off even though the speaker is on, because the squelch is not interfering with the radio by turning the speaker off.
2. Have someone with another radio give you a test transmission, just carrier with no audio modulation. Note the way the background noise disappears when your radio picks up the carrier; this is quieting, and you can tell the other station he's "full quieting" at your location, because his signal is blocking out all the background noise.
3. You can probably appreciate that listening to the background noise all the time you're waiting to get a call could be a pain in the ear, and that is the main reason for having the squelch control. Turn up the squelch level to where the background noise just disappears; you have just told the squelch circuit that an incoming signal has to be slightly stronger than the background noise level before it should turn on the speaker. This is where you should normally set the squelch.

There are two things regarding the squelch which are perhaps obvious, but bear repeating. If you turn the squelch all the way up, you will probably miss a lot of communications from weaker stations. Also, if you have the squelch set at the normal level and you still have trouble copying a station, sometimes it helps to turn the squelch all the way down for a minute. Turn the volume down first to avoid being blasted by the background noise.

I hope this hasn't been too tedious, and that some of this may be of use to you on a mission some day.

APPALACHIAN SEARCH AND RESCUE CONFERENCE RADIO SOP CRIB SHEET

For Internal ASRC Use Only

Jan82KIT

IDENTIFICATION Always identify when calling, answering, or signing, giving your callsign: i.e. BASE, THIS IS TEAM DELTA... ...TEAM DELTA CLEAR. The station which called first should sig first. BASE will announce the time and the license callsign on each half hour while the net is in operation. In convoys, LEADER will announce the license callsign at least every 30 minutes. When no COMCTR is operating, or no mobile station has been designated LEADER, and always on CB, individual stations must use the license callsign at the beginning and end of each communication.

CALLSIGNS License Callsigns — VHF FM: KA8 1942 — CB: KIU0954 — A/C: KD2761
Tactical callsigns are issued by the CO or DO on a functional basis. The COMCTR is BASE; the lead vehicle in a convoy is LEADER; the DO is DISPATCH preceded by a Group name: BLUERIDGE DISPATCH. Each field team uses its letter designator: TEAM ALFA, TEAM BRAVO, etc. A team specifically tasked as a relay will sign RELAY rather than TEAM: RELAY CHARLIE, RELAY DELTA, etc. Each team member signs with his function title followed by his team designator: LEADER ALFA, RESCUE ALFA, MEDIC ALFA, RADIO ALFA, DRIVER ALFA. Each subteam (or incidental radio operator) signs its parent letter designator plus a number: CHARLIE ONE, etc. Other intra-team callsigns are also by function: LEFT WING, BRAKE, etc. Staff sign by title: MISSION COORDINATOR, etc.

ITU PHONETIC ALPHABET AND NUMERAL PRONUNCIATION

					Numbers are spoken digit by digit except for multiples of 100 or 1000.	
ALFA	JULIET	SIERRA	1	WUN		
BRAVO	KILO	TANGO	2	TOO		
CHARLIE	LIMA	UNIFORM	3	TREE		
DELTA	MIKE	VICTOR	4	FOW-ER		
ECHO	NOVEMBER	WHISKEY	5	FI-YIV	16	ONE, SIX
FOXTROT	OSCAR	X-RAY	6	SIX	20	TWO, ZERO
GOLF	PAPA	YANKEE	7	SE-VEN	1800	ONE, EIGHT, HUNDRED
HOTEL	QUEBEC	ZULU	8	ATE	35000	THREE, FIVE, THOUSAND
INDIA	ROMEO		9	NINER	0093	ZERO, ZERO, NINER, THREE
			Ø	ZE-RO (not OH)	3664	THREE, SIX, SIX, FO

SOME COMMONLY USED PROWORDS AND STANDARD PHRASES

THIS IS.....Precedes identification.

OVER.....It is your turn to transmit; I am listening.

GO AHEAD.....I am ready to receive your message.

ROGER.....I have satisfactorily received your message. Does not mean yes.

AFFIRMATIVE.....Yes.

NEGATIVE.....No.

STAND BY.....Wait a moment (other stations keep out).

CLEAR.....I have no more traffic, but I will be listening.

OUT.....I am turning off my radio.

SAY AGAIN.....Repeat your previous transmission.

I SAY AGAIN.....I will repeat what I just said (or last transmission).

SAY AGAIN ____....Repeat the indicated specific information.

CORRECTION.....I have made an error; what follows is correct.

PREPARE TO COPY..Write this down. (Wait for GO AHEAD before sending message).

READ BACK.....For verification, read the message I just sent you.

I READ BACK.....I am reading back your message for verification.

THAT IS CORRECT..I verify that you have received or relayed my message correctly

SPELL.....Spell out your message with phonetics.

SPELL ____.....Spell phonetically the indicate specific information.

I SPELL.....A phonetic spelling follows.

FIGURE(S).....Numerals and letters follow which do not spell words.

STATUS ONE.....Victim found; alive and well.

STATUS TWO.....Victim found; alive, needs evac

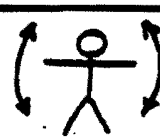
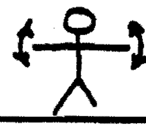
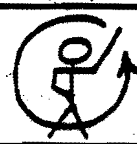
STATUS THREE.....Victim found; dead.

ASRC radio equipment is to be used only during missions and bona fide training operations. All other use is unauthorized. Adjustment and testing (except for brief readiness tests) may be carried out only by FCC licensed technicians authorized by the ASRC Communications Committee.

APPALACHIAN SEARCH AND RESCUE CONFERENCE COMMO CRIB SHEET

For Internal ASRC Use Only

SIGNALS REQUIRE CONTRAST ** WATCH YOUR BACKGROUND

MEANING	WHISTLE/LIGHT/VOICE	HANDS/FLAGS/LIGHTS	
TROUBLE HELP	— — — HELP HELP HELP		(Obvious attention getter)
STATUS ONE (Victim found alive and well)	— • HEEEY ONE		Don't cross (Touchdown)
STATUS TWO (Victim found needs evac)	— • • HEEEY TWO TWO		(Similar to Trouble)
STATUS THREE (Victim found dead)	— • • • HEEEY 3 3 3		(Dead ball) Cross & Uncross
COME TO ME (or Send a Rescue Team)	• — COME HEEERE		(Roll)
DON'T COME TO ME (or Don't Send a Rescue Team)	• • — DON'T COME HEEERE		(Wave away)
AFFIRMATIVE	— • — • "C" IN MORSE		(Nodding)
NEGATIVE	— • "N" IN MORSE		(Shaking)

I Serious Injury	II Require Medicine	X Unable to Proceed	F Require Food and Water	K Indicate Direction to proceed	→ Am Proceeding this Direction
△ Safe to Land Here	LL All Well	N Negative	Y Affirmative	JL Not Understood	⊢ Wind Direction
□ Require Map and Compass	I Require Commo Equipment	 Affirmative	 Negative	 Understood	 Not Understood

GROUND-TO-AIR PANEL SIGNALS

MORSE CODE

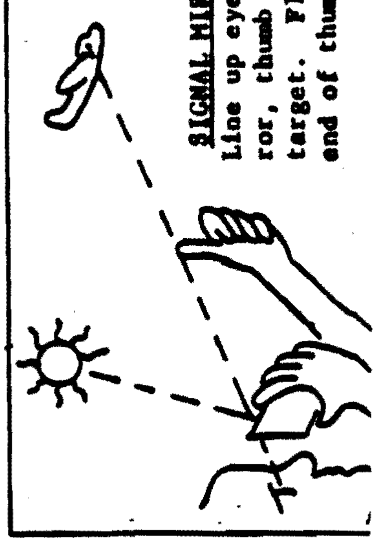
Light: Use hand over light for a shutter.

Wigwag: Flag to sender's right is a dot; left dash.

SEND SLOWLY

•−−−−	1
••−−−	2
•••−−	3
••••−	4
•••••	5
−••••	6
−−•••	7
−−−••	8
−−−−•	9

•−	ALFA	•−−−	JULIET	•••	SIERRA		
−•••	BRAVO	−•−	KILO	−	TANGO		
−•−•	CHARLIE	•−••	LIMA	••−	UNIFORM		
−••	DELTA	−−	MIKE	•••−	VICTOR		
•	ECHO	−•	NOVEMBER	•−−	WHISKEY		
••−•	FOXTROT	−−−	OSCAR	−••−	X-RAY		
−−•	GOLF	•−−•	PAPA	−•−−	YANKEE		
••••	HOTEL	−−•−	QUEBEC	−−••	ZULU		
••	INDIA	•−•	ROMEO	−−−−−	Ø		



SIGNAL MIRROR

Line up eye, mirror, thumb and target. Flash end of thumb.

ANSWERS TO SEARCH PRETEST:

1. b
2. a
3. c
4. d
5. a
6. c
7. b
8. d
9. d
10. c
11. a
12. d
13. b
14. e
15. b
16. b (false)
17. a (true)
18. d
19. b
20. c
21. d
22. b
23. b

SHENANDOAH MOUNTAIN RESCUE GROUP BASIC MEMBER TRAINING COURSE

TEST FOR MODULE THREE: SEARCH

February 1982

Note: you may use any materials normally carried with you in the field as aids for answering the questions of this test.

Pick the best answer for each question. For matching questions, use each answer once only or not at all.

Matching (1-8)

1. Trained Searchers
2. Search Dogs
3. Camp-in at a trail junction
4. Sending a team across the subject's expected route of travel

a. cutting for sign
b. subject finders
c. clue finders
d. passive search

5. Mission Data Form (MDF)
6. Base Officer (BO)
7. Searcher Registration Form (SRF) and Searcher Information Sheet (SIS)
8. Few or no non-ASRC searchers under ASRC control

a. SAROP Phase ∅ (Alert and Mobilization)
b. SAROP Phase 1 (The Quick Response)
c. SAROP Phase 2 (Scratch and Survey Searching)
d. SAROP Phase 3 (Saturation Searching)

9. The callout of a Group is done by:

a. the Base Officer.
b. the Dispatch Officer.
c. the Communications Officer.
d. the Alert Officer.

10. Tactics is the province of:

a. the Mission Coordinator.
b. the Operations Officer.
c. the Equipment Officer.
d. General Patton.

11. The Base Officer:

a. is responsible for direct liason with members of the Responsible Agency during Phase 1.
b. need not be field qualified.
c. serves as a relay between the Dispatch Officer and the QRT's Radio Operator.
d. all of the above are true

12. According to the ASRC SAROP, the job of assigning members to a Field Team is part of the position description for:

a. the Communications Officer.
b. the Personnel Officer.
c. the Operations Officer.
d. second assistant undersecretary to the Mission Coordinator.

SMRG Basic Course — Test For Module 3

Matching (13-20)

13. search of a large area from a single vantage point
14. search of a point or linear feature
15. grid or contour search
16. wide-spaced line search of a small area by a small team
17. patrol of the perimeter of an area

a. containment task
b. sweep task
c. scratch task
d. survey task
e. saturation task
f. difficult task

18. temporary boundaries and trails
19. clues
20. search task area boundaries

a. one flag
b. two flags
c. three flags
d. stars and stripes

21. Who may stop a search line?

a. anyone on the team
b. only the Field Team Leader
c. only the Field Team Leader or MEDIC
d. only the Responsible Agent

22. Who may give the command "FORWARDS!" to a search line?

a. anyone on the team
b. only the Field Team Leader
c. only the Field Team Leader or MEDIC
d. only the Responsible Agent

23. If a Field Team finds a deceased search subject, it should identify the body if possible, give a "Status Three" report to Base Camp with the team's grid coordinates, then:

a. evacuate the body to Base Camp for the Coroner's examination.
b. disturb the area as little as possible, clear the area of people, protect any potential clues in the area, and wait for instructions.
c. place the body in a body bag or storm shelter and load the body into a litter, but wait for permission to evacuate.
d. go home.

24. A downed (fixed-wing) military aircraft should be approached only:

a. from the front.
b. from the rear.
c. from the left side.
d. from underneath.

25. Blue light (as from a flashlight with a blue filter) will not impair night vision adaptation, as will unfiltered white light.

a. true
b. false

26. In terms of clues found per searcher-hour, close spaced line search is approximately 50% more efficient than wide-spaced line search.

a. true
b. false

27. Which of the following is the best example of good questioning technique?

    a. "Hi. We're looking for a plane that crashed yesterday. Do you know anything that might help us find it?"
    b. "Hello. I'm Josephine Backpacker from the Shenandoah Mountain Rescue Group. We're looking for an airplane which has been reported missing. Have you seen or heard anything unusual the past day or so?"
    c. "Hello. I'm Josephine Backpacker from the Shenandoah Mountain Rescue Group. We're searching for a plane believed to have been flying low in this area yesterday. We'd like to know if you saw or heard anything unusual about 3 yesterday afternoon."
    d. "Hello. I'm Josephine Backpacker from the Shenandoah Mountain Rescue Group. We're looking for a red-and-white plane which has been missing since yesterday. Have you seen or heard anything unusual lately?"

28. Containment is used as a strategy to keep the search area small.

    a. true
    b. false

29. Night vision is weaker at the center of the visual field than at the edges, that is, it is difficult to see things in very dim light when you look directly at them.

    a. true
    b. false

30. Step-by-step mantracking is easier near dusk or dawn than at midday, because of the angle of the lighting.

    a. true
    b. false

31. Interrogation search, as practiced by the Civil Air Patrol during downed aircraft searches, refers to:

    a. the proper questioning of all people who call in to Mission Base with clues.
    b. the proper questioning of all people who pass by a roadblock or trailblock.
    c. use of electronic direction-finding equipment.
    d. the questioning of people at houses, stores, and other selected places in a specified search task area.

32. On occasion, the only visual clues to an aircraft crash site have been circling buzzards, clipped trees, or breaks in vegetation cover.

    a. true
    b. false

33. ELT (Emergency Locator Transmitter, electronic direction finding) search tasks are often made difficult with reflections which cause erroneous directional "fixes".

    a. true
    b. false

SMRG Basic Course Test for Module 3

Matching (34-42)

34. serious injury
35. all well
36. not understood
37. wind direction
38. affirmative
39. negative
40. understood
41. safe to land here

a. 

b. 

c. 

d. 

e. 

f. 

g. 

h.

42. An ideal helicopter landing zone in a wooded, mountainous area:

a. should have a clear touchdown pad with a slope less than 5°, and all brush should be cleared to less than 1 foot high.
b. should be on a flat ridge in preference to a narrow valley.
c. should have a clear take-off lane about 300 feet, into the wind, with room for the helicopter to dip below take-off elevation while gathering speed.
d. all of the above are true

43. In general, a helicopter landing zone should allow for a take-off at an angle of 15° to the horizontal, and clearing any obstacles by 10 feet.

a. true
b. false

44. At night, a "T" of flashlights may be used to indicate both the touchdown pad and the wind direction. Which of the following diagrams correctly portrays the orientation of the "T" with respect to the wind direction?

a. 

b. 

45. Which of the following is <u>not</u> considered a major danger area near a UH-type ("Huey") helicopter?

a. to the right rear of the helicopter
b. to the left rear of the helicopter
c. uphill from the helicopter
d. downhill from the helicopter

46. When may you approach a helicopter?

a. only after the rotors are stopped
b. when the crew chief or pilot signal you to do so
c. once the helicopter is settled and all lift is off the rotors
d. only on Tuesday afternoons

47. According to the Commonwealth of Virginia Emergency Operations Plan Search and Rescue Annex, authority for search and rescue within a county, except in a few special cases, falls to:

a. Virginia Wing, Civil Air Patrol.
b. a SAR Coordinator appointed by the County Government.
c. the Virginia State Police.
d. the County Sheriff.
e. the local Virginia Association of Volunteer Rescue Squads District Rescue Officer.

48. In general, responsibility for SAR within a National Forest in Virginia lies with:

a. the U. S. Forest Service.
b. the person in charge of County SAR for the particular County.
c. the U. S. Park Police.
d. the Virginia State Police.

49. Authority and responsibility for downed aircraft search in Virginia lies with:

a. Virginia Wing, Civil Air Patrol.
b. the Civil Aeronautics Board of the State Corporation Commission.
c. the Virginia State Police.
d. the person with authority and responsibility for intra-county search and rescue.

50. Authority and responsibility for SAR in areas of National Capital Parks of the National Park System generally lies with the U. S. Park Police. In other National Park Service areas, such as Shenandoah National Park, authority and responsibility generally lies with:

a. the Park Superintendent.
b. the U. S. Park Police.
c. the State Police.
d. the person in charge of SAR for the County.

51. The Virginia Good Samaritan Law provides that all persons rendering first aid are immune from civil prosecution:

a. under all conditions.
b. if the person rendering aid is an EMT, a RN, or a MD.
c. if the first aid is given in good faith.
d. if the first aid is given in good faith, and without compensation (excepting the salaries of public service workers.)

52. The Virginia Good Samaritan Law provides immunity from civil suit (tort claims). Does it also provide immunity from criminal prosecution?

a. yes
b. no

53. Can ASRC members use force to prevent others from entering a suspected crime scene?

a. yes
b. no

54. Is there a legal requirement for you to aid a person in life-threatening danger?

a. yes
b. no

55. The legal concept of "standards of care" means that you are responsible for providing emergency care consistent with your training and experience. Thus, something which would be criminally negligent when done by an emergency physi cian might be not not considered criminally negligent when done by a person with no first aid training.

a. true
b. false

56. If you began aiding a person in distress, you are legally responsible to continue in your attempts to aid this person.

a. true
b. false

57. If you find an unconscious person, you may assume his consent for you to provide emergency care. If, on the other hand, an adult who appears able to understand what you are saying refuses care, are you obligated to leave him alone? (Note: the right to refuse care for a minor lies with the parent or guardian.)

a. yes
b. no

58. You may enter property posted "No Trespassing", during a search,:

a. when accompanied by a Deputy County Sheriff.
b. when you believe with reasonable certainty that life or property is endangered, and that you must enter the property to save the life or property.
c. in either of the above situations
d. in neither of the above situations

59. In many states, only a doctor may legally say that someone is dead; in Virginia, any EMT may say that someone is dead, although certification of death on paper must be made by a doctor. Is there any reason, other than legal ones, which might make you want to <u>not</u> discuss the finding of a body over the air, other than a simple "Status Three" message?

a. yes
b. no

60. May you legally discuss the injuries of a patient your team just evacuated, when asked to by a reporter?

a. yes
b. no, unless he gave you permission to do so

KEY

SHENANDOAH MOUNTAIN RESCUE GROUP — BASIC MEMBER TRAINING COURSE

TEST FOR MODULE THREE: SEARCH

February 1982

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C 1. Trained Searchers
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D 3. Camp-in at a trail junction
A 4. Sending a team across the subject's expected route of travel

a. cutting for sign
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A 5. Mission Data Form (MDF)
B 6. Base Officer (BO)
D 7. Searcher Registration Form (SRF) and
, 8. Searcher Information Sheet (SIS)
C 8. FEW OR NO NON-ASRC SEARCHERS UNDER ASRC CONTROL.

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SMRG Basic Course Test For Module 3

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a. 
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(a.) true
b. false

57. If you find an unconscious person, you may assume his consent for you to provide emergency care. If, on the other hand, a ~~young~~ man, you find during a search tells you to leave him alone, WHO APPEARS COMPETENT
you must, indeed, leave him alone according to law.

(a.) true
b. false

58. You may enter ~~posted~~ private property during a search POSTED "NO TRESPASSING" IN VIRGINIA.

a. only when accompanied by a Deputy County Sheriff.
b. only when you believe with reasonable certainty that life or property is endangered, and that you must enter the property to save the life or property.
(c.) in either of the above situations.
d. in neither of the above situations.

CHECK

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(b.) no, unless he gave you permission to do so