GROUND SEARCH AND RESCUE MANUAL

FIRST EDITION

1978

EDITED BY

KEITH CONOVER

VIRGINIA WING, CIVIL AIR PATROL

AD HOC COMMITTEE ON

GROUND SEARCH AND RESCUE

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GROUND SEARCH AND RESCUE MANUAL

First Edition, 1978

Virginia Wing, Civil Air Patrol
Ad Hoc Committee on Ground Search and Rescue

Keith Conover, Editor

To my wife Betty

and

To those who died for want of trained ground search and rescue teams.

PREFACE

If this manual is examined as if it were a comprehensive search and rescue manual, it appears strangely unbalanced. It is brief and sketchy in those places you would think such a manual would need to go into great detail, and is thick in places of secondary importance to SAR. This unusual shape is a result of its basic purpose, which is perhaps reflected in its original title: the "Ground Search and Rescue College Supplement." It grew as a result of complaints from GSAR College students that it was difficult or impossible to find written references for many of the things they were taught or expected to know. At first, those of us instructing at the College began preparing handouts, and using a few cheap and readily available texts. Soon, there were so many handouts that we decided to compile them and issue them en masse. Somehow, the amount of material to be included in the Supplement grew as each contributor tried to put down on paper the results of years of personal experience. Finally, the Supplement's contents grew to the point that it was given the new name Ground Search and Rescue Manual, it being too big now to be merely a "Supplement." The Manual's strange omissions should now seem reasonable--it fills the gaps between the other publications on our reading lists. When combined with these references, the complete picture emerges of a basic (multi-) text for ground search and rescue training.

This first edition is actually a rough draft, a fairly polished one to be sure, but still just a draft. The reviewers for this draft will be you--people actually involved in ground SAR in the field. Send us your opinions, critical comments, and suggestions. The decision not to refine the Manual further prior to publication is both due to a pressing need for it, and a conviction that a wider variety of reviewers is needed. Please take the time to send in your ideas, or perhaps contact a member of the Virginia Wing Ground Search and Rescue Committee to arrange a meeting to discuss your comments.

The ultimate purpose of this manual is the same as that of the GSAR College, and of SAR in general: the saving of lives in the outdoors. The long hours of work that have gone into this manual will be more than amply repaid, if it helps to save just one person, be it victim or rescuer.

"So that others may live"
Keith Conover
Charlottesville, Virginia
January, 1979

The Virginia Wing Ad Hoc Committee on Ground Search and Rescue is an informal group of CAP members and others interested in ground search and rescue. Activities of the Committee include the publication of standards for GSAR teams and members, and the sponsorship of the Virginia Wing Ground Search and Rescue College. Those with comments on this manual or other correspondence for the Committee should write to:

Virginia Wing, Civil Air Patrol
Ad Hoc Committee on Ground Search and Rescue
P.O. Box 237
Sandston, Virginia 23150

Committee co-chairmen: David Carter, Keith Conover, and Mark Pennington.

ACKNOWLEDGEMENTS

Many hundreds of people have directly or indirectly contributed to this manual. Those of us directly responsible for writing parts of it have drawn on a great variety of sources. Some of these are publications that are easily listed in the reference section of each chapter. Other sources are not so easy to pin down. Each of us has picked up tidbits of GSAR knowledge from some other SAR team member or instructor during some past mission or training session; now all is forgotten as to when, or where, or from whom it was learned. This manual is an attempt to put such knowledge down on paper. Our thanks go to all those who taught us what we know, either in a training session or through example.

Special thanks go to:

Betty Thomas of the Blue Ridge Mountain Rescue Group of the Appalachian Search and Rescue Conference, Inc., my wife, for typing, editorial assistance, and the support she gave me during the two year process of writing the manual.

Christopher Stubbs and Carrington Gregory of the BRMRG - ASRC for Chapter 12, and their editorial assistance.

Dave Carter of the Virginia Wing GSAR Committee for Chapters 6 and 17.

Mark Pennington of the Virginia Wing GSAR Committee for Chapters 13, 14, 15, and 16.

Yorke Brown of the BRMRG - ASRC, who wrote the ASRC Mountain Rescue Manual and the Search and Rescue Operations Plan, from which much of Chapter 5 is adapted.

And to a small group of CAP members who got together in a hangar at Andrews Air Force Base on a cold January afternoon. They got the ball rolling for us.

READING LIST

Level II (Team Member)

1. Mountain Rescue Manual (Appalachian Search and Rescue Conference, Inc.)
2. Ground Search and Rescue Manual (Virginia Wing, Civil Air Patrol)
3. Topographic Maps (United States Geological Survey)
4. Surviving the Unexpected Wilderness Emergency (Gene Fear)
5. Fundamentals of Outdoor Enjoyment (Gene Fear)
6. Standard First Aid and Personal Safety (Red Cross)

add for Level III (Team Leader)

7. Mountain Search and Rescue Techniques (W. C. May)
8. Mountaineering: Freedom of the Hills, 3rd edition (Furber)
9. Guidelines for Military Aircraft Rescue (GSAR Committee)
10. Helirescue Manual (Survival Education Association)
11. Advanced First Aid and Emergency Care (Red Cross) or
    Emergency Care, 2nd edition (Grant and Murray) or
    Emergency Care and Transportation of the Sick and Injured (American Academy of Orthopaedic Surgeons)
12. Winter Hiking and Camping (Adirondack Mountain Club)

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INTRODUCTION TO GROUND SEARCH AND RESCUE

1.0 GENERAL

The term Ground Search and Rescue (GSAR) refers to the phases of any Search and Rescue (SAR) mission carried out on the ground (as opposed to in the air or at sea), excluding administrative and coordination functions carried out at Mission Base or Base Camp. GSAR includes search from vehicles and on foot, the rendering of immediate care to the victims, and the evacuation of the victims to a medical facility. In the Civil Air Patrol, GSAR personnel may be called upon to serve in non-SAR missions, for example, to provide damage assessment during a natural disaster. Special knowledge and skills required for these additional duties will be addressed in the Ground Search and Rescue Manual so as to eliminate the need for a separate manual.

"Ground Search and Rescue" may be interpreted to include a variety of subjects. As considered in this publication, the following subjects are considered to fall within the province of ground search and rescue:

- -CAP mission operations;
- -the authority and responsibility for prosecution of SAR missions;
- -lost person and downed aircraft search strategy and tactics;
- -details of downed aircraft search tactics, including interrogation, visual, ELT, and locale searches;
- -details of lost person search tactics, including scratch, survey, sweep, and line searches;
- -the following specialized lost person search tactics: man-tracking, tracking dogs, and search dogs;
- -personal short-term survival, including details of temperature-related diseases (e.g. hypothermia);
- -wilderness travel and the use of lightweight backpacking and climbing equipment and clothing for GSAR activities;
- -orienteering and land navigation using an orienteering compass and topographic maps;
- -principles of emergency medical care and first aid;
- -field communication practices;
- -basic principles of radiological monitoring and decontamination;
- -basic principles of fire and firefighting using fire extinguishers and other available equipment;
- -principles of extrication from aircraft, using tools appropriate for use in remote areas;
- -coordination with, and appropriate uses for, rotor-wing aircraft; and
- -mountain rescue techniques using climbing equipment, stokes litters, and specialized techniques (e.g. tree belays for litters).

However, many items occasionally considered as part of ground search and rescue are not considered part of GSAR for the purposes of this manual. These excluded items include:

- -long-term survival;
- -Civil Defense type rescue techniques;
- -vehicle extrication with heavy equipment;
- -urban type firefighting;
- -firearms training;
- -military-style rappelling; and
- -"campcraft" such as latrine construction, construction of lean-to shelters, or routine (rather than emergency) firestarting.

Members interested in these related subjects are encouraged to seek out the excellent training and references available through local agencies and CAP Cadet and Senior Training Officers.

1.1 DOWNED AIRCRAFT SEARCH OPERATIONS

One of the primary missions of the CAP is that of locating downed aircraft. The major part of such search operations is carried out by aerial survey and ELT search. However, ground search may play a vital role, especially in the event of bad weather, or in the case of an ELT that is localized just to a general area, rather than a specific location. Also, GSAR teams must make confirmation of the find on the ground, not to mention rescue and evacuation of any survivors (see sections 1.2 and 1.3).

In Virginia, CAP ground search and rescue teams are divided into three classifications, primarily for the purpose of downed aircraft search; these teams may be reorganized somewhat for other types of missions (see Chapters 2 and 5). The classifications are as follows:

<u>CLASS C TEAM</u> A Class C team, usually referred to as an interrogation team, consists of two or more members and a vehicle. Class C teams do interrogation and visual search only; their members are not qualified to go into the field (i.e. go an appreciable distance from their vehicle into the woods).

<u>CLASS B TEAM</u> A Class B team, usually referred to as a search team, consists of at least four members, a vehicle, and a minimum of personal and team search and rescue equipment. During a downed aircraft mission, Class B teams will do interrogation, visual, and ELT search from their vehicle. In the event that it is necessary, a Class B team will be the first to reach the crash site, so Class B teams must carry emergency medical gear and support gear for the survivors.

<u>CLASS A TEAM</u> A Class A team is usually referred to as a rescue team. Class A teams may be CAP teams or teams from other organizations, for example, the Blue Ridge Mountain Rescue Group in Charlottesville, Virginia. Class A teams are guided into the site by the Class B team making the find, and, in combination with all other Class B teams available, conduct the rescue and evacuation phases (see sections 1.2 and 1.3).

Additional details of team classifications may be found in the Virginia Wing <u>Ground Search and Rescue Program</u>.

Downed aircraft search and rescue missions may be divided into the following phases:

PHASE Ø: Standby and Alerting
PHASE 1: Preliminary and Quick Response
PHASE 2: Survey Searching
PHASE 3: Locale Searching
PHASE 4: Withdrawal
RESCUE
EVACUATION

<u>PHASE Ø</u> (Standby and Alerting) Details of standby and alerting procedures may be found in the Virginia Wing <u>Ground Search and Rescue Program</u>, and in Chapters 2 and 4 of this manual.

<u>PHASE 1</u> (Preliminary and Quick Response) Standard procedure for the Quick Response phase includes the callout and dispatch of a Class B team to the search area immediately after a REDCAP (actual mission) is called. Also, Class A teams that may be called upon to respond should be alerted and put on standby. If weather permits, an aircraft with an ELT locator flies the missing aircraft's projected flight path immediately, in addition to the ELT search carried out by the Class B team on the ground. These actions are particularly appropriate to the case where a REDCAP is called in the evening, and major search operations will not commence until the next morning.

These procedures are treated in detail in Chapter 4.

PHASE 2 (Survey Searching) During this phase, extensive aerial survey and ELT search is carried out in conjunction with the interrogation, visual, and ELT search by ground SAR teams. Class A and B teams are usually distributed or "spotted" throughout the search area so as to minimize the response time between the time of the find and the time a Class A or B team reaches the crash site.

PHASE 3 (Locale Search) Once a possible crash site has been located by aircraft or ground team, a Class B team must actually travel to the site on foot, so as to make a positive identification. Since this process often involves special ground search techniques (locale search) to locate the precise spot, a separate phase is assigned to this procedure. Sometimes it may be as simple as following a compass bearing to the site, or may involve a full day of work if the only information is a weak ELT signal and the weather is severe.

PHASE 4 (Withdrawal) Withdrawal is included as a phase due to the problems in disassembling a large search organization.

RESCUE Although the term "rescue" has a wide variety of meanings, it is used here to mean the provision of lifesaving medical and support aid to the victims. This emergency service is one of the primary missions of Class B teams. These teams have backpackable extrication, medical and victim support supplies, which may be carried long distances to the crash site, if necessary (see also section 1.2).

EVACUATION The term "evacuation", as used here, refers to the transport of victims to a medical facility for definitive medical care. This phase may involve several different modes, for example: overland semi-technical evacuation by a rescue team to a roadside, and then transfer by ambulance to the hospital. The portion of evacuation from the crash site to a helispot or roadside is usually conducted by a Class A team with assistance from Class B teams (see also section 1.3).

1.2 RESCUE

As described above, rescue refers to the immediate assistance given to the victims by a Class B team, or in the case of a lost person search, by the field team making the find. In the case of a crash site, the first priority of the team must be team safety. With military aircraft especially, dangers to the team such as flammable fuel are common. An obvious second priority is the provision of aid to the survivors. However, additional actions must be taken by the first-in team. These include the preservation of as much as possible of the site in its original condition for later investigators, positive identification of the aircraft, and the guidance of additional teams en route to the site. If near civilization, the site should be roped off and signs placed warning the public away. The team leader must see that all victims are accounted for; it is not unusual to find that one or more victims have left the aircraft to find help and are lost or stranded.

Since many crashes occur in distant backcountry areas, teams must be able to care for themselves and the victims over a long period of time, and must be able to travel easily with all required equipment on their backs. Obviously, gear appropriate to an urban rescue squad would be totally unmanageable in such a situation; specialized equipment and techniques must be used.

1.3 EVACUATION

In the present context, evacuation refers to the transport of victims to a medical facility for definitive care. In the case of a crash easily accessible by road, local Emergency Medical Services (EMS) organizations have standard procedures and agencies which may be employed, for example, the use of one of the local rescue squads or fire departments. However, if the crash site is not so easily reached, local protocols are usually inadequate to handle the situation. Often a combination of evacuation modes must be employed, utilizing mountain rescue teams, helicopters, and/or four-wheel drive ambulances. This manual is written with the intent of providing GSAR personnel with the knowledge required for most overland evacuations, and special considerations for coordination with those providing other evacuation modes (e.g. helicopters).

Overland evacuation may be classified according to the severity of the terrain and the corresponding difficulty of the evacuation. Non-technical evacuations are those which require no ropes for security of the victim and litter, but special techniques, such as laddering, toenailing, and rotation of litter bearers may be required. In semi-technical evacuations (semi-tech evacs), a rope and belay are required for the safety of the victim. In some types of semi-tech evacs, called steep scree evacs, the angle of the terrain is such that litter bearers must be tied into the litter or be belayed with a separate rope for safety. Higher angles require technical evacs, or cliff rescue techniques. For all Virginia Wing GSAR personnel, the standard reference for evacuation technique is the Mountain Rescue Manual of the Appalachian Search and Rescue Conference, Inc.; this manual also provides further definition of the evacuation terms. Those interested in the more technical types of overland rescue are urged to contact a local mountain rescue organization for proper training.

Even non-technical evacuations may be traumatic to a severely injured victim, especially if carried out with improper equipment or inadequate training. Often it is wiser to wait for a properly equipped and trained team, rather than risking the victims' lives on a rough evacuation. In cases of particularly difficult evacuations, it may be necessary to bring advanced medical aid to the site prior to evacuation. Any certified Class B team should be capable of providing sufficient lifesaving aid to allow a Class A team to reach the site to coordinate the evacuation operation with the aid of all available Class B teams, rescue squadsmen, and others at the scene.

1.4 LOST PERSON SEARCH OPERATIONS

Search for lost persons requires a completely different approach from downed aircraft search. With a few exceptions, strategy and tactics are both quite different.

The agency in charge of a lost person search is the local law enforcement agency, usually the County Sheriff or Park Superintendent (but see also section 3.1) although this authority may sometimes be delegated. The clues in a lost person search (e.g. tracks) are quite different from those in a downed aircraft search, are considerably more fragile, and require the use of searchers with specialized training. In contrast to downed aircraft search, most lost person operations are carried out on the ground, and often at quite a distance from civilization. This "wilderness" aspect of lost person searches may create major problems, especially dealing with lost or injured searchers. The use of untrained volunteers may also greatly accentuate problems of personnel accountability and control.

In lost person searches, GSAR personnel are regrouped into entities known as Field Teams; each team is "built" for a particular task or type of task. The procedure for creating Field Teams appropriately is discussed in Chapter 5.

Lost person search and rescue missions may be divided into the following phases:

PHASE Ø: Standby and Alerting
PHASE 1: Preliminary and Quick Response
PHASE 2: Scratch and Survey Searching
PHASE 3: Saturation Searching
PHASE 4: Withdrawal
RESCUE
EVACUATION

PHASE Ø (Standby and Alerting) is the same as for downed aircraft search.

PHASE 1 (Preliminary and Quick Response) differs from that of downed aircraft search in that initial actions are usually taken by the local law enforcement agency. Initial information is gathered, and a hasty search is made, usually by the law enforcement agency. At this point, actions will vary with the particular law enforcement agency involved, due to the different degrees of preparedness among these agencies. The following description will provide an outline of actions as they would ideally be carried out.

The law enforcement agency, after ascertaining that a lost person emergency actually exists, would call out a Quick Response Team (QRT). At present (1978), the Appalachian Search and Rescue Conference, Inc., has the only QRTs available in the state; hopefully, in the near future, the CAP will be able to provide such teams. A QRT can fulfill five important missions in a lost person search. These are:

1) Hasty search (if not done by law enforcement agency)
2) Initial survey search
3) Initial scratch search
4) Reconnaissance of the area
5) Initial base operations

Even if the QRT fails to find the victim, the information it gathers about terrain, weather, map accuracy and road conditions may be crucial in the smooth mounting of a large scale search.

The QRT will usually make first contact with the law enforcement agency and others at the site. Good working relationships will depend on how this contact is made.

PHASE 2 (Scratch and Survey Searching) represents the early stages of the full search operation. During Phase 2, the strategy consists mostly of containment, and scratch and survey searching. Small teams of trained searchers are sent out, in the hopes of quickly finding a responsive victim or obvious clues. Containment consists of perimeter patrols, should the victim walk out; it also serves to keep the search area small. Scratch search refers to a quick check of a point or linear feature by a small team, while a survey search is a search of a large area from a single point. In general, only well trained searchers are sent out at this point, due to the danger of clue destruction (e.g. trampling of tracks), and due to the problems associated with managing large numbers of untrained people safely in the outdoors. (It is not unknown to lose several untrained searchers during a lost person search, nor to have difficulty in ascertaining whether or not searchers are still in the field.)

PHASE 3 (Saturation Searching) is instituted when the tactics of Phase 2 fail to find the victim. Saturation search refers to the searching of every square yard of search area by means of large teams, usually consisting of untrained volunteers and trained team leaders. Saturation searching is a last resort, since it destroys the clues on which trackers, dogs, and trained searchers are dependent. In Phase 3 there is often little hope of finding the victim alive.

PHASE 4 (Withdrawal) is included due to the logistical problems involved in safely removing large numbers of searchers from the area.

Man-tracking and dogs have been mentioned. These search methods can be extremely effective, provided that their requirements and limitations are kept in mind. They are usually employed when a field team finds a good clue; this provides a starting place for a tracker or dog team. See Chapter 9 for more information.

Rescue and evacuation are essentially the same as described in previous sections (1.2 and 1.3).

1.5 DISASTER OPERATIONS

The CAP has a committment to aid in times of natural or war-caused disaster. The role of ground SAR personnel in these missions has not been clearly defined, and many different tasks may be requested of teams during these missions. Other than two special types of tasks described below, it is best to assume that regular GSAR skills and equipment can be adapted to fill the needs of the assigned tasks.

DAMAGE ASSESSMENT is a primary concern of emergency services officials, as the extent of emergency aid required will correspond to the amount of damage. The most useful tool for this type of task is a camera that will automatically produce pictures without additional developing, as such developing services may not be available during a disaster. Combined with accurate note-taking and reporting, pictures will enable local officials to back up their requests for aid.

RADIOLOGICAL MONITORING AND DECONTAMINATION may be necessary in cases of radioactive spills, crashes of aircraft with radioactive cargo or weapons, and in the event of nuclear war. Details concerning these procedures are provided in Chapter 17.

1.6 GSAR PERSONNEL AND TEAMS

Ground search and rescue can be dangerous; flying can be dangerous. Both are activities of Virginia Wing, CAP, and both should be carried out in a manner so as to minimize the danger involved. A primary method of providing for safe operations is the inspection and certification of both equipment and personnel. For GSAR, this certification is to be carried out on two levels. First, every person wishing to be certified as a Class A or B team member must present himself and his personal equipment for inspection and testing at a special testing weekend. There he must meet all of the requirements and standards of the Virginia Wing GSAR Program; he must also face this same test when due for recertification. These standards (available through Wing Headquarters) are sufficiently detailed and realistic to assure that all members meeting the standards are capable of handling themselves well in any GSAR situation.

When a unit assembles the personnel and equipment required for a Class B or A team, a similar testing weekend is scheduled for the team, again using the standards provided in the GSAR Program. For those units developing Quick Response Teams, special no-notice tests may be used for evaluation. This dual certification system is somewhat restrictive, but so is the evaluation of flight-worthiness of CAP aircraft and mission pilots. Any member or group of members interested in certification for GSAR will find adequate guidance in this manual and the GSAR Program.

Two classes of members involved in GSAR have not been addressed directly so far. First are those members who will serve as Class C (Interrogation) Team members. Since the danger involved in serving as such a team member, and the knowledge required, are much less than with Class B and A teams, the standards (in the GSAR Program) and certification requirements are much less stringent. Class C team members must pass a brief written test on relevant matters to obtain Level I (Class C team member) certification. As of the time of this publication (1978), there are plans to issue a small pamphlet with the information necessary for Level I certification. Until such time as this is issued, Chapters 1, 3 - 5, 8, and 9 may be used as study material.

The second type of member involved in GSAR who needs to be considered now is the manager, be he mission coordinator, ground operations officer, on-scene commander, or otherwise. Ideally, any person managing GSAR personnel and teams on an actual mission should have a solid background of actual field experience as a member of a GSAR team. Since this will be difficult to achieve in practice, some additional means must be found to provide managers with an adequate understanding of GSAR techniques and problems. As of the time of this writing, plans are being made for detailed standards for managers as far as GSAR knowledge. Until these standards are finalized, a careful study of this manual and the primary references for all levels is advised. Additional study in strategy and management will be necessary; the bibliographies will be of use in this. Particularly recommended are:

The ASRC Search and Rescue Operations Plan and Operations Manual

Kelley's Mountain Search for the Lost Victim

and the National Association for Search and Rescue papers listed in section 1.7.

As a final note, the Level IV GSAR certification standards, now in draft form, focus primarily on management. Any person attaining this level of GSAR certification should be ideally qualified to serve as ground operations officer or on-scene commander of several teams.

1.7 REFERENCES

Appalachian Search and Rescue Conference, Inc. (ASRC). Search and Rescue Operations Plan (SAROP). First edition, Alexandria, VA: ASRC, May, 1976.

ASRC. Operations Manual. Draft edition, Alexandria, VA: ASRC, March, 1977.

Glen Canyon National Recreation Area. Search Manual. Glen Canyon NRA, UT: no date.

Kelley, Dennis. Mountain Search for the Lost Victim. First edition, Montrose, CA: 1976.

May, W. G. Mountain Search and Rescue Techniques. First edition, Boulder, CO: September, 1972.

National Association for Search and Rescue Papers:

s 76-103 Wade, J. W. "The Role of the Management Team in a Large Search". 1976.

s 76-107 Freeman, Fear, McCoy, La Valla, San Diego Mountain Rescue and Survival Education Association. "Stormy Weather Search for ELTs". 1976.

s 76-108 Kelley. "The $250,000 Message". 1976.

77-1003 McCoy. "Pre-planning the Land Search Organization". 1977.

CHAPTER TWO

TEAM ORGANIZATION AND TRAINING

2.0 GENERAL

The competence of a team in the field is determined in major part by activities conducted when it is not in the field, but at its home base. This chapter is intended to provide a guide to such activities; organization, training, and similar considerations will be discussed. The reader may note that sections of this chapter appear to duscuss field operations, but these sections actually relate to preplanning for operations.

Once a call for a REDCAP (actual mission) has come in, it is too late to restructure an alerting plan; similarly, once in the field, it is too late to instruct team members as to the appropriate equipment to bring on missions. Adequate preplanning is an absolute necessity for a successful GSAR team.

2.1 FIELD ORGANIZATION

Some search and rescue manuals and organizations go to great lengths to define the various positions on a team and the specific duties associated with each position. Often each position requires special training, and cross training is added only as an afterthought. In Virginia Wing, however, any certified GSAR team member should be able to competently carry out the duties of any team position, with the possible exception of the team leader. The advantages of such a system lie in its flexibility and stability.

At the beginning of each mission task, the team leader assigns to team members the established functional positions. Each member is aware of the duties and responsibilities of each position, so this serves to distribute the necessary workload in a quick and efficient manner. Usually, the team leaders will take advantage of the strengths of each member when assigning positions; however, for training purposes, members may occasionally be assigned to positions outside their primary area of interest. Obviously, for such a system to work, it is necessary for every team member to know the duties and responsibilities of each position.

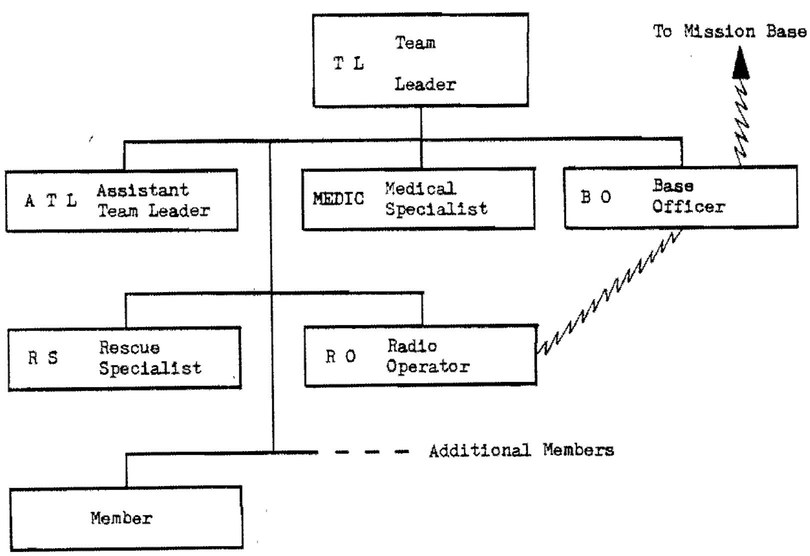


FIGURE 2-1: The Ground Search and Rescue Team
(Virginia Wing, CAP Class A and B Teams)

(The following functional team structure is adapted from the Search and Rescue Operations Plan of the Appalachian Search and Rescue Conference, with permission.)

There are six positions on a Class A or B GSAR Team, but one person may fill more than one position.

1. Team Leader (TL)

The Team Leader's responsibility is to carry out the task assigned the team by the Mission Coordinator (MC), within the constraint that he provide for the safety of his team. He is the highest authority on the team, but must consider the judgement of the others, particularly the MEDIC. The TL's specific duties are:

a. Task planning
b. Navigation
c. Personnel management
d. Equipment management
e. Safety
f. Task reporting.

2. Assistant Team Leader (ATL)

The Assistant Team Leader is the member of the team designated to take command should the TL become incapacitated. While the TL is in command of the team, the ATL has no duties or responsibilities, and he is not considered to be in the chain of command.

3. Medical Officer (MEDIC)

The MEDIC is responsible for the medical care of victims and incidental medical care of team members. It is highly recommended that the MEDIC be a registered Emergency Medical Technician (EMT). The MEDIC's specific duties are:

a. Assembling necessary medical equipment
b. Medical care of team members
c. Medical care of victims
d. Advising the Team Leader and Rescue Specialist on medical situations and priorities during rescue and evacuation.

4. Rescue Specialist (RS)

The Rescue Specialist (RS) is responsible for the execution of any technical operations including rescue and evacuation of victims. His specific duties are:

a. Assembling necessary technical equipment including litters and rigging
b. Supervising all roped travel
c. Planning and supervising rescue and evacuation
d. Advising the TL of technical situations and priorities
e. Enforcing safety standards.

5. Radio Operator (RO)

The responsibility of the Radio Operator is to maintain communication with the Base Officer (BO) when the team is in the field. His specific duties are:

a. Assembling communication equipment (with the BO)
b. Maintaining contact with the BO
c. Advising the TL of the communications situation.

6. Base Officer (BO)

The Base Officer is responsible for securing the team's Base (where the vehicles are left when the team goes into the field) and providing a communications link to the Mission Base and with other search and rescue and law enforcement organizations at the scene. The BO remains at Base and therefore need not be field qualified. However, he nust be qualified as a CAP radio operator, and it is suggested he be an Amateur Radio Operator (HAM). His specific duties are:

a. Assembling communications equipment (with the RO)
b. Establishing contact with the team's home unit and with Mission Base during the initial stages of the mission.
c. Maintaining contact with Mission Base and the RO
d. Advising the TL and the RO of the communications situation
e. Keeping a Radio Log
f. Handling communications with other organizations at the team's Base (the roadhead where the team's vehicles are located).

During lost person searches, GSAR teams will be broken down and reformed into entities known as Field Teams, in accordance with accepted terminology. Such teams will be built to fit a particular task, so it is not possible to specify in advance details such as the size of the team. The positions on a Field Team are the same as those on a GSAR Team, with the following exceptions:

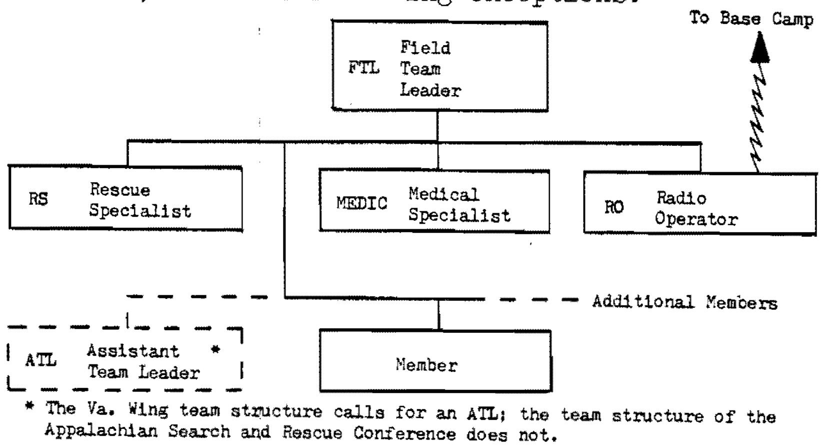


FIGURE 2-2: The Field Team
(Virginia Wing, CAP and Appalachian Search and Rescue Conference)

1. The leader will be termed a Field Team Leader (FTL), and will have the same duties and responsibilities as the Team Leader of a GSAR Team.

2. Since lost person searches are generally confined to relatively small geographic areas, no Base Officer is necessary, as the Radio Operator should be able to communicate directly or through a relay station with Base Camp. (However, refer to section 2.4 concerning the use of GSAR Teams for Quick Response in lost person searches.)

3. Often, members of other SAR organizations will be working together with CAP GSAR members on Field Teams. In this case, some flexibility will be necessary in order to work efficiently with the protocols of these other organizations. If the CAP is working with the Appalachian Search and Rescue Conference, Inc. (ASRC) there should be little difficulty in forming joint Field Teams; the ASRC uses the same positions and position duties as does Virginia Wing CAP, with the exception that the ASRC Field Team Leader does not appoint an Assistant Team Leader. These positions may be assigned to ASRC members, CAP members, or others, at the FTL's discretion.

4. CAP members may serve as Field Team members under a Field Team Leader from another organization, provided that the following requirements are observed:

a. Any Field Team with CAP cadets must also have a CAP senior member present.
b. One CAP senior member on each Field Team must always be designated as the Responsible Member, to be responsible for the safety and conduct of all CAP members on the team. This does not mean that the Responsible Member is directly in command of CAP members, because the FTL is by definition in command of the entire team. The Responsible Member's only authority and responsibility is to remove CAP members from the team if he judges the danger to them to be unjustified. The Responsible Member will be selected on the basis of (1) GSAR certification level and (2) CAP rank. Thus a Level IV First Lieutenant would be a Responsible Member rather than a Level III Captain. This method of selection is used because of the difficulty of judging the safety and appropriateness of GSAR practices and techniques without GSAR training.

2.2 ADMINISTRATIVE ORGANIZATION

The organization of a GSAR team during times other than missions (Phase Ø, Alert and Standby) is necessarily different from the organization of the team when it is prosecuting a mission task. There are four primary functions to be carried out: command, training, alerting, and equipment management. These may be carried out by a single member, or may be delegated to several members, at the pleasure of the unit commander. For illustration, the duties will be addressed as if they were spread among four individual members.

1. Ground Search and Rescue Coordinator

The GSAR Coordinator is appointed by the unit Emergency Services Officer, with the approval of the unit commander. He is responsible for all routine GSAR activities of the unit, including the supervision of all other subordinate GSAR Officers. The position of GSAR Coordinator carries with it no special qualifications to be a member or leader of a GSAR team in the field. The GSAR Coordinator's specific duties are:

a. Advising the unit, Task Force, and Wing as to the status and capabilities of the team
b. Maintaining the certification of the team
c. Advising the unit commander as to the needs of the team
d. Assuring that all duties required for proper maintanence of the team are carried out.

2. GSAR Training Officer

The GSAR Training Officer is responsible for all unit GSAR training, including scheduling, supervision, and evaluation. The GSAR Training Coordinator's specific duties are:

a. Preparing all training records and plans required for team certification and recertification
b. Recruiting, briefing, and guiding the instructors for each training session
c. Publishing a training schedule as per section 2.3 at regular intervals
d. Maintaining a training log with the following information for each training session:
   i. Topic(s) covered
   ii. Hours of lecture and of practical work
   iii. A brief critique

iv. A list of all members in attendance.
(This may be in the form of a few sentences and an attendance list.)

e. Recruiting and indoctrinating new members
f. Providing basic GSAR training for the unit, with the aim of certifying many Level I members.

3. GSAR Alert System Officer

The GSAR Alert System Officer is responsible for all aspects of the team's alerting system. The GSAR Alert System Officer's specific duties are:

a. Maintaining and distributing an up-to-date team roster as illustrated in figure 2-3.

CROZET SQUADRON
Ground Search and Rescue Team Roster

I. ADMINISTRATIVE OFFICERS

GSAR Coordinator Henry Scott
Training Officer Larry Jones
Alerting System Officer Rich James
Equipment Officer Rich James

II. QUALIFIED TEAM LEADERS

GSAR Certification Level	Name	Comments
1. IV	SCOTT, Henry	EMT-Paramedic, EMT Instructor
2. IV	JONES, Larry	EMT-Paramedic, ASRC Rescue member
3. III	JAMES, Rich	EMT-Cardiac
4. III	SMYTHE, Fred	EMT
5. III	JOHNSON, Kevin	EMT
6.		
7.		

III. TEAM ROSTER

GSAR Level	Name	Telephone Home	Telephone Other	Comments
IV	JONES, Larry	823-6574	823-6963	FM HT; Jeep-4
IV	SCOTT, Henry	823-4351	924-5979	FM HT; Van-6
III	JAMES, Rich	537-6271	924-5979	FM HT; Car-2
III	JOHNSON, Kevin	823-6785	924-7892	FM HT; Car-3
III	SMYTHE, Fred	823-6785	924-4256	FM HT; Car-3
II	ABELSON, George	823-5674	823-7649	Car-3
II	CARSON, Bill	537-6723	823-4325	FM HT; Car-4
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

FIGURE 2-3: Example of a possible GSAR Team Roster

b. Conducting regular tests of the alerting system, and reporting the results to the GSAR Coordinator.

4. GSAR Equipment Officer

The GSAR Equipment Officer is responsible for acquiring, maintaining, and replacing all team equipment as necessary. He must also see that all equipment is available at any time for missions. The GSAR Equipment Officer's specific duties are:

a. Maintaining an inventory, usage log, and check-out system for all equipment
b. Arranging for storage of all team equipment so that it is secure, yet readily available for missions
c. Providing a regular inspection and maintenance program for all team equipment.

2.3 TRAINING AND RECRUITING

2.3.0 General

Recruiting and retaining team members is one of the major problems facing any CAP Ground Search and Rescue Team. Since the CAP (and therefore any of its ground teams) is a volunteer organization, the organization's programs must meet the needs and interests of the individual member, or else he has no motivation to remain with the program. As related to ground search and rescue, this means that (1) the GSAR program must be presented in an interesting manner, and (2) GSAR teams must recruit members capable of handling the required training and missions. At the same time, it must be realized that the CAP, and GSAR teams in particular, have a commitment to provide a public service requiring a minimum level of competence. Any training program, especially at the unit level, must consider these two purposes: first, to provide a stimulating, responsive activity, and second, to provide a program that relates to the realities of ground search and rescue. It is not necessary to inject distantly-related items, such as firearms familiarization and long-term survival, into the program. A program based on just the content of the standards of competence can be made interesting and appealing, if carried out in an intelligent, knowledgable, and enthusiastic manner.

2.3.1 Training Considerations

One of the primary requirements for any type of training program is planning. Detailed planning might seem at first to be detrimental to the responsiveness and spontaneity of a program. However, a good instructor knows that planning is required in order to allow him to use his personal style to enliven the sessions. It is difficult for an instructor to use style and enthusiasm when all of his energy is expended in keeping track of what the session is supposed to cover. A poor instructor with a good lesson plan is sometimes better than a good instructor who is totally disorganized, but best of all is a good instructor with a good lesson plan to back him up. Please note that the lesson plan referred to here is not necessarily a neatly typed sheaf of papers (although for some instructors this may be appropriate), but is often just a well-thought-out plan of action in the back of the mind, with perhaps a few notes on a file card.

Not only must individual sessions be well-planned, but the entire program must be well coordinated. It must take into account several factors in order to be successful.

1. Who will be attending the training? The team members could be placed into three categories, at least for the purposes of building a training program:
   a. The Old Salt has been involved in GSAR for longer than anyone else has been in CAP, and knows everything about GSAR (or thinks he does).
   b. The New Member, who has become certified recently, and has all brand-new equipment (probably more than the team leader) and some experience.
   c. The Tenderfoot, totally new to the team.

The program must offer something to each of these members, or they simply will not come.

2. What facilities are available?
3. How much time are members willing to invest?
4. What resources outside the unit are available for training?
5. What training, and how much, is really needed?

2.3.2 Building a Training Program

The first step in building the program is to set some reasonable goals. For example, a program might aim to certify new members to Level II in a year's time, and to have all old members complete EMT training in that same year.

The next step is to decide on the intensity of the training. One weekend per month plus one night a week might suit one unit; perhaps just one weekend a month might be better for another unit. Next, topics must be selected for each session, and an instructor selected and briefed. Each instructor should be given detailed student goals, and an indication of the type of students and their background. The use of non-unit instructors is encouraged; the "visiting expert syndrome" will sometimes provide better attention and attendance than if it is just another team member lecturing.

A major step is to publish a training schedule. Refer to figure 2-4 for an example; every training schedule should include similar information. The final step is the follow-up, to find out the deficiencies and the good points about each session, and about the program in general. This feedback must come from the members themselves, and is the key to a responsive training program.

2.3.3 The Basic Principles of Learning

When preparing any type of educational event, the planner must take into account the manner in which human beings learn and retain information. Although it is not possible to go into detail in this manual, a brief overview will be presented. The reader is urged to consult the various references for a more comprehensive treatment.

<u>RULE 1: The Law of Readiness</u> When a person feels ready to act or learn, he acts or learns more effectively. A trainee that is ready to learn feels a need or desire to master the lesson and feels annoyed if he is prevented from doing so. In a state of readiness a trainee is not easily distracted by other stimuli. This mind-set may weaken to the point where continuing to act in the same direction will become annoying. Just prior to this point the instructor should take steps to regenerate readiness.

<u>RULE 2: The Law of Effect</u> This means, simply, that more flies can be caught with honey than with vinegar. People learn better in pleasant surroundings. Conversely, an attitude of fear, gruffness, unpleasantness, all interfere with learning. This is not speculative; it has been proven in established psychological experiments.

<u>RULE 3: The Law of Exercise (Repetition)</u> The more often an activity is repeated, the more likely it is to be learned. The more often a set of facts is repeated, the more likely they are to be learned. There are many exceptions to this law but it is usually true. <u>The drill should be as much like the activity which will be used as possible</u>.

THE MORAL: Do not assume, because you have stated some facts to the trainees, that they are automatically learned and remembered. Instead, restate them, summarize them. Here is a good training precept to follow:

> Tell 'em what you're gonna tell 'em.
> Tell 'em.
> Tell 'em what you told 'em.

Also, do not assume that, because your students can successfully demonstrate a skill or ability once, they have mastered it. Require them to repeat it--to "over learn" it--before you can really assume that they have learned it.

CROZET SQUADRON QUARTERLY TRAINING SCHEDULE JAN-MARCH 1978

GOALS: By 31 March 1978 all certified team members will have reviewed semi-technical evacuations and will be able to perform a multi-pitch evacuation using whistle signals only. Trainees will complete the classroom training for GSAR standards II-A through II-G and will have basic familiarity with semi-technical evacuations.

Schedule: The team will hold two 2 hour evening meetings, one 4 hour Sunday practice session, and one no-notice alert and inspection per month. The no-notice alert will be canceled in the event of an actual mission that month.

DATE	TIME	LOCATION	INSTRUCTOR	TOPICS	PERSONAL PREPARATION	TEAM EQUIPMENT
1/4/78	1900	Sqdrn. HQ	Jones, L. James, R.	L.II&III: Litter loading Trainees: GSAR II-A, -B	 Read GSAR Ch. 1-3	2 Stokes & rigging
1/14/78	1300	Practice Area	Jones, L.	Non-tech. evacs & litter loading	Rucksack gear & tech. gear	2 Stokes & rigging
1/25/78	1900	Sqdrn. HQ	Jones, L. James, R.	L.II&III: Belaying Trainees: GSAR II-C	Gloves; Read MRM Ch.2 Read GSAR Ch. 17	Practice rope RADEF kit
2/8/78	1900	Sqdrn. HQ	Smythe, F. Jones, L.	L.II&III: Knots Trainees: GSAR II-D	Tie-in; read Mtn Rescue Manual Ch.1 Read GSAR Ch. 15-16	Practice rope Movie projector
2/18/78	1300	Practice Area	Smythe, F. Jones, L.	L.II&III: Belay practice Trainees: Intro belaying	Rucksack and tech. gear Rucksack and tech. gear Read MRM Ch.2	2 practice ropes
2/23/78	1900	Sqdrn. HQ	Jones, L. James, R.	L.II&III: whistle signal for semi-tech evacs Trainees: GSAR II-E,-F	Gloves Read GSAR Ch. 13-14	2 Stokes & rigging Slide projector, 2 HTs
3/8/78	1900	Sqdrn. HQ	Jones, L. Johnson, K.	L.II&III: Prusiking Trainees: GSAR II-G	Read handout Read SUWE, OE, and GSAR Ch. 7 & 12	1 practice rope slide projector
3/18/78	1300	Practice Area	Jones, L. James, R.	L.II&III: Drill on evac w/whistle signals Trainees: Belaying test	Rucksack and tech. gear Rucksack and tech. gear	2 Stokes & rigging 2 practice ropes
3/22/78	1900	Sqdrn. HQ	Jones, L.	Business meeting; review and critique training		

FIGURE 2-4: SAMPLE TRAINING SCHEDULE

RULE 4: The Law of Recency The fresher and more recent a subject, the more we remember it. We tend to come away from a good class session with a sizeable recollection of what we heard and saw. As time goes by, our memory grows dimmer and dimmer. Finally, we remember only a small portion of what we thought we had learned.

RULE 5: The Law of Intensity (Vividness) The more vividly a subject is presented, the better it will be learned. Think back upon your old school days--the dramatic chemistry experiments, with their change of colors, igniting of gases and explosions, etc., are incidents you can still recall.

RULE 6: The Law of "Learning by Doing" This is the most important law of all. The great teacher and philosopher, John Dewey, was the exponent of this law of teaching. Want to thoroughly learn to do something? Then do it. Do it repeatedly. Do it under the supervision of someone who can instruct and help you.

This kind of learning--learning by doing--will provide by far, faster, more effective results for you, than would the most brilliant lecture, or even a good discussion with the other trainees on how something should be done.

RULE 7: The Law of Sensory Appeals This is another familiar concept. Humans learn better when you appeal to all the senses. One estimate holds that trainees remember:

10% of what they hear
20% of what they read
30% of what they see
70% of what they do

THE MORAL: This does not hold true for all people and all situations. The example listed is probably exaggerated. However, the thing to remember is never conduct a class session without using as many visual aids as possible. At the very least, have a blackboard or easel and use it, to illustrate the points you make orally.

2.3.4 Recruiting

Every GSAR Team member should recognize that personnel turnover is a basic problem with volunteer teams, and that it is a major problem facing any CAP team. A common finding is that about 25% of the team will be lost over a period of about one year. The reasons for this are many; some of them may be altered so as to reduce the rate of turnover (e.g. the team training program), but others may be beyond the capability of the team leaders to change (e.g. cadets leaving for college). Teams should strive to develop "two deep" leadership, so that a back-up member is available for every major leadership position. These apprentices should be actively involved in the management of the team, so that they may step in and assume leadership roles. This will help to avoid major disruption, should one of the team's leaders suddenly become unavailable.

Not every CAP member is capable of becoming a Level II GSAR Team member. Teams must actively search for unit members or prospective members who have the potentiality for becoming productive GSAR Team members. The following traits will often be indicative of good results:

1. Stability: Behavior that does not vary greatly with stress is a most useful characteristic in GSAR personnel. A person with an uneven temper may become a liability to the team.

2. Self-motivation: Does the person tend to stick with a job until it is finished? Many GSAR tasks require perseverance, even in the face of major difficulties.

3. Consciousness of detail: Is the person sloppy, or does he pay careful attention to doing the task right the first time? Details may assume major importance in some GSAR tasks.

4. Ability to work with others: The ability to keep differences of opinion from creating conflict is required for the smooth functioning of a team. It is especially useful in coordinating with other organizations.

Experience is also an important factor in the selection of good GSAR recruits. Those with a good background in the outdoors have a major advantage over others. Look particularly for those with a background in mountaineering or winter backpacking, but also consider scouting, hunting, or military training as good indicators. A final consideration is physical condition. Although this may seem trivial to some, GSAR tasks can be quite demanding physically, and some people may simply not be able to handle the physical requirements of GSAR activites.

Since personnel turnover is such a severe problem, GSAR teams should consider actively recruiting team members from the community, as opposed to recruiting solely from within the ranks of the CAP. Such projects may require a considerable investment of effort, but will often yield commensurate results. The decision to institute such a recruiting campaign must not be done hastily, however; a poorly executed effort may cause more harm than good to the team. A first step in any recruiting drive is to create adequate written information about the organization. Most CAP recruiting literature is inappropriate for GSAR teams, so construction of a special fact sheet about the CAP GSAR teams may be necessary. This must be constructed carefully, so as not to put forth unsupportable claims or to offend other organizations.

There are many possible routes for a GSAR recruiting program, a few of which are given below.

1. Piggyback: Add your effort to that of the CAP unit proper. This is the least difficult in terms of effort, but will probably produce the least results. It is difficult for those not GSAR trained to assess possible recruits, or to answer detailed questions regarding GSAR. To minimize this problem, those unit members doing the recruiting should be given a briefing on GSAR and the unit's team, and provided with a good GSAR fact sheet.

2. Scatter-gun: Pick out specific people in the community who appear to have the potentiality for becoming good GSAR team members. Approach several people close to one of your prospective recruits, and solicit opinions of him. Mention that you have a specific community service job in mind for him. Leave it at this point, and wait until you receive a phone call or visit. Then is the time for some serious one-on-one recruiting, and to offer him a specific job.

3. Team recruiting: Make up a team of two or three members, and provide them with a program (e.g. a slide show) about the GSAR team. Go to groups such as rescue squads, fire departments, or hiking clubs. Do your recruiting after the program.

4. Advertising: Put notices of meetings and training sessions in the media, and allow interested people to see the team in action. A good idea is to run a special "orientation" session to expose possible new recruits to GSAR activities.

Many additional approaches to recruiting exist. In every case, there are two major pitfalls to be avoided: (1) inadequate planning and follow up, and (2) overselling your team.

2.4 ALERTING AND QUICK RESPONSE

The important criterion for evaluating an alerting system is simple: can the team be ready to go within the appropriate time frame? (e.g. two hours from notification). If the answer is yes for any time of day, day of the week, or season, then the alerting system is adequate. One way to meet this objective is to have a qualified team leader (Level III) and three qualified team members (Level II) always available, perhaps with pagers or scanners on 148.15 MHzFM (CAP VHF frequency). Assuming that a vehicle and equipment are readily available, a Class B team will then be ready to go at a moment's notice. Another alternative is to have three or four qualified team leaders, seven to ten qualified members, and a callout roster listing home and work/school numbers for each. Enough members will generally be available to put together a Class B team at any given time. Either of these alternatives, or a combination, may be appropriate for a particular team; or a completely different approach may be used, as long as it does the job.

The following checklist may be of use in constructing an alerting system:

1. Personnel. For paging systems, rotation may be worked out, so that a paging call will always reach the minimum required number of available personnel. For a Class B team, this will usually require a minimum of two Level III and six Level II members so as to allow for work and vacation schedules, illness, and so forth. Additional personnel, perhaps three or four Level III and seven to ten Level II members, will be necessary for a phone callout system, and when members have limited availability (e.g. due to jobs).

2. Callout Roster. No matter what type of alert system is utilized, the team should have an up-to-date callout roster, with phone numbers, personal equipment, etc. (see figure 2-3). This must be updated and distributed to team members and unit alerting officers regularly.

3. Communications Network. For phone alert systems, there are two primary callout modes: (1) the Phone Tree System, where a member calls two other members, each one of them calls two more, etc. This works well with a small team, but breaks down easily if some problem arises, for instance if someone isn't home, or isn't sure whether he can go or not. (2) The Dispatch Officer System, where a Dispatch Officer (DO) is in charge of the callout. He may appoint assistants, but is responsible for the entire callout. The DO need not be a GSAR team member, thus allowing all GSAR personnel to respond without delay. The advantage of this system is that the DO may stay at his phone and provide a stable central communications point during the crucial initial stages of a callout. This DO may also continue to call out team members after a Quick Response Team has been dispatched.

4. Equipment. All equipment must be readily available (e.g. not locked in a vacationing member's house). One approach to this problem is to designate a locked closet or outbuilding somewhere as a team equipment locker, and distribute keys to all qualified team leaders. Equipment may also be stored in the team's vehicle(s), although this is somewhat risky in terms of possible equipment theft.

5. Training. A callout will go smoothly only if members are familiar with what is expected. For instance, members should know to intersperse a minute or so of waiting between every second or third call, so as to allow for incoming calls. Callout telephone conversations should be kept brief; "We have a REDCAP. Can you go?" "Yes." would be ideal. However, some briefing will probably be necessary, and the best way to insure accuracy is to use some type of form such as the SAF (Searcher Alert Form) used by the Appalachian Search and Rescue Conference (ASRC) shown in Figure 2-5. For the callout to work properly, members must be trained in the proper manner to act in a callout; drills are essential.

APPALACHIAN SEARCH AND RESCUE CONFERENCE, INC.

SEARCHER ALERT FORM

I. CONTACT

A. Dispatch Officer (Name, Phone)________________

B. Mission Coordinator (Name)________________

C. Quick Response Leader (Name)________________

II. SITUATION

A. Problem type________________

____

B. Location________________

________________Distance________________

C. Weather and terrain________________

____

D. Special problems or special equipment required________________

____

____

III. DISPATCH INSTRUCTIONS

____

____

____

____

____

____

____

____

REFER ALL QUESTIONS CONCERNING THE MISSION TO THE DISPATCH OFFICER, NOT THE MISSION COORDINATOR

FIGURE 2-5: ASRC SAF

In many search operations, the quick dispatch of a ground SAR unit to the scene may be of vital importance. In the case where an ELT signal is heard in the late afternoon, a quick GSAR response may make it possible to find the crash site before dark. In the case of a person lost in severe weather, hours may be crucial as far as victim survival and containment of the search to a small area.

In order to provide a timely GSAR response for such missions, CAP units with a Class A or B team capable of reliably providing a quick response will be so identified. A Mission Coordinator may call upon one of these units to provide a Quick Response Team, and may be sure of the team's availability, quick response time, and capability to handle the required SAR tasks. Those teams with Quick Response status will probably receive many calls for mission tasks, a vital concern for any team.

Each QR team will be structured as a GSAR team, even if the mission is a lost person search. There will be no Base Camp at the time the QR team responds, so a Base Officer will be necessary to provide a communications relay, and other functions as outlined in Section 2.1.

2.5 EQUIPMENT

2.5.0 General

The Virginia Wing GSAR Program provides specific lists of personal equipment for certification of Class A and B GSAR teams. People or teams with specific questions not answered here should contact the Virginia Wing Ad Hoc Committee on Ground Search and Rescue directly.

This section deals specifically with packaging of personal and team equipment, and selection, care, and maintenance of team equipment. Selection, acquisition, and care of personal equipment are discussed in Chapter 12.

2.5.1 Personal Equipment Packaging and Quick Response

One major problem in developing a short team response time is the assembly of personal gear. Although this will probably always be a problem, some actions may be taken to minimize its impact on response time.

1. Education. Team members must have an understanding of the equipment requirements of various types of missions. This perhaps is only truly gained by experience, but experienced team members may be able to pass on some of their expertise to new members. It is also possible to have equipment inspections at mock callouts, and then to discuss as a group the surfeits and lacks found in the various members' equipment. Although it is probable that no general consensus will be derived, the talk should even so be of educational value.

2. Checklists. The team may provide each member with a checklist, or better yet, require each member to create a personal checklist. This list will find its primary use in the pre-sorting of equipment, but also when a callout occurs.

3. Pre-sorting. Members may assemble a large portion of their personal equipment in one particular place, ready to use. Packs may be packed, or gear may be stored in cargo bags. A list of additional items needed for a mission may be posted nearby, so as to allow someone to pick up all of the necessary gear for a member, without requiring his presence. This type of personal preparation is of great importance in reducing response time.

4. Central equipment storage. It is theoretically possible, and quite appealing initially, to store all required personal equipment in a central location, along with team equipment. Unfortunately, there are many problems associated with this. For example, much of the equipment must be the personal property of the members, and placing it in a central place limits access to equipment such as boots, rucksacks, etc. which are used for other purposes than GSAR.

The best way to evaluate personal equipment preparation is through mock callouts and equipment inspection; this will also serve to persuade members of the necessity of such preparation.

2.5.2 Team Equipment Selection

(Note: this subsection is keyed to, and is a discussion of, pages 20-21 of the Virginia Wing GSAR Program.)

A. Vehicles Jeeps and other four wheel drive vehicles may be invaluable in certain specific situations, but on the other hand, most CAP jeeps are not capable of traveling at highway speeds, and can carry little team or personal equipment. For most teams, a large four wheel private vehicle such as an AMC Jeep Cherokee, capable of traveling at highway speeds and for long distances, would be ideal, but such vehicles are seldom found in the pool of surplus vehicles available to the CAP.

The primary needs of a ground team in a vehicle are:

reliability
speed
ability to carry team and personal equipment
ability to carry team members
ability to traverse rough roads
comfort
security of stored equipment.

In most cases, the ability to carry the team and its equipment to a given locality overshadows the need for rough-terrain capability. A van with a fairly large engine and snow chains will probably serve a team best as a first or major vehicle; a jeep with lock-out hubs in front and winter top makes a good second or minor vehicle.

The major vehicle must carry radio equipment sufficient to communicate (1) with Mission Base and the team's home unit, and (2) with a team in the field. The first requires either a VHF-FM radio capable of simplex and repeater operation, or a HF-SSB radio. Although a discussion of radio characteristics is not appropriate at this point, it is appropriate to point out that reliable VHF communications are limited to two stations within line-of-sight range of a repeater, and that the CAP repeater network in Virginia is not good enough to insure coverage in many areas. Also, many search areas may be completely out of VHF range, even with repeaters, from Mission Base. On the other hand, HF-SSB in the four MHz range provides reliable communications up to several hundred miles during most of the year. However, certain aspects of time of day, season, and sunspot activity may conspire to make HF communications difficult or impossible. All things considered though, a HF-SSB radio is preferable to a VHF-FM radio for long distance communications.

For short distance communications with a team in the field, VHF-FM simplex is ideal. Line-of-sight communications distance is essentially unlimited for VHF, and interference is rare. On the other hand, the CAP frequency at 26.620 MHz AM is subject to much interference from Citizen's Band radios, static, and background noise. Thus, 26.620 MHz AM is a poor second for field-to-vehicle communications. One consideration may prompt teams to start out with 26.620 MHz AM: cost. Cheap CB crystal-controlled radios, both hand-held and mobile, may often be easily converted to the CAP frequency. Teams are cautioned from investing heavily in CB radios; this money would probably be better spent if applied towards VHF-FM mobile and hand-held radios.

Routine care and maintenance of vehicles and radios are covered adequately in other publications, so no discussion of these will be presented here. Each vehicle, however, must have minimum equipment for maintenance, repair, and emergencies, as listed in the Virginia Wing GSAR Program.

B. Search Equipment

Most of the equipment listed under Search in the GSAR Program needs no discussion, but the subject of ELT locators is quite controversial. The GSAR Committee does not wish to endorse any particular brand of ELT locator, but will note that it has had success with both Bee-Line and L-Per models, and both seem satisfactory. The Bee-Line is more compact, but the L-Per appears slightly more sensitive.

C. Extrication Equipment

The extrication equipment listed is designed to make a compact, fairly lightweight extrication kit which may be easily carried for long distances. With the addition of a hacksaw, this kit will allow disentanglement from almost any light civil aircraft. Additional tools may make the job easier or quicker, but their usefulness must be weighed against the difficulty of bringing them to the scene. Most of these tools may be purchased at a Sears store or hardware store. Teams should check out the possibility of a donation of tools from such a store.

D. Trauma Equipment

The equipment listed is not intended to represent a comprehensive first aid or medical kit, but rather a trauma kit. Teams should check with local rescue squads and hospitals when building such a kit. It is suggested that each team secure a physician medical advisor, and solicit his help in creating a trauma kit.

E. Evacuation Equipment

The equipment listed is sufficient to handle most non-technical and semi-technical evacuations. The litter should be of steel or aluminum construction, and sectioning the litter as shown in May's Mountain Search and Rescue Techniques is a most useful modification. The sleeping bag should be of synthetic material (e.g. fiberfill or polarguard), although an old army down and feathers mountain mummy bag may be used. For the helmet, a slide-down face shield is preferable to goggles. The backboard should be a 3/4 length, cut narrow to put in the litter, with webbing loops for strap attachment.

The sleeping bag and wool blanket may usually be acquired through CAP surplus property acquisition, through the Wing Liason Officer. The rope, rigging, and technical climbing gear are available through an outfitter. Surplus stokes litters are sometimes available.

2.5.3 Team Equipment and Maintenance

Every team should have a routine set of orders for equipment maintenance. Vehicle and radio maintenance are responsibilities of the unit proper, but GSAR teams should be aware of the status of these unit maintenance programs. For all other equipment, the team has primary maintenance responsibility, and should develop a system of routine care and maintenance. The following checklist may be of an aid in developing such a program.

1. Inventory. At certain preset intervals, all team equipment should be checked against previous inventories, and deficiencies should be noted. Any minor losses should be replaced promptly, and major losses should be reported to the team for discussion.

2. Checkout. In order to keep track of equipment, a checkout system should be started, using a notebook, file cards, or some similar method. Each time a piece of equipment is removed from its storage place, the person checking it out should sign for it with a date. As the equipment is returned, it should be signed in, again with a date.

3. Logging. Some equipment, ropes in particular, may be damaged by hard use, without external evidence. Therefore, for the team's safety, a record of the severity and duration of use must be kept. This may easily be recorded as equipment is signed back in, but team members must be made aware of the importance of such logging.

The ASRC Mountain Rescue Manual provides details of care for ropes and technical equipment. The references to Chapter 11 provide additional information concerning care of such equipment.

2.5.4 Team Equipment Packaging

There are two primary approaches to packaging team equipment. First, it is possible to have members carry team gear in or on their personal packs. This requires that all members have packs with sufficient straps or capacity to carry the necessary gear, and that team gear be organized into small modules or stuffsacks, each of which is easily added to a member's pack. On the other hand, team gear may be pre-packed into medium or large capacity packs, with additional room for a member's personal gear. Each of the systems has characteristic advantages and disadvantages, most of which are readily apparent. It is possible to combine the two systems, and to have a few team equipment packs with spare room, and have the rest of the team equipment in easily packed modules.

2.6 REFERENCES

Appalachian Search and Rescue Conference, Inc. (ASRC). Mountain Rescue Manual. Draft first edition, March, 1977, with CAP GSAR College Supplement, August, 1977, Charlottesville, VA: Blue Ridge Mountain Rescue Group, ASRC.

ASRC. Operations Manual. Draft edition, Alexandria, VA: ASRC, March, 1977.

ASRC. Search and Rescue Operations Plan (SAROP). First edition, Alexandria, VA: ASRC, May, 1976.

Bush, Stan. "Getting into the Act." National Association for Search and Rescue Paper #77-1001. 1977.

Miller, John J. Team Commanders Notebook: No. 5. Forming and Training a Ranger Team. Ranger section, PA Wing, CAP: 1974.

Warter, Jon. ESAR Team Member and Team Leader Training Manual. Explorer Search and Rescue, Seattle, WA: 1976.

Williams, Paul. Mountain Rescue Leadership. Mountain Rescue Council, Seattle, WA: Fall, 1970.

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 <u>local Responsible Agent</u>, 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 54-276.9 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.

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 search is an emergency! 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 Ø 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.

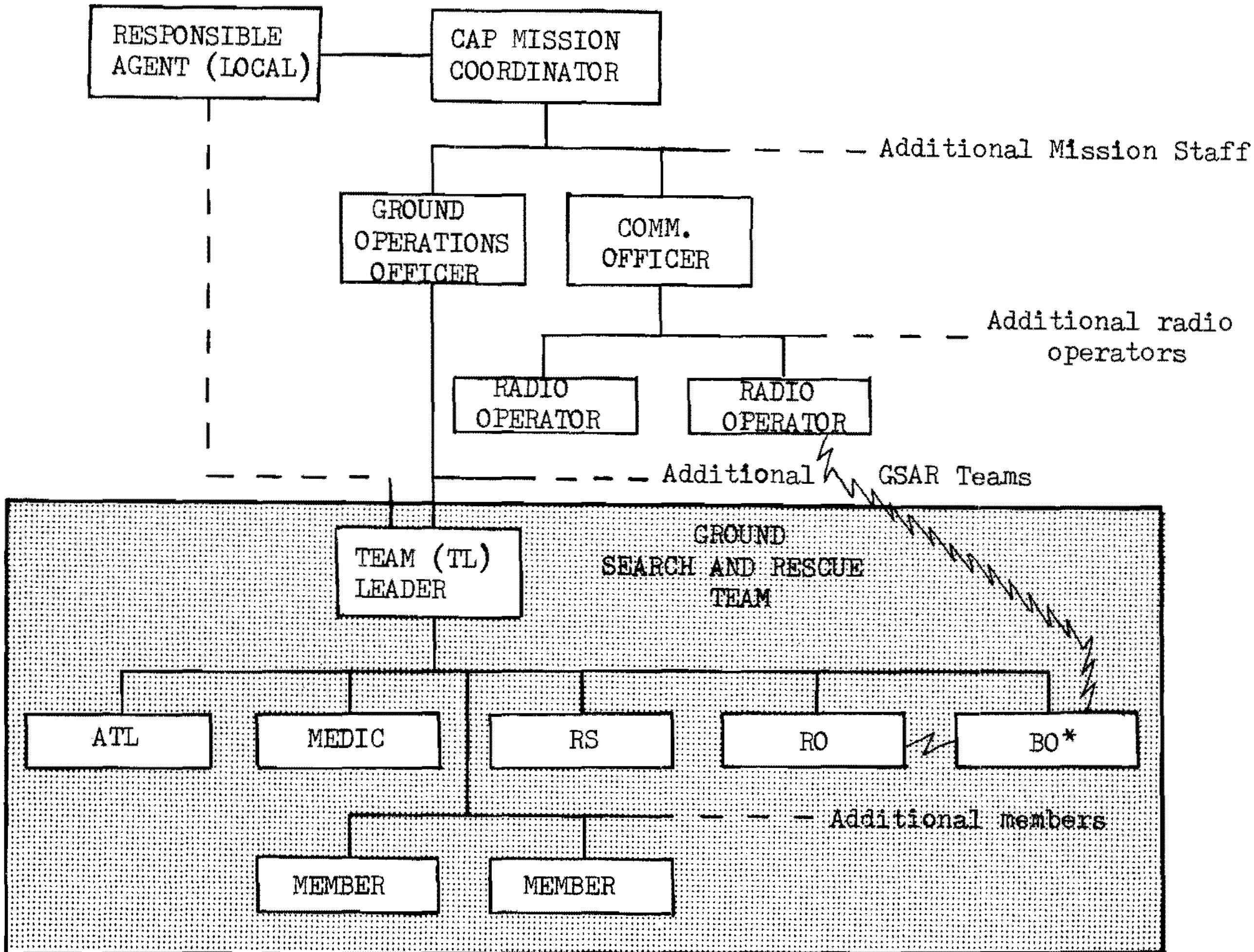
The Appalachian Search and Rescue Conference, Inc. (ASRC) has rescue and evacuation teams available for use upon request of authorized CAP Mission Coordinators by calling their twenty-four hour phone number (804) 924-7166 (University of Virginia Police). Those teams have a comprehensive rescue and evacuation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



TL	Team Leader
ATL	Assistant Team Leader
MEDIC	Medical Specialist
RS	Rescue Specialist
RO	Radio Operator
BO	Base Officer

*Although a Base Officer (BO) is a member of a GSAR Team, he need not be field qualified, as he will stay with the vehicles, rather than go into the field.

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

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 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)

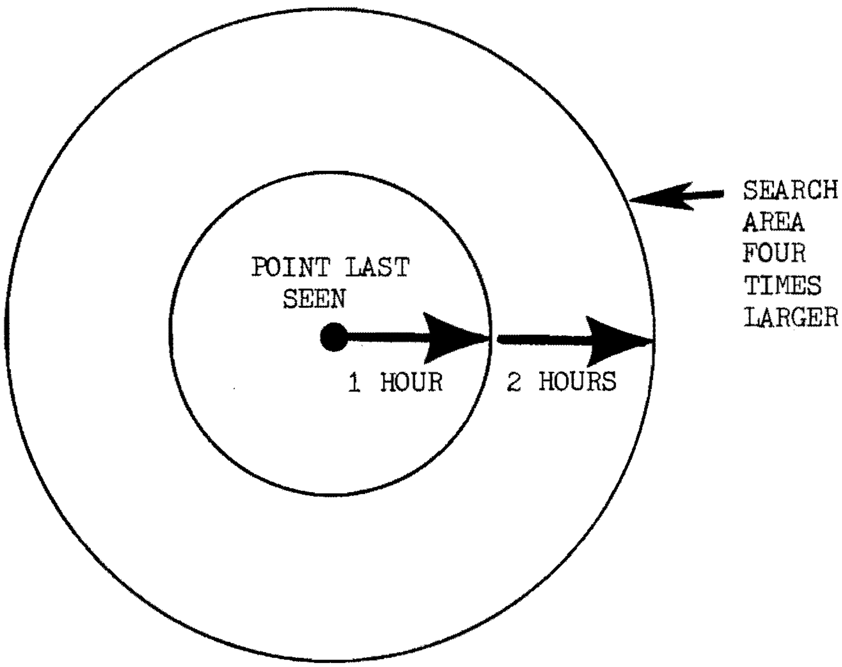


FIGURE 5-1: A Quick Response means getting searchers into the field to minimize search area size.

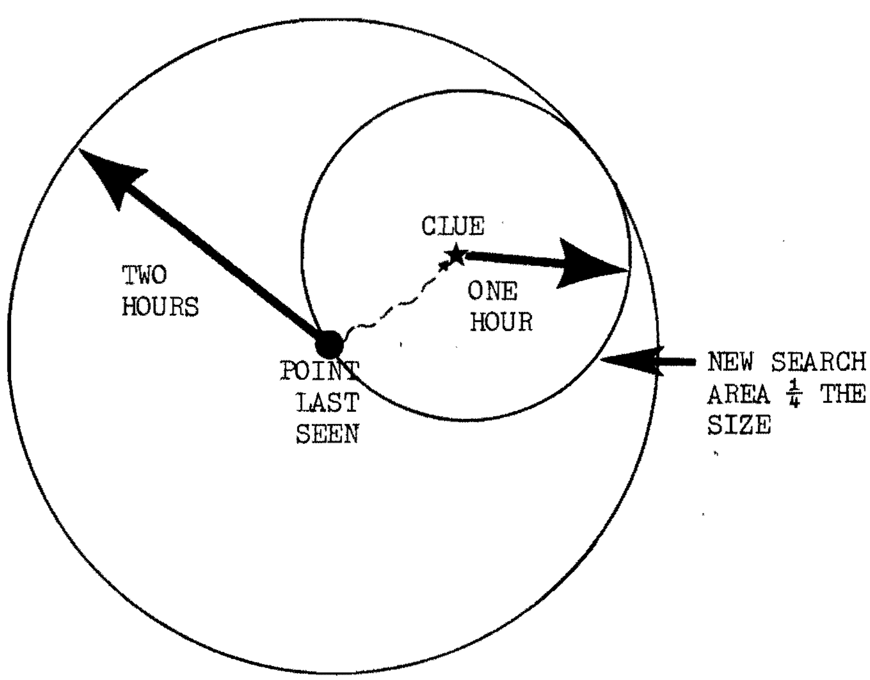


FIGURE 5-2: Search for <u>clues</u>, not subjects

<u>Concentrate on aspects that are:</u>
<u>important to search success</u>
<u>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

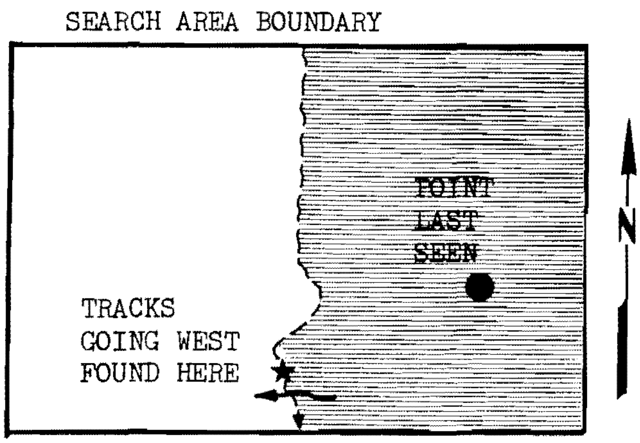


FIGURE 5-3: Binary Search

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.

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)

5.2 ORGANIZATION AND OPERATIONS

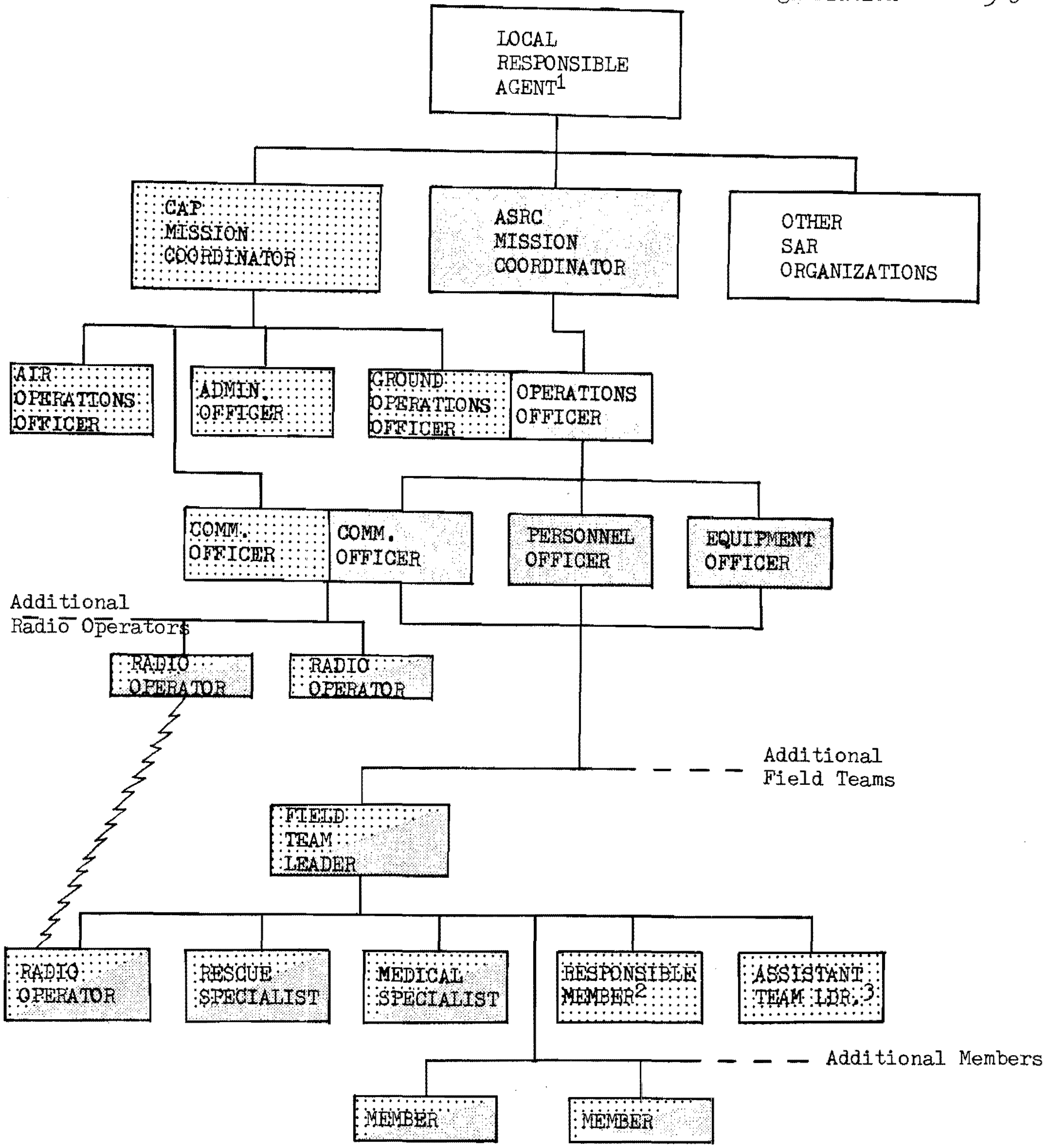
An important point for all CAP personnel to understand is that the standard CAP mission staff set-up is not designed to handle lost person searches. Attempts to blindly apply it to a lost person search are doomed to failure. However, with intelligent adaptation, the structure may be made to serve the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

FIGURE 5-4: A Suggested Joint CAP/ASRC Lost Person Search Organization



KEY

CIVIL AIR PATROL POSITIONS

APPALACHIAN SEARCH AND RESCUE CONFERENCE POSITIONS

COMMON POSITIONS

1. Local Responsible Agent is usually the County Sheriff or National Park Superintendent.

2. A CAP Senior Member must be designated as Responsible Member for each Field Team containing CAP members.

3. CAP (Virginia Wing) team organization calls for a designated Assistant Team Leader; the Appalachian Search and Rescue Conference Search and Rescue Operations Plan does not.

5.3 THE PHASES OF A LOST PERSON SEARCH

The following material is adapted from the Search and Rescue Operations Plan (SAROP) of the Appalachian Search and Rescue Conference. The SAROP is designed for use by the ASRC when participating in a lost person search, rather than being a comprehensive plan for search operations. With minimal adaptation, this plan can fit the needs of the CAP in coping with lost person search emergencies. The outline presented here is for familiarization purposes only, and should not be taken as a comprehensive plan for running lost person search missions. Those interested in further information and guidance should consult a copy of the ASRC SAROP and Operations Manual directly.

"Although the SAROP is intended to provide standard procedures which may be followed with little thought, it does not ignore the intelligence of the searchers who are using it. It is up to the mission leaders to adapt the Plan to the situation at hand, and only apply those procedures which are necessary or useful. It is through adaptability that a simple plan can be complete.

There are two main features of the SAROP which aid its adaptability. The first is the organization of a mission into phases:

Phase Ø: Alert and Mobilization

Phase 1: The Quick Response

Phase 2: Scratch and Survey Searching

Phase 3: Saturation Searching

Phase 4: Withdrawal

Each phase need only be initiated if it is appropriate, and the strategy employed in each phase is based upon need rather than the procedure.

The second adaptable feature of the SAROP is its functional organization. The Plan describes many jobs which may need to be done during the mission. How people are assigned to jobs or the jobs to people depends on the circumstances and is up to the leaders. For example, a Field Team is composed of Leader, Medic, Rescue Specialist, Radio Operator, Driver, and Searchers, but on a simple task a team of two people can discharge all these duties."

Phase Ø

During Phase Ø, the Virginia Wing is alerted through Scott Air Force Base (the Aerospace Rescue and Recovery Service) or directly through the State Office of Energy and Emergency Services (OEES). After analysis of the available information, the appropriate action is taken. This includes the appointment of a CAP Mission Coordinator, and may involve the dispatch of a Quick Response Team (QRT) or the planning of a major search effort. It is important to note that in lost person searches the CAP Mission Coordinator does not act as a Responsible Agent. He serves at the pleasure and the request of the local Responsible Agent, usually a County Sheriff. (See also chapter 3 concerning Responsible Agents).

The Mission Coordinator's job is to direct all aspects of the CAP's participation in the mission. The effectiveness of the CAP is his responsibility. The MC's first task is to make an initial response plan. However, no action can be taken in the field until the Responsible agent is contacted and his approval is secured. This is a simple matter when the Responsible Agent has made the original request for help. If not, once the MC has initiated the appropriate mobilization plan, he must contact the Responsible Agent.

Once the appropriate callout procedures are set into motion, the MC begins the tasks of gathering information and planning for the operation. These tasks are not complete until the operation has ended.

The MC should consult with the Responsible Agent, pointing out other SAR resources (e.g. the ASRC, the Virginia Rescue Dog Association) that may be of use, and ascertaining the expectations the Responsible Agent has for CAP participation in the search.

Phase 1: The Quick Response

Lost person search emergencies require an urgent response. Part of this response is to begin search efforts early, so as to minimize the search area size and therefore search difficulty.

An appropriate response for the CAP is to provide a Quick Response Team (QRT), and to dispatch one or two aircraft to the scene for survey search. Although the duties of an ASRC QRT are primarily rescue and evacuation, an ASRC or CAP QRT can serve a useful function in a search situation as well. Although the probability of finding a lost person with a QRT may be small, the team can fulfill four important missions in a search. These are

1) Hasty Search
2) Initial Survey Search
3) Initial Scratch search
4) Reconnaissance
5) Initial Base Operations.

Even if the QRT fails to find the victim, the information it gathers about terrain, weather, map accuracy, and road conditions may be crucial to the mounting of a large search.

The QRT will usually make first direct contact with the Responsible Agent and others at the site. Good working relationships will depend on how this contact is made.

The organization of a QRT is discussed in chapter 2.

During Phase 1 the MC is faced with two main problems. The first is supporting his units in the field. Second is planning for phases 2, 3 and 4 should the QRT not locate the victim.

1) The support requirements of the QRT are
    a) Manpower (if more is needed)
    b) Supplies (if the QRT is in the field more than 24 hours)
    c) Intelligence
        aa) Mission status
        bb) Victim information
        cc) Weather reports
        dd) Maps
    d) Medical and evacuation support
        aa) Helicopter evacuation
        bb) Rescue Squad (ambulance) evacuation
        cc) Medical supplies for definitive care (if the Medic is capable of it)
    e) Communication (if the situation is more difficult than anticipated).
2) Planning for a large scale search depends on the circumstances. At the present, the CAP does not have the capability for operating a large search effectively and efficiently. If the Responsible Agency has a Mission Staff capable of managing a large search well, the MC should strive to adapt the resources at his command to this structure. If the Responsible Agent does not have this capability at his disposal, a tactful suggestion might be made to contact the ASRC, which has the capability for such management and does so routinely on many lost person searches.

Two other principles apply to search planning:
a) All action must be approved by the Responsible Agent
b) Initial intelligence gathering is crucial to success.

Phase 2: Scratch and Survey Searching

If the QR is unsuccessful, a large scale search effort must be initiated. The following operational phases will be described as if the CAP and the ASRC are working cooperatively on the search mission, with a mission staff organization as illustrated in figure 5-4.

During Phase 1, the CAP and ASRC MCs should have made plans for the possibility that a large search effort would be needed, so that a Base Camp can be established and Phase 2 can begin as soon as daylight and weather permit. If the CAP and ASRC have been called to participate in a search organized by the Responsible Agent and involving other organizations, the procedures of Phase 2 will be followed to ensure effective participation of CAP and ASRC personnel.

During Phase 2, the strategy will consist mainly of containing the search area and in survey and scratch searching. The details, of course, depend on the situation.

The Responsible Agent, the CAP and ASRC MCs, and representatives of other organizations coordinate to determine search strategy. The two primary parts of search strategy are (1) search area determination, and (2) the assignment of priorities for different segments of the search area.

1) The search area may be determined by several means
   a) Search theory and information concerning the victim's mobility may be used to calculate the search area
   b) Statistics may be used to predict a search area with a given probability of containing the victim
   c) A subjective estimate based on knowledge of the victim and the local terrain may be made, or
   d) The Mattson Consensus Method may be used to combine various estimates and to arrive at a weighted combination.
2) Segmentation of the search area and the assigment of priorities may be done in similar ways: theory, statistics, subjective judgement, or a combination of ways through the Mattson Consensus method.

Search area segments and priorities are plotted on a Strategy Map using standard symbols, and a desired search coverage for each is entered on the map, again using standard symbols.

The basic tactical unit in a lost person search is the Field Team; the command and support unit is the Mission Staff. Fixed-wing and rotor-wing aircraft are also used as tactical units, but usually do not present a large management problem due to the small numbers required for lost person search operations. The Staff assembles Field Teams (designated by letters) and deploys them on specific tasks (designated by members) in accordance with the search strategy. The Task Assignment Form (TAF; see figure 5-5) is used in assembling a team for a specific task. Phase 2 organization is shown in figure 5-4.

MISSION STAFF

The purpose of the Mission Staff is to provide the MCs and Responsible Agent with the freedom to work on strategy. The ASRC MC uses the Mission Staff to meet his responsibilities in coordinating the mission. On a small mission, the ASRC MC himself may discharge some or all of the staff duties. There are six of these.

APPALACHIAN SEARCH AND RESCUE CONFERENCE, INC. TAF

TASK ASSIGNMENT FORM

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

GEOGRAPHICAL FEATURE	MAP NAME

ASSIGNMENT

TYPE	DIFFICULTY 1 2 3 4 5 6

time

PERSONNEL

FTL__________ SR__________

MEDIC__________ SR__________

RO__________ SR__________

RS__________ SR__________

TOTAL

DR__________ SR__________

ATL__________ SR__________

EQUIPMENT

GROUP	INDIVIDUAL

TRANSPORT

COMMUNICATIONS

During Phase 2, the specific duties of the ASRC MC are

a) Maintaining liason with the CAP MC, the Responsible Agent, and leaders of other organizations in the operation
b) Coordinating with the Responsible Agent and the CAP MC on a choice of a location for the Base Camp
c) Debriefing the Quick Response Team Leader (QRL)
d) Continuing intelligence gathering
e) Planning strategy, with the advice and consent of the Responsible Agent (maintaining the Strategy Map)
f) Planning relief and support.

The specific duties of the CAP MC during Phase 2 are

a) Maintaining liason with the ASRC MC, the Responsible Agent, and leaders of other organizations in the operation
b) Coordinating with the Responsible Agent and the ASRC MC on the choice of a location for the Base Camp
c) Debriefing the aircrews of search aircraft
d) Arranging for continued air cover for the mission
e) Assisting the Responsible Agent and the ASRC MC in any way possible.

The Operations Officer (OO) is the ASRC MC's lieutenant. He is responsible for executing the search strategy and running the Base Camp and Operations Center. He supervises all other members of the Mission Staff. If a CAP Ground Operations Officer is appointed, he should work directly with the ASRC Operations Officer. The OO's specific duties are

a) General operational planning
b) Supervising task assignment (initiates the use of the Task Assignment Form)
c) Maintaining the Status Map
d) Briefing and debriefing Field Team Leaders
e) Maintaining the Operations Log
f) Enforcing security in Base Camp
g) Supervising the Mission Staff.

The ASRC Communications Officer (CO) is responsible for the effectiveness of all ASRC communications. He and the CAP Communications Officer, if one is appointed, should work together. The joint duties of the ASRC and CAP COs are

a) Directing the establishment, maintenance, and improvement of the communications network
b) Supervising the Communications Center and Radio Operators
    aa) Enforcing SOPs
    bb) Enforcing security at the Communications Center
    cc) Supervising log keeping
    dd) Maintaining the Communications Systems Chart
c) Advising the Mission Staff on communications matters
d) Advising the Equipment Officer (EO) on issue and maintenance of communications equipment
e) Providing communications instruction to Field Teams (this is accomplished using the TAF)

The Equipment Officer (EO) is respensible for the physical needs of the operation: equipment, transport, shelter, food, water, and sanitation. Some of the EO's duties are

a) Maintaining the Equipment Inventory
b) Issuing equipment to teams and collecting it (this is accomplished using the TAF)
c) Scheduling the use of vehicles

d) Coordinating the efforts of relief agencies (e.g. the Red Cross) to supply food and shelter
e) Advising the Mission Staff on matters under his control.

The Personnel Officer (PO) is responsible for all the people working with the CAP and ASRC in the operation. He should be able, at any time, to say where any particular person is, or whether or not a person of certain capabilities and personal equipment is available for team assignment. The PO's specific duties are

a) Registering all incoming searchers
b) Checking out all outgoing searchers
c) Maintaining the Personnel Roster
d) Maintaining the TAF File
e) Coordinating with ASRC Dispatch Officers and, through the CAP MC, with CAP units, in executing dispatch and relief plans
f) Assembling Field Teams (this is accomplished using the TAF).

The Field Team is the basic tactical ground SAR unit. Field team organization is treated in chapter 2.

Operational Problems

1) Task Assignment

A task is an attempt to solve a particular tactical ground SAR problem, generated by the search strategy. There are four basic kinds of tasks:

a) Support Task
   These are efforts to resupply or add manpower to teams in the field.
b) Communication Task
   aa) Relay: a radio operator who relays messages
   bb) Repeater: an automatic or semi-automatic relay station
c) Search Task
   aa) Scratch: search of a point or a linear feature
   bb) Survey: search of a large area from a single vantage point
   cc) Sweep: area search by a small team, wide spacing
   dd) Line: saturation search of an area by a large team
   ee) Containment: patrol of the perimeter of the search are in case the victim walks out.
d) Rescue Task
   aa) Rescue: extrication and medical stabilization
   bb) Evac: transportation of the victim to road or helicopter landing zone.

There are an infinity of variations.

Once a task need has been identified, the Operations Officer numbers it and enters a description on a Task Assignment Form (TAF). The other Mission Staff members then follow the standard task assignment procedure (on the TAF) to assemble a suitable Field Team with proper equipment and communications to execute the task. The FTL is summoned and briefed; he assembles his team; it gets a final briefing and departs from Base Camp.

If a task is identified which can be carried out by a team already in the field, a similar (but simpler) procedure is followed and the team is briefed by radio on its new assignment.

When a team returns to Base Camp, the FTL must be debriefed and the team must check in all its equipment with the EO before its task is considered complete.

One final point should be stressed: Phase 2 is distinguished by the almost exclusive use of small Field Teams of trained, clue conscious searchers.

Phase 3: Saturation Searching

Phase 3 begins as soon as the decision is made to begin saturation searching (whether or not scratch and survey searching is terminated). The organization of the operation changes very little at this time; it is the nature of the task which is different. The biggest change is the large influx of people (mostly untrained volunteers) and the subsequent dilution of Field Teams with inexperienced searchers. Even though volunteers may be available, Phase 3 search may be delayed due to problems of personnel management and clue destruction.

The ASRC and Virginia Wing, CAP do not have enough trained GSAR personnel to run a large scale saturation search. Consequently, volunteers will be needed during Phase 3. These are a mixed blessing. Often local people have a more thorough knowledge of the terrain than any CAP or ASRC people and the wise MC will exploit this knowledge. He will also be careful of it. The problem with volunteers is that they are inexperienced as searchers and must be taught search techniques on the spot. This teaching makes great demands on the leadership capabilities of CAP and ASRC GSAR people. During Phase 2, few volunteers should be employed by the CAP and ASRC except in containment tasks and in those special circumstances where a volunteer has a valuable expertise. During Phase 3, however, volunteers are completely indispensable.

The usual deployment of volunteers is in line searches. CAP and ASRC GSAR people provide leadership, communication and medical expertise, while the volunteers provide the bulk of the manpower. Specially skilled volunteers such as Hams and Rescue Squadsmen should be placed in positions where their skills can be utilized. CAP and ASRC GSAR team members must be particularly alert for safety problems.

Each incoming volunteer must register with the PO (using a Searcher Registration Form (SRF)), and be issued a Searcher Information Sheet (SIS) containing line search instruction, operational procedures and safety rules. The PO should endeavor to assign volunteers to Field Teams as soon as possible for the welfare and effectiveness of the volunteers.

Volunteers leaving the search must check out with the PO, and each FTL should take care to see that his volunteers do so.

Phase 4: Withdrawal

Phase 4 begins whenever the search is terminated, either because it has been successful or because it has been abandoned.

An orderly withdrawal is necessary so that no searchers get misplaced and so that the CAP and ASRC are ready for mobilization again as soon as possible. The withdrawal is carried out in three stages:

1. Withdrawal of volunteers. All volunteers must be accounted for, and since some can be counted on to fail to check out, CAP and ASRC GSAR people will be needed to track them down.
2. Withdrawal of CAP and ASRC GSAR searchers. Once the volunteers are checked out, the CAP and ASRC members begin withdrawing with their equipment. The procedure is the same as for a field team returning from a task, except that the team is released to go home rather than to rest in Base Camp. All searchers must check out with the PO and all equipment must be checked through the BO.
3. Staff withdrawal. Once all people and equipment are accounted for, the MCs should report to the Responsible Agent that all is well and then withdraw the staff. The mission is not completed, however, until all equipment is properly stored.

5.4 REFERENCES

Appalachian Search and Rescue Conference (ASRC): Operations Manual, Draft edition, ASRC. Alexandria. March, 1977.

---Search and Rescue Operations Plan (SAROP), First edition, ASRC. Alexandria. May, 1976.

Kelley, Dennis: Mountain Search for the Lost Victim, First edition, Search and Rescue Magazine. Montrose. 1976.

National Association for Search and Rescue: Paper # 77-1003. McCoy. "Pre-planning the Land Search Organization". 1977.
---Search Management Graphics. Survival Education Association, Tacoma. 1978.

CHAPTER SIX

MANAGEMENT

6.0 GENERAL

Effective management of the team during both field and home base operations is a prime responsibility of the leaders of any SAR team. Effective management requires team leaders who are capable managers at home base, as well as in the field. It should not be assumed that a good field team leader is necessarily a good manager for the team at home base, but since good field team leaders often end up managing the team at home base, it would be wise for them to study management. Such base management is a topic of vital interest to any team wishing to perpetuate itself, but although much has been written about the details of SAR techniques, little has been written in the SAR literature about management styles. However, SAR people may adapt from the detailed management studies done by large corporations, where proper management is essential for maintaining the corporation on an even keel financially.

This chapter focuses on five key areas team leaders should consider while running the team. The basic style of management the Wing GSAR Committee recommends is outlined, a model for team planning is duscussed, personnel appraisal and recognition are reviewed, and budgeting of resources is covered.

6.1 STYLES OF MANAGEMENT

Within the past fifty years, many styles of management have been proposed by professional managers and theorists. The basic model which offers the best method of managing a GSAR team, given the constraints of time, money, and the organization itself, is known as Management By Objectives and Results (MBOR).

This model states that the manager must first decide upon the major objectives of the organization, that is, specific results that are to be produced. This set of objectives should be in a form that is stated with (1) an action verb (e.g. run, will make), (2) a time frame (e.g. daily, weekly, within one year), and (3) a measurable outcome (e.g. six digits, 1000 hours of travel). An example might be that our rescue team (1) will respond to a mission alert within one hour of notification (2) at any time (3) with at least a full Class B team. Another might be that our team (1) will meet the (3) GSAR certification standards for Class B Quick Response Team by (2) January 1, 1979.

Having made the decisions about what the specific outcomes he wants, the manager begins to break the large goals into smaller units which can be accomplished by the team members. Example: In order for the team to be en route within one hour of a mission callout, James White will run the squadron rescue truck for fifteen minutes each week. Once having broken the large goals into specific objectives for the team members, the team leader can determine if, in fact, the results meet the objectives set for the team. There is a feedback loop built into this system which requires that if an objectives is not being met, the manager must determine if the objective was realistic, and if sufficient resources existed to accomplish it. If not, he must determine what needs to be done to correct the discrepancy, either by changing the allocation of resources or by adjusting the objective. A danger is, of course, that failure to meet the objectives can cause these objectives to be adjusted so often that the system becomes essentially meaningless.

A second concept which couples closely with MBOR is participatory management. In essence it means that team members have a say in determining what the goals/results are to be and thus "buy into" choosing and accomplishing them. This does not mean that the team membership does the managing, thus creating confusion, but that they must take part in the team's planning and choice of objectives. Since the CAP is a volunteer organization this becomes very important. If the manager fairly considers and uses the imput from team members, the team will be strengthened. If, however, he is arbitrary or clannish, the team will be weakened. It is important that all understand that the team leaders run the team, and member input is advisory only, especially during missions. Obviously you cannot be on the side of a mountain in the middle of an evacuation and stop to get a group concensus on what rope to use. But in the planning, choice of goals, and routine work of the team, all should participate.

6.2 A PLANNING MODEL FOR GSAR

Historically, units in Virginia have spent little if any time on effective planning. Certainly some have goals they want to meet or things they want to accomplish, but this by itself is not effective planning. It takes time and effort to plan properly, and this may seem wasteful to people who see it as time better spent in other ways. The idea of planning is not strange to most of us, but most of us rarely use it extensively in our daily lives. Not much credit is given for the time that it takes to plan something, because we are all oriented to results, and the relationship between planning and results is not intuitively obvious. The Rand Corporation, however, discovered that the overall length of time it takes to do a project is lessened when the initial period of planning is lengthened, up to a point. We in our crowded personal lives (which includes CAP activities) should take careful note of this. We simply do not have endless time. It is limited, and the more effective we are in the use of it the better our CAP mission will be performed and the more enjoyable our belonging to it becomes.

A model which works well for both team and personal planning is a derivative from the MBOR concept. The model described here has several parts, the first being the setting of broad team goals. This could come from a general meeting of the team membership, or in some way that produces a feeling of member participation. Such goals follow the format as mentioned above in the MBOR planning concept: (1) an action verb, (2) a time frame, and (3) a measurable outcome. Example: Our team (1) will purchase (3) a DF locator (2) by March 1, 1979. Once the goals the team has decided upon are listed, the team sets a relative priority for each goal. It is difficult for a team of ten people to accomplish all of their goals at once, so some consideration must be given to the order in which they are attacked. The goals will probably change over time, which is why it is a good idea to review them periodically.

Having done this, the team then breaks the major goals into short term objectives. These are things which must be done to accomplish the long term goal. Example: Write manufacturers about costs. Find out who makes DF locators. Etc. Then a time frame is given for the accomplishment of each activity, and each is assigned to a team member. It is then up to the team leaders to monitor their progress. An example of this sort of plan is attached.

You might decide to re-evaluate the process because something has happened which you were not aware of at the time. Example: The Wing buys twenty DF locators and distributes them; or a member fails to do his assigned job. This sort of planning is not "cast in bronze," and it must have the same feedback loop mentioned in MBOR to reassess the goals, objectives and progress towards them.

6.3 PERFORMANCE APPRAISAL

Any prudent team leader is concerned about performance of the team members. The same logical process discussed in the previous section can be followed to determine individual performance, provided the original MBOR concept has been utilized to set down the performance ideals for each team member. For routine conduct, it is possible to start then with any discrepancy between the ideal performance (as established by the objectives) and the actual performance. Assuming there is a discrepance, we can proceed to the question: Does the discrepancy make any difference? If the answer is yes, then we ask? Could the team member do the job if his or her life depended on it? If the answer is no, we have a training problem; if yes, we have another sort of problem: motivation. If it is a training problem, then we need to ask: Could the person do the task before? Did the person ever know how to do it? If the person could perform the skill before or knew the material, but has forgotten it, then the next question comes into play: How often is the skill used? If the skill is used infrequently, it is likely that performance will suffer. If the skill is practiced frequently it will be better retained. If the person never learned the skill in the first place, then a training program to teach the skill or knowledge may be required, or the performance objectives should be reassessed.

Before developing a training program it might be well to ask: Can the person possibly perform the skill? Does he have the physical or mental capability to perform the task? True, it is not always an easy question to answer, but it is important to ask it and answer it honestly. If he does not have the abilities, then you must change the job or change the person.

Another question in this series is: Does accomplishing the task mean anything to the person doing it? If it makes no difference to him whether or not the objective is accomplished, then you need to examine his understanding of the job; what, if anything, he perceives as a reward or punishment for doing it. In short, there is a need for a feedback loop here too. If he does the task routinely and you do not comment or correct him, he probably has no idea what is really needed, and as a result performance suffers.

A slightly different question is: What happens if he doesn't do the job? Nothing? Then he will stop doing it after a time, or his performance will drop off. Something as small as telling the person you are counting on him to do the job can make that difference.

If you have examined the person's performance in light of these questions, you should have an idea of what needs to be done to correct the problem, the problem being defined as the difference between the person's performance and the stated objective.

6.4 RECOGNITION

Since CAP members are volunteers, they have a need for recognition. The CAP has recognized this and created a variety of awards for achievement, performance, and learning. The GSAR team leader has only a few sorts of formal recognition available for him to give team members. He does have many different informal rewards and means of recognition that can be given.

Certainly the easiest and sometimes even the best is a "well done" when it is deserved. Nothing makes a team member feel better than personal recognition of their work. An occasional "pat on the back" or the "warm fuzzy" means a better working team. It is important that such things be given out fairly and based on merit. Undeserved praise, clannishness, or total lack of recognition may cause a team to dissolve in bitterness and internal feuds.

More formal awards in the way of plaques or certificates may be given when warranted. These should never be presneted in an off-handed manner, but in some sort of formal ceremony, even if this is around a campfire while spending the night in the field. These awards can be created and purchased or made by the team itself and if given fairly and for due cause can be an internal motivator.

Rather than getting involved in complicated book-keeping systems to track team members' performance, teams should keep their energy focused on their basic mission: providing aid to the victim. It is easy to get carried away with systems that reward for training and excellence in exercises, while neglecting the fact that performance on missions is the most important.

6.5 BUDGETING RESOURCES

One of the biggest problems most GSAR teams face is limited money; a closely related problem is limited equipment. The two usual sources of GSAR team money are the unit coffers and the team members' pockets. It is possible, however, to raise funds in the community and to gain equipment directly, but it takes good planning (such as the model previously developed) plus specific, reasonable objectives.

There is one resource that we all have which is limited: time. Thus it is vital that leaders be selective about their choice of team goals. Often a leader has several objectives he wants the team to accomplish. Tremendous energy is generated toward some goal, only to be suddenly sidetracked because a new idea, piece of equipment, or new menber with different skills comes into the unit. Thus suddenly the team is pursuing two or three goals and the result is usually exhaustion. It is wise not to get sidetracked with new goals unless there is a valid reason for doing so. Example: You have been working on your rescue vehicle. A considerable amount of time and energy has gone into the unit, and it is almost ready to roll. Suddenly your unit receives a large tent and a cooking range through Wing supply. "Gee," someone says, "Wouldn't it be great to have a field kitchen." So now, the team divides, and some are working on building the field kitchen and others are working on the truck. Both ideals or goals are good but both will now suffer and it will take longer to produce a finished product in both.

Supplies can often be gained by simply asking for them in a community. If you have a particular thing you want which is not tremendously expensive and is available you can ask for one. You may ask a number of people and get no, but if you ask long enough you'll probably get a yes. Note: You must sell the CAP program. What does your unit have to offer to this community? If it is only to save lives of aircrews and the town doesn't have an airport, folks may not get very excited. Member squads of the Virginia Association of Volunteer Rescue Squads raise many thousands of dollars each year, because the community can see what they do. Can it see what you do?

Equipment such as a vehicle will deteriorate without use, yet at the same time overuse shortens its useful life and opens the door to maintainence costs. Thus for effectuve budgeting you need to plan for a certain amount of wear and tear to keep things ready. Example: Running the squadron rescue truck up each week for fifteen minutes and taking it around the block a few times keeps the battery charged, the oil circulating, etc. However, driving it to and from each meeting might be too much use.

Effective budgeting also calls for looking at future needs, not just the present. With the use of the planning tools described, you can get a handle on what future team goals might be, and raise funds toward them. Be careful to avoid the old problem of saving for a frangus only to have someone get all excited about a dingus and have the team vote to buy the dingus (particularly if the dingus doesn't fit into your goals).

A final word of caution: most GSAR teams are oriented towards field work, and tend to slight activities not directly related to GSAR. Don't let this attitude keep your team from proper planning and management.

6.6 REFERENCES

Drucker, Peter. Managing for Results. Harper and Row, New York, 1964.

Kepner, Charles H. and Tregoe, Benjamin B. The Rational Manager. McGraw Hill, New York, 1965.

Lakein, Alan. How to Get Control of Your Time and Your Life. Signet, New York, 1973.

Mager, Robert F. and Pipe, Peter. Analyzing Performance Problems or "You Really Oughta Wanna". Fearon, California, 1969.

Williams, Paul. Mountain Rescue Leadership. Mountain Rescue Council, Seattle, WA: Fall, 1970.

LONG TERM GOAL	SHORT TERM GOALS	ACTIVITIES	WHO	TIME FRAME
Purchase an ELT locator by 1 Jan 1979	Obtain information on available ELT locator models by 1 Nov 1978	1. Write to L-tronics	Jones	10/15/78
		2. Check out other manufacturers	Jones	10/15/78
		3. Discuss ELT locators with Wing experts	Smallwood	10/1/78
		4. Compile data and make report to team	Jones	11/1/78
	Raise money to purchase ELT locator	1. Research effective fund raising methods for team	Franks	9/10/78
		2. Select fund raising techniques	Team	10/1/78
		3. Get permission from Wing Commander	Carter	10/15/78
		4. Schedule first activity	Carter	10/25/78

FIGURE 6-1: Example of a management plan

CHAPTER SEVEN

SURVIVAL AND WILDERNESS TRAVEL

7.0 GENERAL

The texts Surviving the Unexpected Wilderness Emergency and Fundamentals of Outdoor Enjoyment provide ample coverage of all of the standards for Level II GSAR certification, with the exception of some winter considerations, discussed in 7.1, conditioning for GSAR activities, discussed in 7.2, and hypothermia, discussed in Chapter 10. The related subject of personal equipment is dealt with in detail in Chapter 12. Those aspiring to the Level III GSAR standards should consult Mountaineering: The Freedom of the Hills and Winter Hiking and Camping for additional information concerning wilderness travel.

7.1 WINTER CONSIDERATIONS

The text Winter Hiking and Camping deals extensively with the process of coping with winter conditions. Level III GSAR team members should be familiar with much of this material. Level II GSAR team members should be familiar with some basic winter considerations not discussed fully in the Level II references. These are set forth below.

Wool. Only wool will retain warmth when wet, and wetness of all clothing is a situation that must be expected by winter travelers. Lots of wool clothing is necessary.

Dry. Wetness, even with wool clothing, is to be avoided. Ventilate well, avoid overheating, and brush snow off clothes before it melts.

Avoid frostbite. Frostbite may occur from direct skin contact with metal, so wear thin liner gloves to keep skin from freezing and sticking. Also, volatile liquids such as gasoline may cause instant frostbite if spilled on the skin.

Avoid trenchfoot (immersion foot). Prolongued exposure to cold, especially in wet-cold conditions, may cause tissue to die due to lack of blood. This may occur at temperatures above freezing, but will look like frostbite. The prevention is the same as for frostbite.

7.2 CONDITIONING

Ground SAR tasks may be demanding and physically strenuous, so GSAR team members must be physically, emotionally, and mentally prepared for such stresses. Physical conditioning is part of this preparation.

The most obvious reason for physical fitness is the ability to hike out on an assigned task, and to be able to carry it out without being excessively fatigued. One of the less obvious reasons is for individual and team safety. A fatigued person's senses, agility, and resistance to illness and injury (e.g. hypothermia) are extremely diminished. Another reason for conditioning is the confidence it creates.

There are 3 aspects to fitness for GSAR: strength, flexibility, and endurance. Strength is of obvious importance, but is useless without the flexibility required to use strength effectively. Endurance requires the provision of oxygenated blood to the working muscles. In order to accomplish this effectively, the cardiovascular and respiratory systems must be built up by endurance training. Long, hard exercise without rest breaks is necessary to build endurance.

Conditioning for GSAR tasks will make SAR tasks easier and will produce additional benefits in terms of personal health and fitness.

7.3 REFERENCES

American Petroleum Institute: Staying Alive in the Arctic, 2nd. ed. American Petroleum Institute, Washington, D.C. 1976.

Danielsen, John A.: Winter Hiking and Camping, Adirondack Mountain Club; Glens Falls, NY. 1977.

Department of the Air Force: Search and Rescue Survival, AFM 64-5. U.S. Government Printing Office, Washington, D. C. August, 1969

Department of the Army: Survival, Evasion, and Escape, FM 21-76. U.S. Government Printing Office, Washington, D. C. March, 1969.

Fear, Gene: Surviving the Unexpected Wilderness Emergency, Survival Education Association, Tacoma, WA 1972.

Fear, Gene and Mitchell, Jim: Fundamentals of Outdoor Enjoyment, Survival Education Association, Tacoma, WA 1977.

Ferber, Peggy: Mountaineering; The Freedom of the Hills, The Mountaineers, Seattle, WA 1974.

Fletcher, Colin: The New Complete Walker, Alfred A. Knopf, New York, NY 1975.

Greenbank, Anthony: The Book of Survival, Signet-New American Library, New York, NY 1967.

Manning, Harvey: Backpacking One Step at a Time, Vintage, Random House, Seattle, WA 1973.

Osgood, William and Hurley, Leslie: The Snowshoe Book, Stephen Greene Press, Battleboro, VT 1978.

Roberts, Harry: Movin' Out, Stone Wall Press, Lexington, MA 1975.

Tacoma Mountain Rescue Unit: Outdoor Living, Tacoma, WA

Van Lear, Denise: The Best About Backpacking, Sierra Club Totebook, San Francisco, CA 1974.

CHAPTER EIGHT

LAND NAVIGATION

8.0 GENERAL

Any GSAR task will employ at least some of the land navigation techniques described in this chapter. Land navigation skills may well be the key to survival in some outdoor emergencies; therefore, every GSAR team member should take care to learn and maintain his or her personal land navigation skills, for personal survival value, if for no other reason.

Land navigation is an art requiring knowledge of the proper use of map and compass. However, this alone is not sufficient; good land navigation also requires the ability to apply navigation concepts in the field. No amount of practice with map or compass alone will guarantee proficiency in land navigation. Cross country travel with map and compass is perhaps the best way to become proficient, and Orienteering (described below) is an ideal way to get this experience.

This chapter will discuss maps and grid systems, compasses, Orienteering, and several specific navigation techniques. The chapter is designed for a reader having studied the U. S. Geological Survey pamphlet "Topographic Maps", or having equivalent knowledge.

8.1 TOPOGRAPHIC MAPS AND GRID SYSTEMS

8.1.0 General

Maps are necessary for any land navigation. A map is defined as a symbolic representation of the terrain features of a given area, and it may take one of many forms. A mental map derived from past experiences, a pencil sketch and verbal description, or an aerial photograph, all could be used for navigation. However, the best map for general land navigation on foot is one of the <u>topographic maps</u> put out by the U. S. Geological Survey (USGS). Such maps are available for all of Virginia.

A common problem in ground search and rescue is the accurate transmission of geographic position information using voice communications (e.g. radio). To facilitate this process, various systems have been developed for reporting position, most of which are <u>grid systems</u>. Although there are a great many such systems in use, only those of major importance to GSAR personnel will be presented here. These are:

1. <u>The Latitude and Longitude System</u>. Although this is the oldest and most widespread method of indicating position, it is not useful for GSAR, as accuracy of a hundred meters may be vital to GSAR teams. An understanding of it is essential to most other grid systems used for SAR, and it may be used as a reliable but slow last resort.

2. <u>The "Second G in George Washington" System</u>. This system works only when the same map is available at both ends of a communications link. The position is specified by referring to details printed on the map. For example: "We are at a point on the 1580 foot contour line where an intermittent stream crosses it, which is about 2½ inches northeast of the second G in the words George Washington National Forest where they are printed in the top left corner of the map." This system, if it can be called a system, is cumbersome, subject to error, and useful only when a large supply of identical maps are available.

3. <u>The Uniform Map System (UMS)</u>. This system is the "official" SAR grid system, such that there can be an official system, and it incorporates the grid system long used by the CAP. It requires the use of pregridded maps, but is quick and easy to use. It is primarily used for downed aircraft search, and is described in section 8.1.2.

4. Lost Person Search Gridding. Lost person search operations are usually confined to a relatively small area. For position reporting during such missions, accuracy is essential, and none of the systems described above can provide such accuracy without becoming complex and confusing. Field Team Leaders are usually provided with a photocopy of a portion of a $7\frac{1}{2}$ quad, and it is common practice to put a 100 meter grid on the photocopy map, by means of a gridded overlay. Every Field Team Leader, and Base Camp, then has a common large-scale grid system for accurate position reporting.

5. Position and Azimuth (Bearing). Pilots may give GSAR teams position coordinates in terms of an azimuth (a compass direction, or bearing) and distances; or in the form of several azimuths to be used for resection (see section 8.7.2). Such azimuths are usually given from navigational aids called VORs, which are named and identified on aeronautical charts (sectional charts), but not shown on most other types of maps.

8.1.1 Topographic Maps

Topographic maps ("topo maps") provide information as to the actual shape of the land surface by means of brown contour lines. At first glance, these lines will probably seem meaningless or confusing to the untrained map reader. However, to one used to such maps, the contour lines provide a wealth of information, and make the terrain "leap out" as if he were looking at a scale model of the area. Rapid interpretation of contour lines takes practice, but the skill is easily retained.

The USGS publishes a folder entitled "Topographic Maps" which serves as an excellent introduction and reference to topographic maps, and which is available from the USGS at little or no cost. The reader is urged to refer to it at this point, as the remainder of this chapter will assume familiarity with its contents.

Every 7'30" x 7'30" quadrangle ($7\frac{1}{2}$ quad) has certain border information which is of great importance. As an example, we will consider the Waynesboro East $7\frac{1}{2}$ quad, shown in Figure 8-1. Explanation of the relevant border information is given below.

1. Name. Each map is designated by a unique place-name, a series, (e.g. $7\frac{1}{2}$ minute topographic series), and by the state(s) which have land shown on the map. This information is found in the upper right corner.

2. Date. In the lower right corner, the map name is reproduced, along with some index numbers. A map date is given, which represents the completion date of the map. (See also number 7).

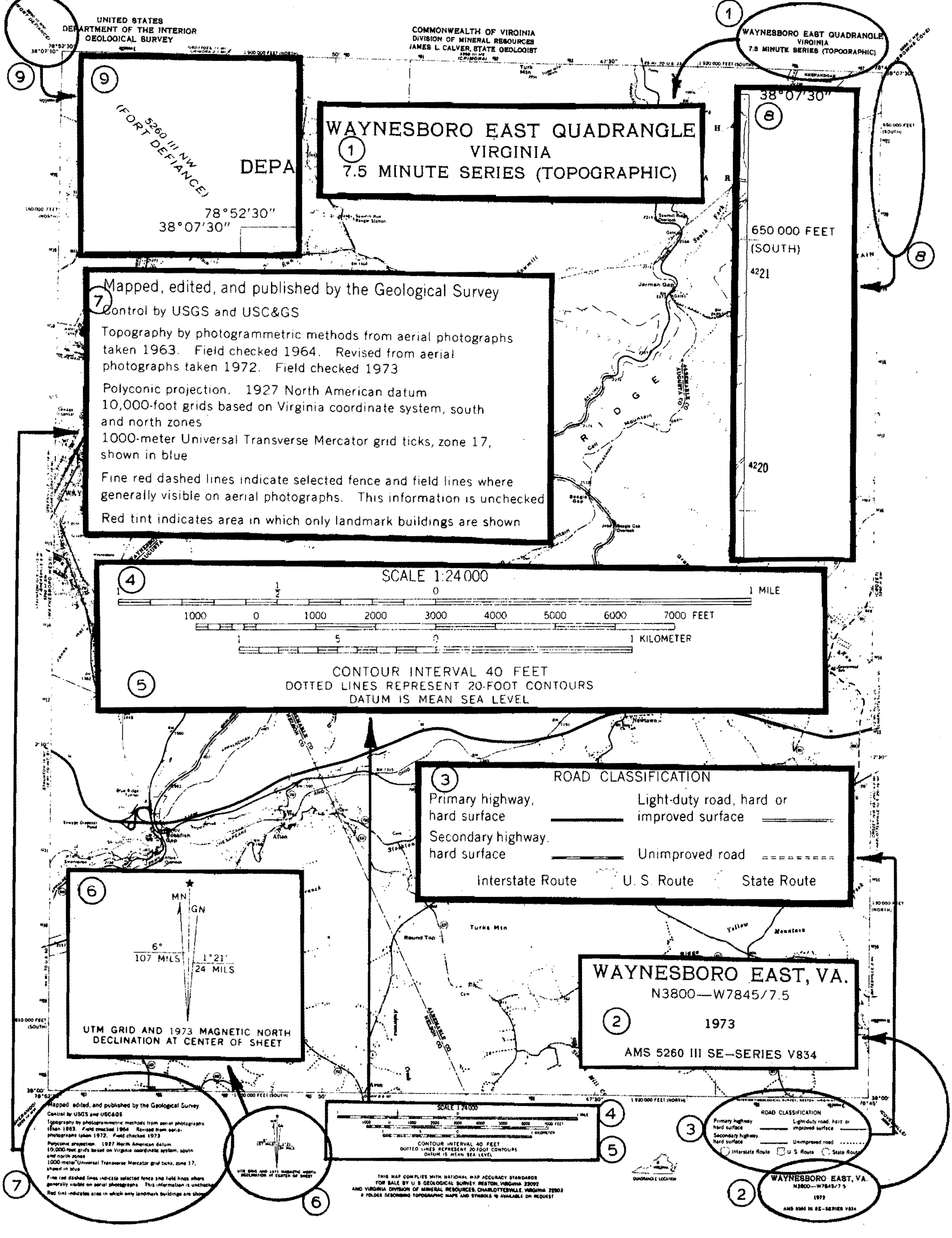
3. Road Classification. Directly above the name and date (number 2), a key to the road symbols is given. This is not the complete topographic map legend; the legend is issued separately, and is shown also on pages 20-21 of "Topographic Maps."

4. Scale. At the bottom center of the sheet, the map scale is indicated in two ways. First, the ratio of map distance to actual distance is given, 1:24,000 being standard for $7\frac{1}{2}$ quads. Second, a graphic scale of miles, feet, and kilometers is displayed. Directly under the scale is notation of the contour interval used.

5. Contour Interval. The contour interval is the elevation difference between adjacent contour lines. If additional supplemental (dotted) contour lines are used, their use is usually shown here.

6. Declination. A set of three arrows is shown, which indicate the directions of grid north (GN), magnetic north (MN), and map ("true") north (star). These arrows indicate a general direction only and should not be used for orienting a map. The measure of each declination angle (true-magnetic and true-grid) is provided in de-

FIGURE 8-1: USGS Topographic Quad Border Information



grees and in mils. (There are 6400 mils to 360°.) For this map, the magnetic declination is 6° West, meaning that magnetic north is six degrees west (counterclockwise) of true or map north. Note that grid north and map north are not the same; map north is "true" north, and the edges of the map are lined up map north-south and map east-west. Grid north refers to north in the Universal Transverse Mercator (UTM) grid system, which is no importance for routine land navigation. Also, the phrase "at center of sheet" under the arrows serves to remind us that declination may vary from one part of a map to another. In Virginia, this variation across a map is usually a small fraction of a degree, and may be ignored for our purposes. However, large changes in declination may be brought about by the presence of a ferromagnetic body, such as an outcrop of iron ore, a scrap of metal on the ground, or a belt buckle brought near the compass.

7. Mapping Information. This information expands on the bare fact of the map date, providing information as to when and how the mapping was carried out. Additional information concerning the map is often given here.

8. Edge Information. Around the edge of the map are blue and black "ticks" which key the map to the UTM and Virginia grid systems, respectively. These are of little importance for GSAR. Shown also are markings and ticks indicating latitude and longitude; care should be taken not to confuse the latitude/longitude ticks with those for the two grid systems.

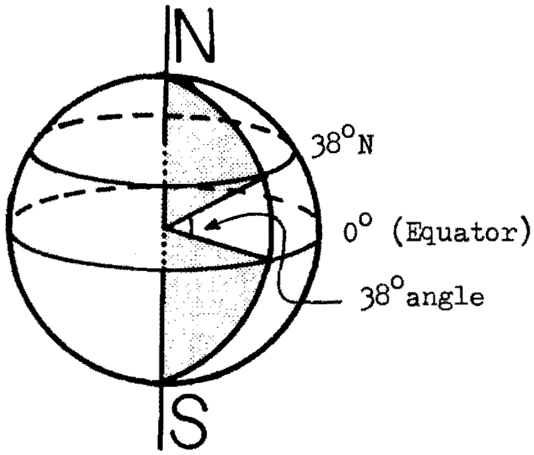
9. Key to Adjacent Maps. In the center of each side of the map, and at each corner, a map name is printed in parentheses and italics. This provides the map user with the names of all surrounding quadrangles.

8.1.2 Latitude and Longitude

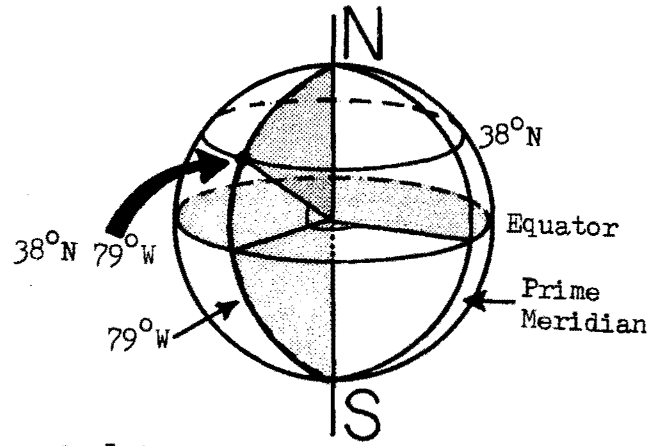
The coordinate system for the earth's surface known as latitude and longitude has international acceptance. The words are Latin: Romans referred to the direction along the axis of the Mediterranean Sea as longitude, and the direction across it as latitude. Latitude now refers to a point's north-south position on an arc (actually, close to a half-circle) drawn from the north pole to the south pole. All such arcs may be divided into degrees, as can any part of a circle, and there are therefore 180 degrees (180°) in each such arc. (There are 360° in a full circle.) The latitude of 0° is arbitrarily set at the equator, and latitude is described as being north or south of the equator. Thus 90° north is at the north pole, and 90° south is at the south pole. If all points of equal latitude were to be connected by a line, a circle would result which is referred to as a parallel. An example of this is shown in figure 8-2a.

If any line of latitude describes a circle, then we may again use degree measure to refer to points on this circle. For reference, all points along a north-south arc through Greenwich, England are referred to as being at a longitude of 0°. This north-south line of 0° longitude is referred to as the Prime Meridian, and all other north-south lines are referred to as meridians, as shown in figure 8-2b. Longitude is measured in degrees east or west of Greenwich; therefore, 180° east and 180° west both describe the same meridian, which is at the exact opposite side of the world from the Prime Meridian going through the Royal Observatory at Greenwich.

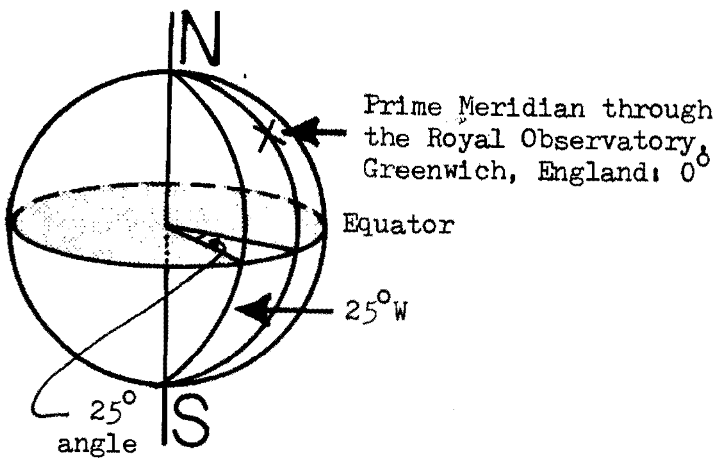
A location may then be totally and precisely located by its latitude and longitude, as illustrated in figure 8-2c. When locations must be specified to greater accuracy than one degree, divisions of degree measure called minutes and seconds of latitude and longitude may be used. One degree may be divided into 60 minutes, and one minute may be divided into 60 seconds, or $1^{\circ}=60'=360''$.



a. Latitude 38° North



c. Latitude and longitude 38°N 79°W



b. Longitude: Prime Meridian (0°)
and 25° West meridian

FIGURE 8-2:

Latitude and longitude

8.1.3 The U. S. Geological Survey Topographic Map Series

The United States Geological Survey (USGS) publishes maps, including the topographic series. Topographic maps are published at three primary scales which may be encountered by GSAR personnel.

<u>1:250,000 Series</u>. These maps cover an area 1° x 2°, at a scale of approximately one inch to about four miles. Most such maps for Virginia are not up to date as far as road and culture information are concerned, and are not very useful for localized search operations due to the small scale. As a supplement to a state highway map, they are very useful in downed aircraft search operations.

15' Quadrangle Series ("15 minute quads") are published at a scale of 1:62,500, or approximately one inch to a mile. Each quad covers an area 15' by 15', as may be inferred by the name. These maps are quite useful for many types of search operations, as the scale is large enough to be of use in small area operations such as lost person search, but small enough in scale to be useful for search operations covering a larger area. Unfortunately for GSAR teams, the USGS is gradually replacing all 15' quads with 7½' quads, and few 15' quads are still available for Virginia.

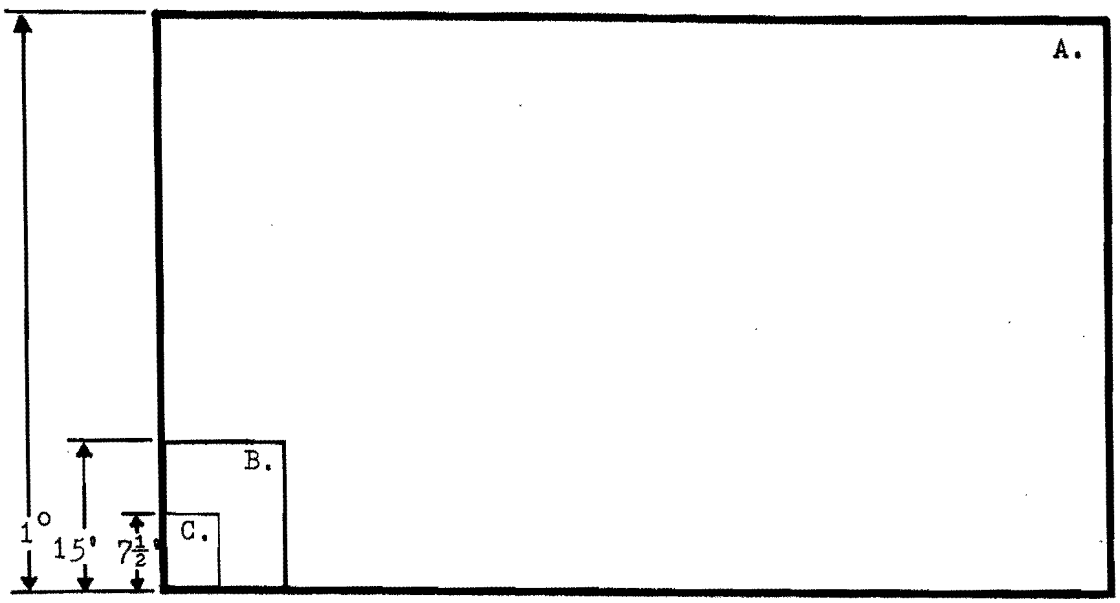


FIGURE 8-3: Relative Coverage of 3 USGS Topographic Map Series Sizes. A: 1:250,000 Series (1° x 2°) B: 15' x 15' Quadrangle Series (1:62500) C: 7'30" x 7'30" Quadrangle Series (1:24000)

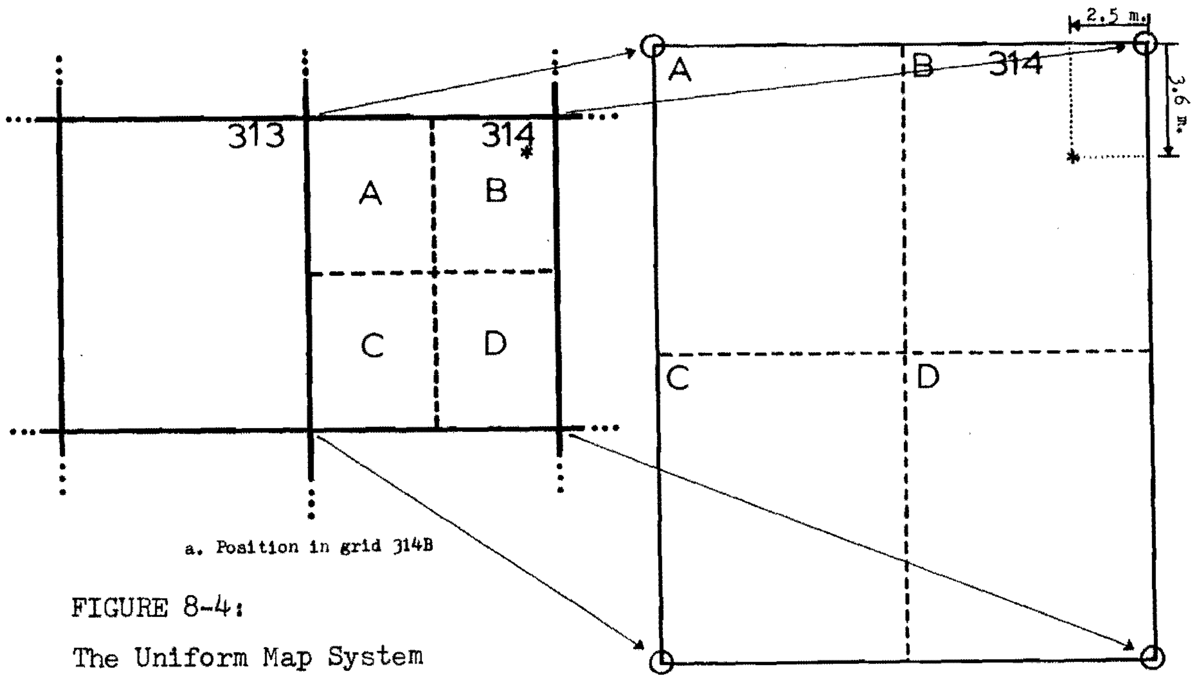
7½' Quadrangle Series ("7½' quads") are published at a scale of 1:24,000, or about 2½ inches to the mile, and are available for most of Virginia. These maps are quite detailed, and are ideal for lost person search or close-in downed aircraft search. One problem with 7½ quads is that they are somewhat unwieldly when more than one is required, as it is often difficult to find space to spread them out in the field. Another problem is that although it takes four 7½ quads to cover the same area covered by a 15' quad, the cost of an individual map is the same. Acquiring enough 7½ quads to cover an area can be quite a financial burden to a GSAR team.

The relative coverage and shapes of each of these series is illustrated in figure 8-3.

8.1.4 The Uniform Map System (UMS)

The Uniform Map System (UMS) is the official SAR grid system. CAP members are fortunate in that this system incorporates the standard grid system used by the CAP for years.

The UMS is based on the standard Sectional Aeronautical Chart (scale 1:500,000). Each chart is gridded into 15' x 15' quadrangles, and each quadrangle is assigned a number, from left to right and top to bottom, across the chart. Each quadrangle, or "grid" as it is usually called, may be further subdivided into four quadrants, although this is not usually done on sectional charts. Each quadrant is assigned a letter as shown in figure 8-4a. Thus, any individual $7\frac{1}{2}$ quad in the country may be specified by (1) a sectional chart name or abbreviation, (2) a number up to three digits, and (3) a letter. Thus the X in figure 8-4a nay be referred to as being in grid Washington 314B. Further specification of position is provided by specifying the distance in miles from the nearest 15' (as opposed to $7\frac{1}{2}$') quadrangle corner, giving the horizontal (east-west) distance first, then the vertical (north-south) distance next. This is illustrated in figure 8-4b, where the position of the X may be given as Washington 314B 2.5-3.6. Note that the horizontal distance is always given first, and that the horizontal distance may be east or west, depending on the quadrant (A,B,C, or D) of the grid. Similarly, the vertical distance is always last, and may be north or south from the 15' quad corner. The reason for this seemingly bizarre choice of reference is that most gridded maps have lines only at 15' intervals, and it is difficult to measure distances from the center of a grid's side, or worse, the center of a grid, when these are not marked accurately in advance. Specific instructions for the assignment of grid numbers are given in Attachment 10 to the CAP Emergency Services Manual (CAPM 50-15).



a. Position in grid 314B

FIGURE 8-4:

The Uniform Map System

b. Position coordinates grid 314B 2.5, 3.6. Note that distances are measured from circled corners.

8.2 COMPASSES

8.2.0 General

A compass is a device used to determine direction. There are many types of compasses, but the only type of compass to be considered here is the magnetic compass. A magnetic compass has two primary parts: (1) a magnetic needle, and (2) a suspension of some sort, to allow the needle to turn freely. A simple and workable compass could consist simply of a magnetized needle suspended on the surface of a cup of water. Many additional features may be added, depending on the purpose of the compass.

The earth has a magnetic field, with north and south poles, as does any magnet. The north magnetic pole, however, is not at the same location as the "true" rotational north pole; magnetic north is located in northern Canada. The magnetic poles are the origins of magnetic "lines of force" which extend from one pole to the other. A compass needle will line up along these lines. The direction of the lines is seldom that of the north-south on a map. The displacement of magnetic and "true" poles contributes to this, as do local effects such a large iron ore bodies. One may measure the angle between these lines and the "true" north-south direction; this is the magnetic declination (see figure 8-5). In Virginia, this declination is approximately $5\frac{1}{2}^{\circ}$ west. (Each map gives a declination for that particular map.) The declination may be affected by ferromagnetic materials held near the compass.

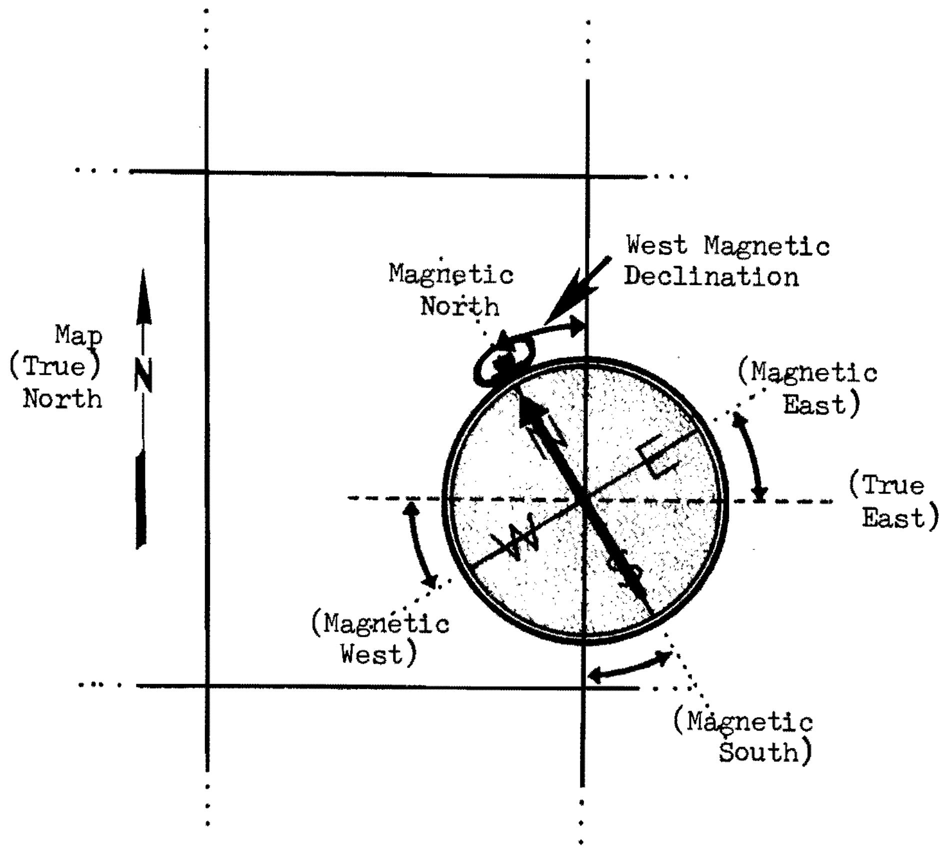


FIGURE 8-5: Magnetic Declination

8.2.1 ORIENTEERING COMPASSES

Orienteering type compasses are well suited for the land navigation tasks required of GSAR personnel. An orienteering compass (see figure 8-6) has three major parts: (1) a magnetic needle on a bearing, (2) a central transparent needle housing with parallel lines on it, and degrees marked around the edge, and (3) a rectangular transparent base with a direction of travel arrow on it. There are three arrows on this type of compass: (1) the magnetic needle, (2) an arrow parallel to the lines in the needle housing, and (3) the direction of travel arrow on the rectangular base.

8.2.2 LENSATIC COMPASSES

The lensatic compass is widely used by the military, and may be used for orienteering and land navigation in general; however, the orienteering type is easier to use for most land navigation tasks. The lensatic compass (see figure 8-7) has the following main parts: (1) a magnetic needle, which is actually a disc with degrees marked on it, (2) a compass housing in two parts, the top of which has a hairline, and provides a straight edge parallel to the hairline, and (3) a moveable luminous line. Thus, as with the orienteering compass, there are three arrows: (1) the magnetic needle, (2) the compass housing hairline, and (3) the moveable luminous line. A lensatic compass may be used in a manner similar to that of an orienteering compass; specific instructions are given in subsequent sections. However, some lensatic compasses do not have a straightedge along the side of the case, which makes their use for navigation (as explained herein) extremely difficult.

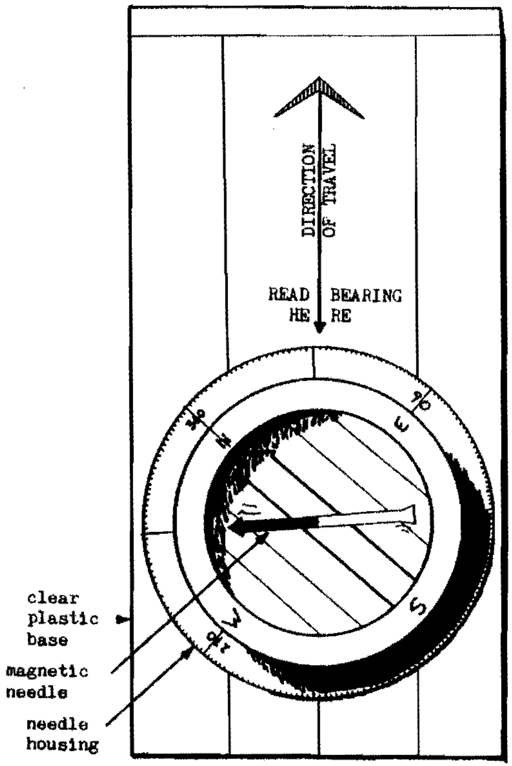


FIGURE 8-6: The Orienteering Compass

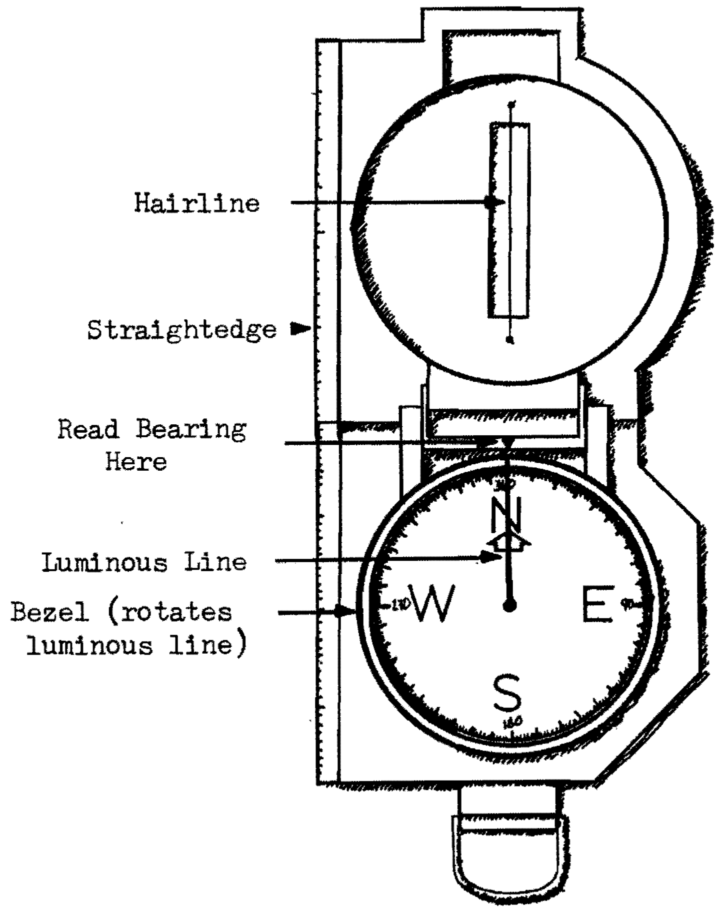


FIGURE 8-7: The Lensatic Compass

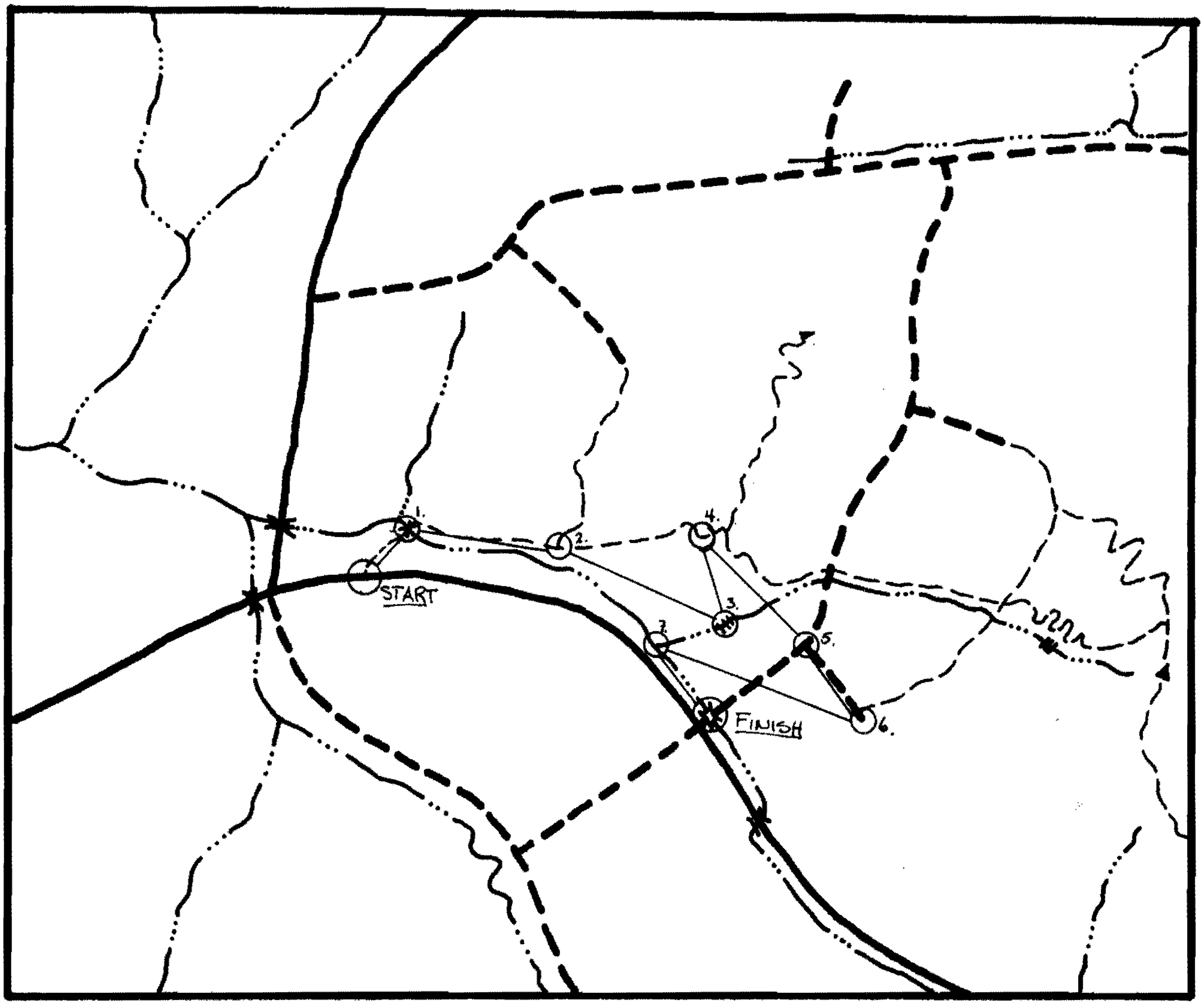
8.3 ORIENTEERING

8.3.0 General

Orienteering is an outdoor sport, originally from Scandinavia, which has gained a large following in the U.S. It involves a timed map and compass course, which requires of contestants good physical condition, map reading and compass skills, and the ability to make optimum route choices. Orienteering offers an opportunity to practice the majority of land navigation skills required for GSAR tasks. In addition, the concepts and techniques developed by and for orienteering are useful in almost any kind of land navigation problem.

The U.S. military services use orienteering as a vehicle for teaching land navigation skills, and the Army and Marine Corps orienteering teams are among the world's best. Much of the material in this section is adapted from military orienteering teaching materials.

The simplest type of orienteering course is a point-to-point course, as illustrated in figure 8-8. Contestants copy points from a master map onto their own, and are to go to each point in the order given. At each point, the contestant will find



KEY

	Streams; falls
	Trail; peak
	1st class road; bridge
	2nd class road

FIGURE 8-8: Point-to-point Orienteering Course

1. The footbridge
2. The trail junction
3. The waterfall
4. The trail switchback
5. The road junction
6. The road end
7. The stream junction

a marker, usually with a special paper punch, and is expected to document finding the marker by punching his ticket. The person completing the course (i.e. showing up at the end with a ticket with punchmarks for all markers) in the least time is the winner. There are many other types of orienteering courses, and the interested reader is referred to Kjellstrom's book <u>Be Expert with Map and Compass</u> for a discussion of them.

8.3.1 Orienteering Concepts

The concepts discussed in this subsection are central to the sport of orienteering, and will be of use in any type of land navigation task. Since some concepts are difficult to explain in prose, the reader is urged to make use of the illustrations in figure 8-9. Numbers refer to examples shown in figure 8-9.

Bearing. Also known as an azimuth, a bearing is simply a direction specified from true north (a true bearing) or from magnetic north (a magnetic bearing). For example, a true bearing of 90^o is due East.

Northing Lines. (1) Many maps designed primarily for orienteering are often published with magnetic north-south grid lines across them. These lines, put there to simplify obtaining magnetic bearings from the map, are called northing lines.

Catching Features. (2,3) The bigger an object is, the easier it is to find. This principle applies to orienteering as well. Rather than trying to navigate a compass course directly to a small target, it is often easier to navigate first to a large linear catching feature, then to navigate further to the target.

In orienteering, it is customary to divide navigation into different types, based on the difficulty involved. The first stage of navigation from one point to another is known as rough orienteering or the "green segment", where often the only route description would be a rough direction, such as "east". Once the selected catching feature is reached, standard orienteering or the "green segment" is used. Often this may consist of nothing more than following along a catching feature such as a trail or stream for a while. Such catching features that lie roughly parallel to the intended route of travel are called "handrails". Sometimes, a catching feature on the far side of a target is selected, to "catch" oneself if the target is missed. Also, it may be easier to go to a catching feature on the far side of the target, then navigate back to the target, rather than to aim directly for the target.

Attack Points. (4,5) The final part of navigation to a target, known as precision orienteering or the "red segment", involves careful use of compass and pacing. Since following a compass course precisely is difficult, and errors increase with increasing distance, the distance to be precisely navigated must be minimized by the use of catching features. When selecting catching features, and planning a route in general, you must look for attack points, points that may be precisely located both on the map and in the field. In general, the attack point closest to the target should be chosen, even if it is on the far side of the target, in order to minimize the distance of the "red segment".

Aiming Off. (6) A "T" intersection of one sort or another is occasionally selected as an intermediate target or attack point. If one is approaching the intersection from "above" the T, one will probably come out somewhere along the "top" of the T, with no clue as to whether the intersection is to the left or right. To avoid this problem, it is simple to aim off to one side or the other. In this way, the way to turn once one hits the top of the T is known. For example, if one were deliberately to steer a course 5^o to the left (5^o less than the bearing directly to the intersection), one would immediately turn right upon reaching the top of the T, and soon reach the intersection.

Collecting Features. It is not advisable to strike off on foot along a bearing towards a target, without having some idea of the distance involved. It is possible to be on the right track to reach the target, only to turn back too soon for fear of having overshot it. To avoid this type of problem, one must maintain a constant knowledge of one's position. There are two primary methods for doing so, pacing,

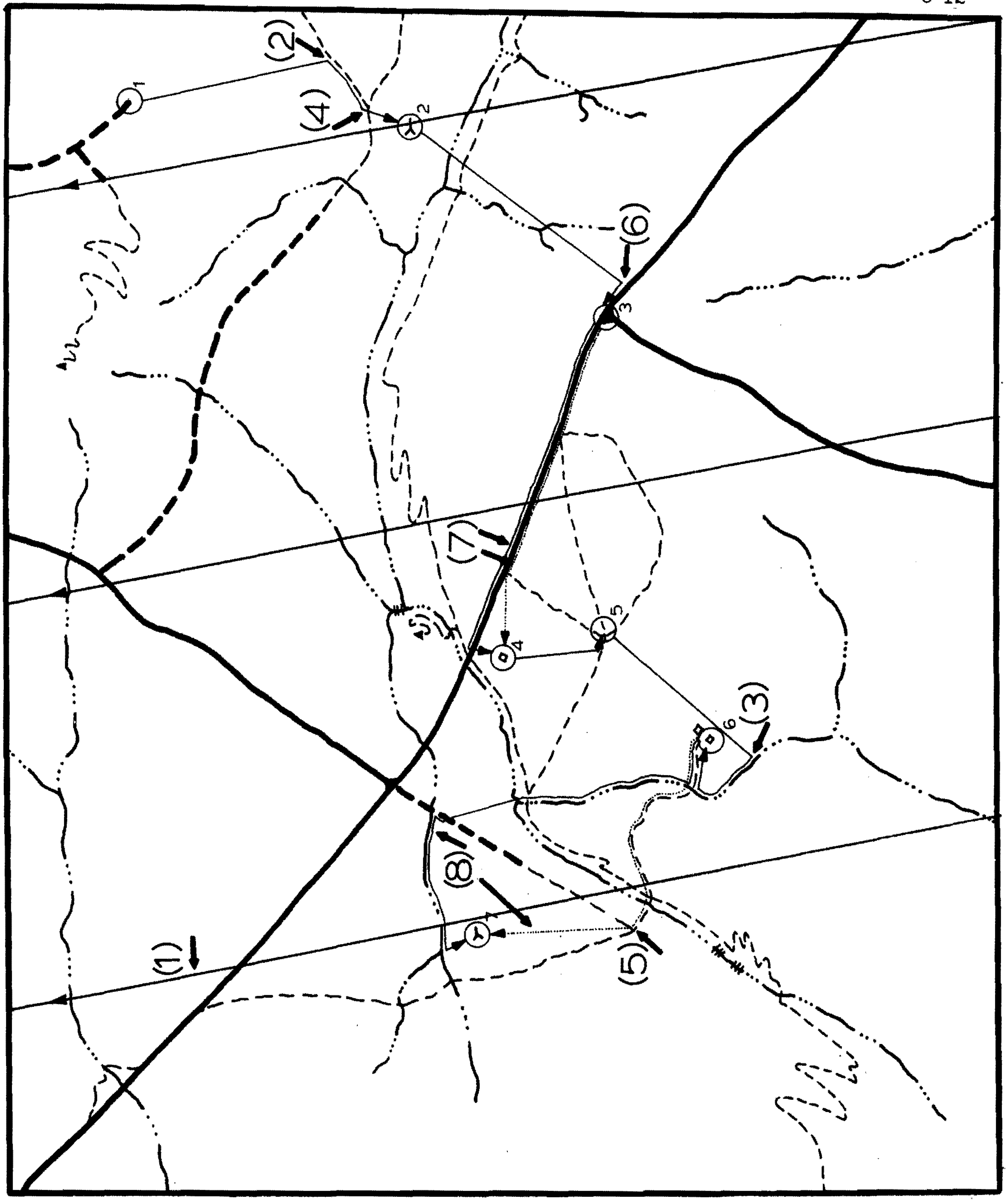


FIGURE 8-9: Orienteering Concepts   Small numbers are target point numbers; large numbers in parentheses are keys to explanations in the text.

which is discussed in a subsequent section, and collecting features, which will now be described. Collecting features refers to the act of preparing a mental list of landmarks along a planned route. As each is passed, it is checked off the mental list. Thus, a close check is kept on one's position. If a major feature is apparently out of place on the list, or missing, it is time to stop and reassess one's position and route.

Backwards Route Planning. (7,8) In general, one should plan a route from target to starting point, rather than from starting point to target. This is due to the ease of selecting good attack points when planning "backwards". Examples of four routes, two planned forwards and two planned backwards, are given in figure 8-9 (7,8). The dotted lines (from station 3 to 4 and 6 to 7) represent the forwards-planned routes which contain longer red segments (precision navigation) to the target.

8.3.2 Route Selection

Proficiency in the art of route selection is necessary for GSAR personnel. The ability to evaluate routes for speed, distance, and difficulty is not only required for GSAR navigation tasks, but is an important survival skill as well. Route selection skills may easily mean the difference between a half-hour hike and a half-day bushwhack.

A good route between two points will usually minimize the use of the compass. An experienced orienteerer will run a basic level orienteering course with little or no use of the compass. (However, even the most experienced GSAR team member will find occasions requiring the use of a compass.) One of the major considerations in route selection is that of elevation gain. As a general rule of thumb, twenty-five feet climbed is the equivalent of 100 meters (approximately 300 feet) of level foot travel, in terms of energy expended. Another consideration is that of vegetation. If one is confronted with a patch of brush, a choice must be made between pushing on through the brush, or going around it. Although it is difficult to provide a quantitative expression for difficulty due to brush, the following table will provide a rough indication of travel times for two and one half miles of level foot travel:

path or road:	one hour
light vegetation:	two hours
open woods:	three hours
dense forest:	five hours
laurel/rhododendron:	ten hours.

Specific terrain features such as cliff bands, rivers, and marshes may influence difficulty and travel time.

Route selection is perhaps the one most important skill for GSAR land navigation, and is one of the most difficult to learn. One of the best methods to develop a facility for route selection is to participate often in orienteering meets. Many areas have orienteering clubs sponsoring regular meets; GSAR team members are encouraged to seek out these activities.

8.4 DETERMINING A BEARING

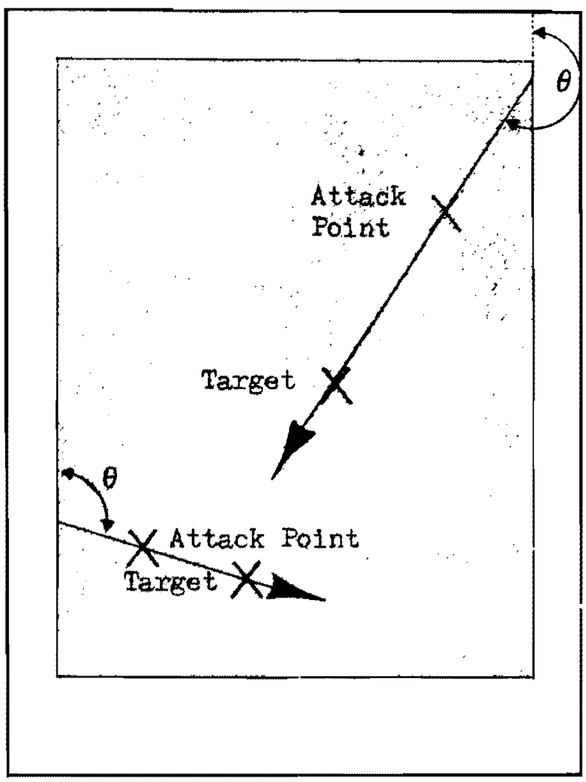
8.4.0 General

Given a starting point and a target on a map, one must select a route between the two, using the concepts porvided in the last two sections. Sometimes it will be necessary to plot and follow a direct bearing from an attack point to a target point or catching feature. This section will discuss how to arrive at a proper bearing between two points plotted on a map.

8.4.1 Map, Protractor, and Straightedge Method

One may derive a true bearing from a map with a protractor and straightedge, as follows: (this procedure is illustrated in figure 8-10)

1. Draw a line from attack point to target, and extend it until it meets a north-south line on the map (e.g. the map edge).
2. Using the protractor, measure the angle formed between map north and the desired line of travel, measuring clockwise. Take care not to measure the angle from north to the line of travel <u>backwards</u> from target to attack point.
3. This angle is a true bearing from attack point to target; a declination correction must be added or subtracted to obtain a magnetic bearing for use in the field.



1. Using straightedge, extend line connecting starting point (attack point) and target to a map north-south line.

2. Using protractor, measure angle from map north to intended travel direction (two examples shown).

3. The angle measured is a true bearing; add or subtract the proper magnetic declination correction to obtain a magnetic bearing for use in the field with a magnetic compass.

FIGURE 8-10: Protractor/Straightedge Method for Determining Bearings

8.4.2 Magnetic Declination

Since true bearings and magnetic bearings are not equivalent, except in a very few locations, one must be able to convert from true bearings (as from a topographic map) to magnetic bearings (as taken or used in the field with a magnetic compass) and vice versa.

Declination is the difference between true north and magnetic north, or for that matter the difference between any two corresponding true and magnetic bearings (a point worth several minutes of thought, if it is not immediately clear). Declination is specified as being east or west. West declination, as in Virginia, means that a magnetic needle will point slightly to the west of true north. In terms of degrees, (where $0^\circ = 360^\circ$ = north, 90° = east, 180° = south, 270° = west), true north is a few degrees more (i.e. clockwise) than magnetic north, and magnetic north is of course a few degrees less (i.e. counterclockwise) than true north. Similarly, magnetic east is a few degrees less than true east, and true west is a few degrees more than magnetic west. Thus when converting from a magnetic bearing (e.g. one obtained from triangulation in the field) to a true one (e.g. to be plotted on a map), one must subtract the declination. Similarly, when converting from a true bearing to a magnetic one (as when taking a bearing off a topographic map for use in the field), one must add the declination.

A final example will be given to give a better intuitive understanding of declination. Let us say that we are considering a bearing from point A to point B, as shown in figure 8-11. We may then assign to this actual line of travel a true bearing, which is the number of degrees from true north to the line of travel, measured clockwise from true north. Similarly, we may assign to the line of travel a magnetic bearing, which is the number of degrees from magnetic north, again measured in a clockwise direction. We see that the magnetic bearing is a larger angle than the true bearing, and since this is so, it is intuitively obvious that we must add declination to correct from true to magnetic bearings, and subtract the declination to go from magnetic to true bearings. Rather than to continue attempting to explain declination adjustment in this section, it is recommended that readers obtain a map and compass and practice with them to increase their understanding of declination.

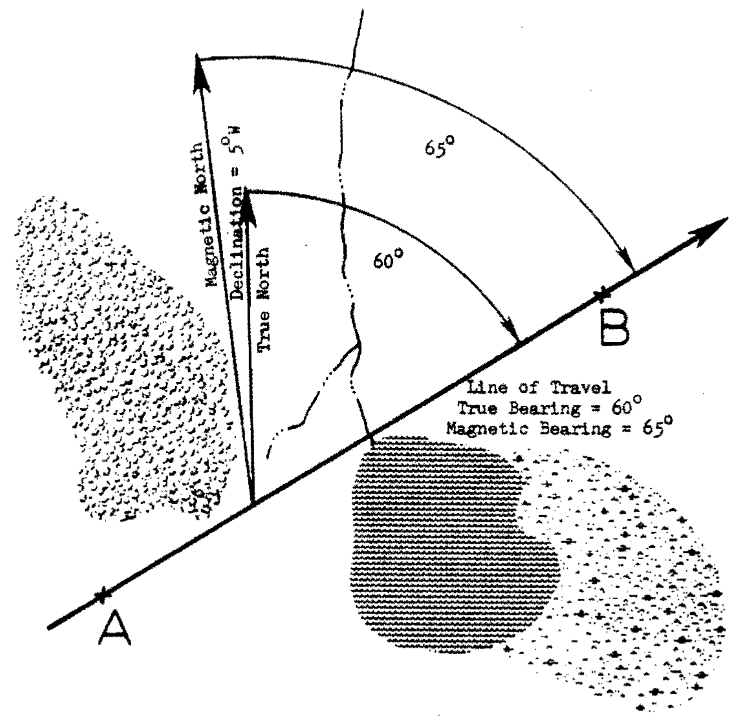


FIGURE 8-11: Declination correction

8.4.3 Map and Compass Method

Since protractor and straightedge are not always available in the field, an alternate method using map and compass is described below. Although the description assumes the use of an orienteering compass, the procedure may be used with lensatic or other compasses with some minor changes.

1. Orient the map precisely to true north. (An oriented map is one that is turned so that map and actual directions coincide; that is, the top of the map points due north.) This may be done by inspection of the surrounding terrain, or by use of the compass as follows:

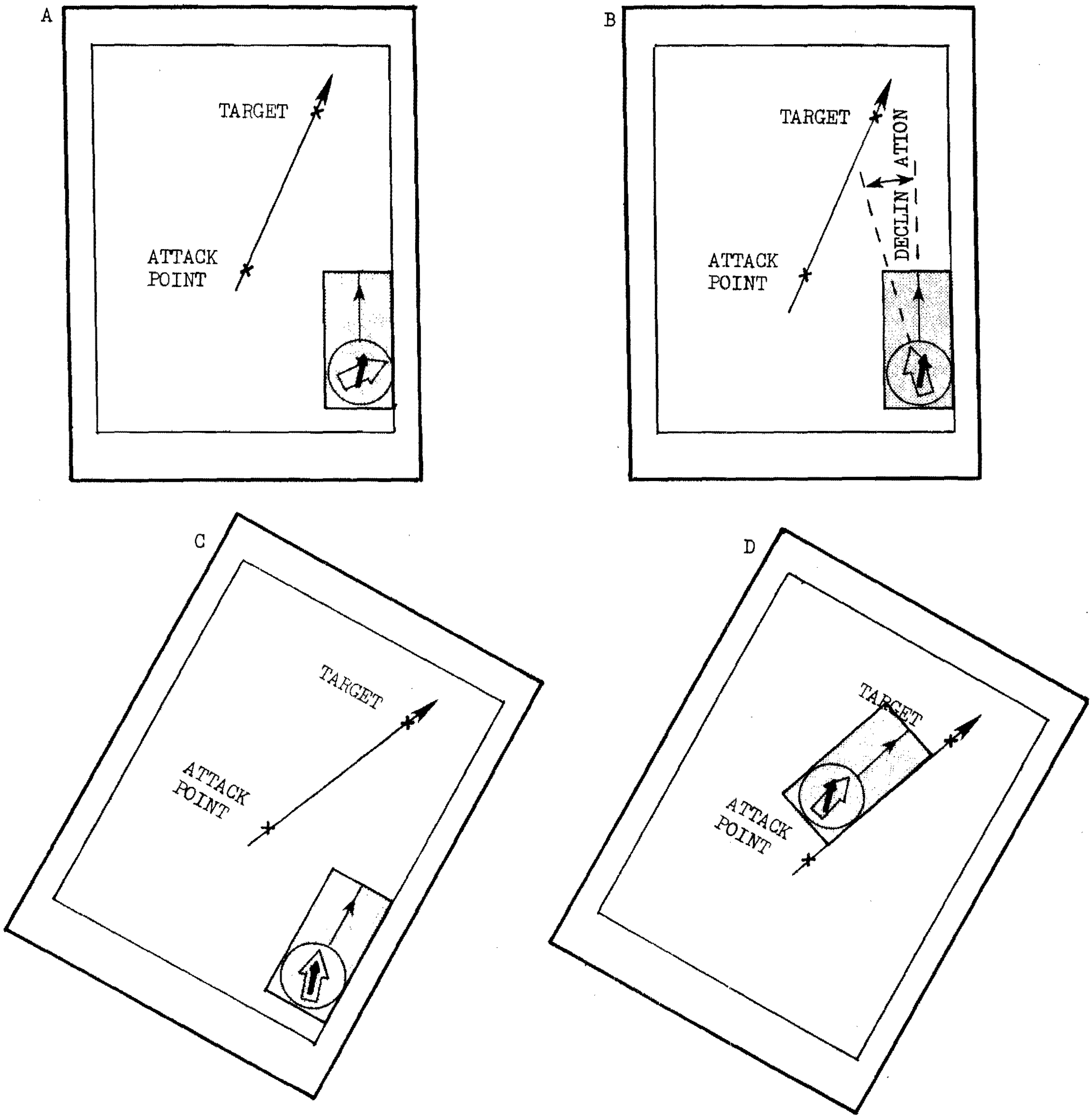
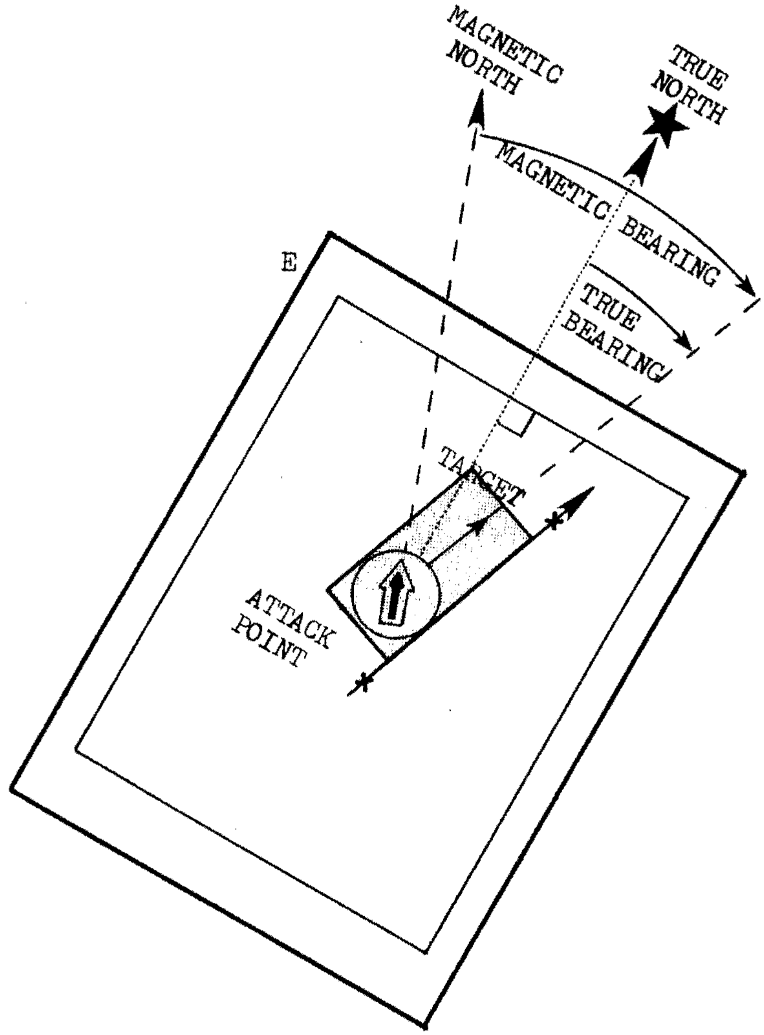


FIGURE 8-12: Map and compass method for determining bearings
(continues on next page)



(figure 8-12 continued)

a. Place the compass on the map with the edge of the compass base along the edge of the map and the direction of travel arrow pointing to map north (see figure 8-12a).

b. Turn the needle housing to the indicated magnetic declination: 0° plus the declination for west declination, 360° minus the declination for east declination for east declination (see figure 8-12b).

c. Turn the map and compass as a unit until the magnetic needle is centered properly in the needle housing arrow (see figure 8-12c).

2. Without moving the map, place the side of the compass base along the line from attack point to target with the direction of travel arrow pointing towards the target (see figure 8-12d).

3. Turn the needle housing until the needle housing arrow and the magnetic needle coincide. A magnetic bearing is now shown by the compass (see figure 8-12e).

It is also possible to orient the map to magnetic north initially, then to correct later for magnetic declination. Also, if one were to turn the needle housing arrow to map (true) north instead of magnetic north in step three, above, a true bearing would result.

Using the Lensatic Compass

1. Orient the map precisely to true north:

a. Place edge of opened compass along the map edge, with hairline pointing to map north.

b. Turn map and compass as a unit until the compass reads the specified magnetic declination (e.g. reads 6° for 6° west declination).

2. Place the edge of the opened compass along the line from attack point to target, with the hairline pointing in the direction of intended travel (towards target).

3. Move the luminous line over the north arrow.

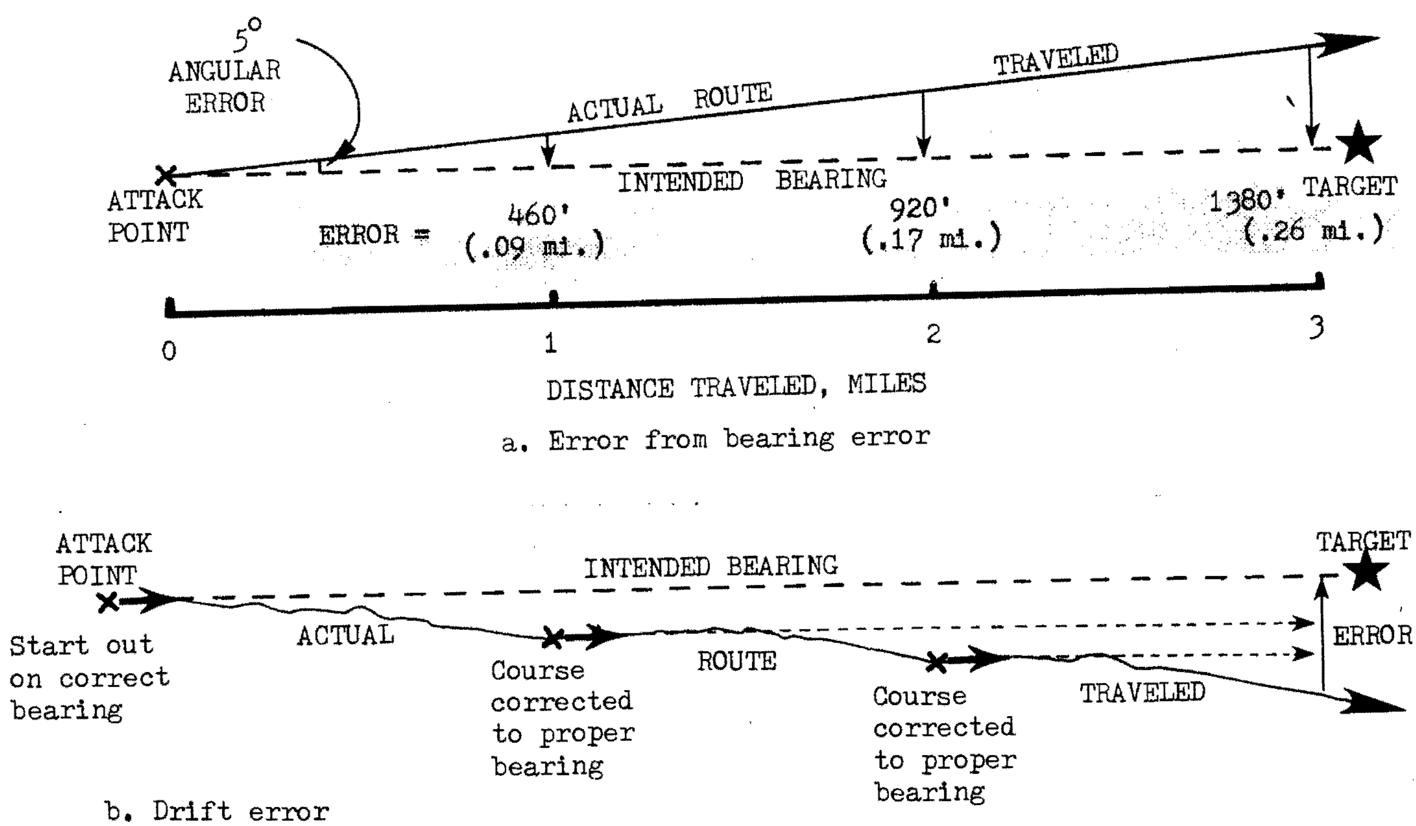
4. Read off the magnetic bearing under the hairline.

8.5 FOLLOWING A BEARING

Once the compass is set for a given magnetic bearing, <u>commit the bearing to memory</u>, as it is possible to inadvertantly change the compass setting, especially when traveling through brush or rough terrain. For this same reason, one should check the compass setting frequently.

The compass is held in the hand (palm up), directly in front of the body, at elbow height. One then rotates, keeping the compass in front, until the needle is lined up in the needle housing arrow. (For a lensatic compass, rotate until "north" on the needle is under the luminous adjustable line.) To follow this bearing, one merely travels in the direction one is facing.

Staying on a bearing may be difficult. A small error in the bearing will result in an error at the target, with the magnitude of the error increasing as the distance the bearing is followed increases (see figure 8-13a). Even if there is no error in the bearing, continued "drift" may result in error, even though one's course is corrected back to the proper azimuth at regular intervals (see figure 8-13b).



a. Error from bearing error

b. Drift error

FIGURE 8-13: Errors in following a bearing

There are several methods for following a bearing accurately. Perhaps the simplest is to choose an intermediate "target" (e.g. a tree), directly on the bearing. Once this is reached, the compass is used to select another target.

A refinement on this is to sight past the first target and immediately pick out a second target in line with the first. As the first target is reached, a third is chosen, and so on. This may seem more complex and time consuming than the method described above, but is actually much quicker, as fewer compass readings are required.

When traveling in a team, and when extreme accuracy is required, it is possible to send a member on ahead. Verbal instructions to this member will suffice to keep him or her on the proper heading. With practice, this may be done with a minimum of delay and very accurately.

Sometimes a detour may be necessary when following a bearing. If a target can be sighted on the other side, there is little problem. However, if such is not the case, techniques known as "triangulation around an obstacle" (distinct from triangulation as discussed in 8.7.3) and "boxing" may be employed. Triangulation refers to the interposition of a triangle into the route bearing (see figure 8-14a). As the obstacle is reached along one's bearing Θ, a new bearing of Θ plus or minus Φ is set (in figure 8-14a it is Θ minus Φ); Φ is picked so as to "triangulate" around the obstacle with a minimum of extra walking. A distance, x, is traveled along the new bearing, then a third bearing of Θ minus or plus Φ is set along this third bearing, bringing one back into line with the original bearing Θ. If the angle Φ is chosen to be 45° (which is often possible) then the equivalent distance along the bearing Θ ($\overline{AC}$ in figure 8-13a) is equal to about 1.4x. An example is given in figure 8-13b.

Boxing is somewhat longer in terms of distance, but simpler in terms of calculations. As the obstacle is reached along bearing Θ, a new bearing of Θ plus or minus 90° (Θ minus 90° in figure 8-14c) is traveled a distance y until one is clear of the obstacle. The bearing Θ is again followed until past the obstacle, then the bearing Θ minus or plus 90° (Θ plus 90° in figure 8-14c) is followed the same distance y back to the original bearing.

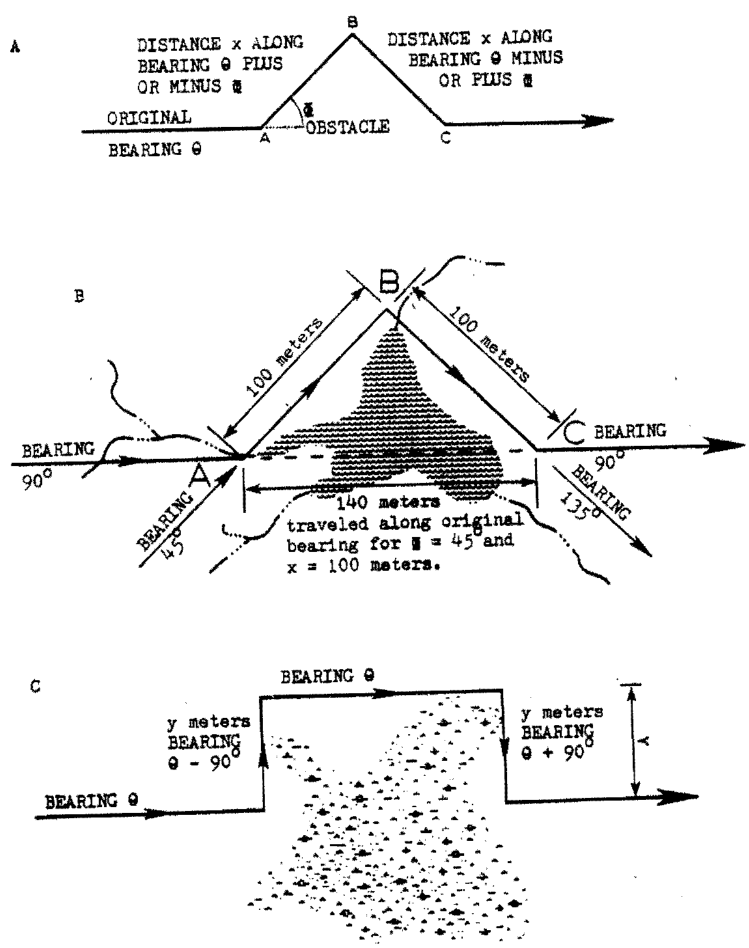


FIGURE 8-14: Navigating a bearing around obstacles

8.6 DETERMINING DISTANCE

There are two primary methods for estimating the distance one has traveled. The first is by the use of collecting features as described in a previous section (8.3.1). Often it is necessary to estimate distance without the use of collecting features, or in between such features. This is done by counting the number of paces taken, a pace being counted each time the left foot touches ground. Every person has a unique stride, and strides vary under different conditions of terrain, brush, and steepness, and when running, trotting, or walking. Every GSAR team member should learn his pace length under various conditions. The following chart may be of use for new GSAR personnel:

	Number of paces in 100 meters (for a fresh person, in daylight, on level ground)		
	Small (< 5'8")	Medium	Tall (> 6')
Road/Trail	42	40	37
Light Vegetation	45	43	40
Open Forest	50	46	43
Dense Forest	55	50	46

8.7 DETERMINING POSITION

8.7.0 General

Determining a position in the field may be difficult and trying to even the most experienced GSAR team member. Keeping track of position constantly is simple with the use of a map and collecting features. A useful hint is to hold the map in one hand, with a thumb on the map marking the present position. As each collecting feature is passed, the thumb may be moved up. Another good idea is to count paces regularly, so the distance back to the last "collecting" feature is known. Some orienteering compasses even have a built-in register for keeping track of paces.

Mission tasks will occasionally require the GSAR team member to be able to determine position with little information to guide him, and the ability to determine position is an important survival skill.

8.7.1 Position by Inspection

Sometimes it will be possible to determine one's position by simply orienting the map and inspecting the surrounding terrain. Since this method may produce several map locations possibly corresponding to one's actual position, the following procedure is suggested:

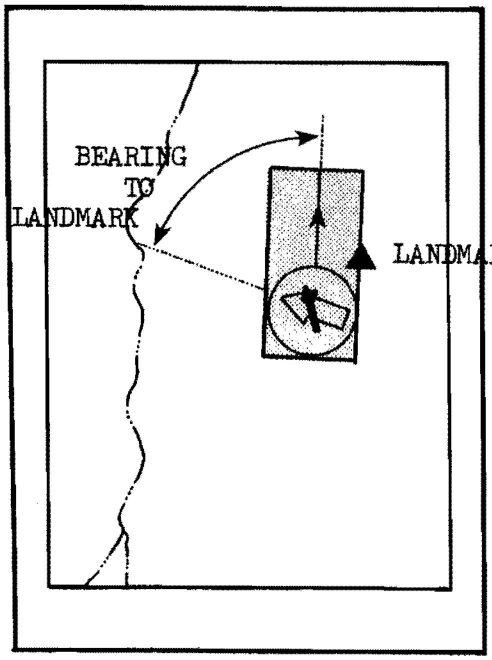
1. List the map locations possibly corresponding to the team's location.
2. Determine a route for the team (e.g. proceed north, or go downstream) which will provide different clues if followed from each of the possible locations on the map.
3. Once one of these clues is located, the team's position is known.

8.7.2 Position by Resection

If one is along a known linear feature (road, stream, trail, ridgeline) and a prominent landmark is sighted, one's position may be determined. The magnetic bearing to the landmark is determined and recorded. This is done as follows:

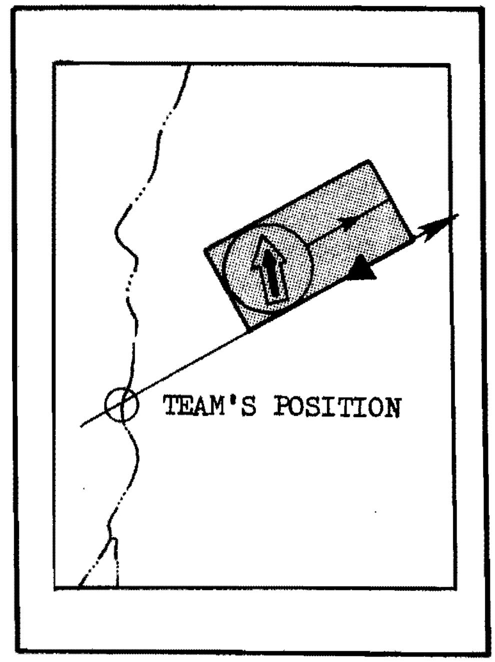
1. Sight (point) the compass at the landmark.
2. Turn the needle housing until the needle housing arrow and the magnetic needle coincide.
3. Read the magnetic bearing under the direction of travel arrow (leave this setting on the compass).

A



(map oriented to true north)

B



C

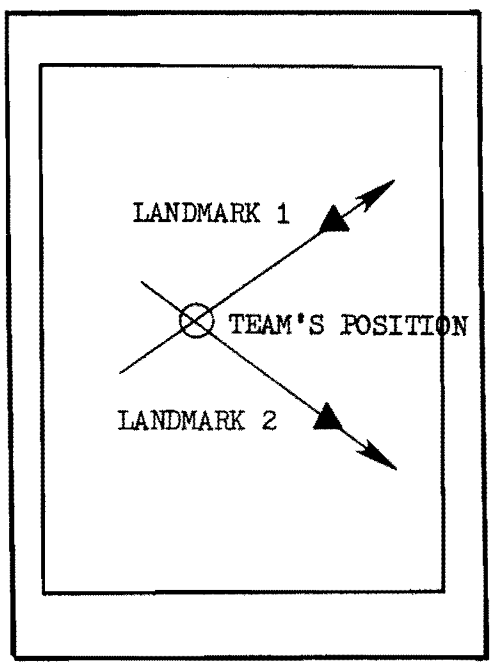


FIGURE 8-15:

Resection

The map is now oriented to true north as described in section 8.4. The edge of the compass may be placed so as to cross through the landmark on the map (see figure 8-15a). The compass base edge is then pivoted around the landmark until the magnetic arrow and needle housing arrow coincide (see figure 8-15b). The intersection of the compass edge line with the linear feature then marks one's position.

If the team is not on a linear feature it is still possible to use bearings from two or more landmarks to determine the team's position, as shown in figure 8-15c. Lines are plotted from each landmark as described above, with the intersection of the bearing lines marking the team's position. This process is known as <u>resection</u>.

8.7.3 Position by Triangulation

It may occasionally be necessary to specify the location of a position distant from one's own, for instance a possible crash site on a mountainside. The process of triangulation used for this purpose is essentially the reverse of resection. The team takes magnetic bearings on the possible crash site from two or more known locations. These bearings are plotted as shown in figure 8-16 and their intersection marks the possible crash site location. It is also possible to use bearings from an ELT locator and to triangulate to derive an estimated ELT position. When plotting bearings, pivot the compass base edge around one's location (A, B, or C in figure 8-16).

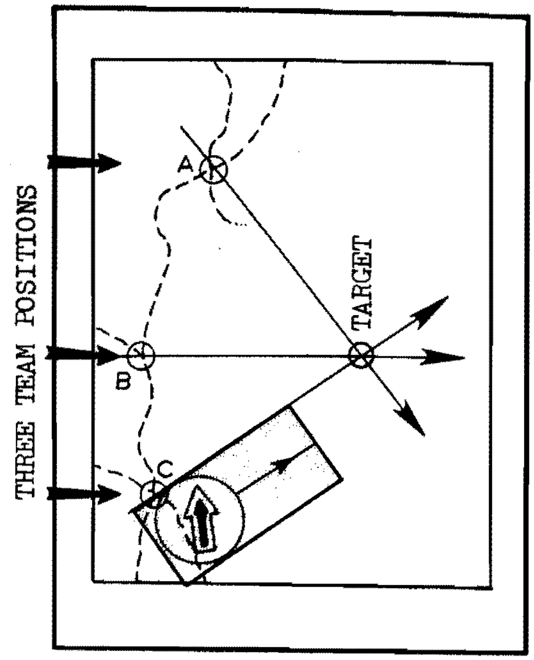
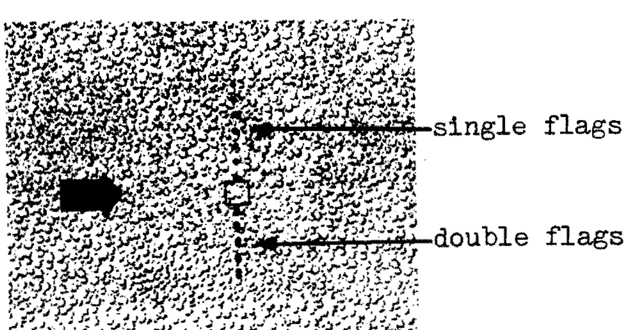


FIGURE 8-16: Triangulation (bearings from three team positions to target plotted as shown in fig. 8-15)

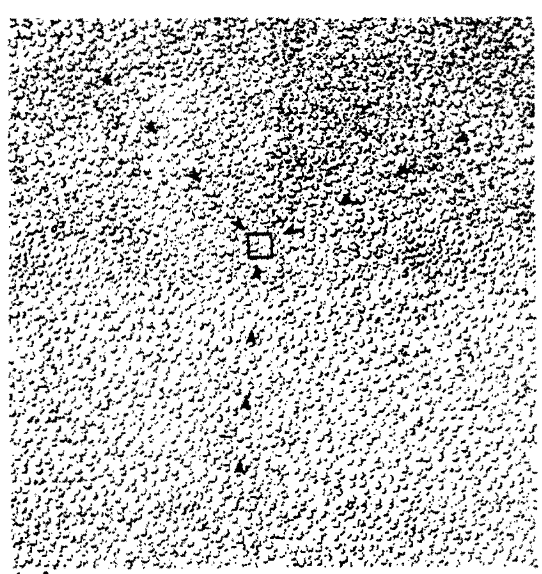
8.7.4 Making Positions Easily Found

One of the tasks of the first team to a crash site or to a lost person is to guide in additional teams. Although the site location may be reported to the incoming teams via radio, this is not always sufficient to avoid delays in the team's arrival.

It is possible to leave a trail marked by plastic surveyor's tape to the site, but often this is not feasible. An alternative is to provide a bearing from an attack point which is easily located. In order to make the site a larger target, surveyor's tape markers may be placed to either side of the site, as shown in figure 8-17a. Use of single flags to the "left" of the site and double flags to the "right" of the site will also aid teams in finding the site more quickly. If teams may arrive from multiple directions, a three-arm array may be set out, as in figure 8-17b.



A. Team approaching from known direction



B. Team(s) approaching from unknown or multiple directions

FIGURE 8-17: Site marking

8.8 EMERGENCY DETERMINATION OF DIRECTION

8.8.0 General

The possibility of becoming stranded without a compass may be small. Even so, this small chance is enough to make knowledge of emergency direction determining methods worthwhile for GSAR personnel. This section will provide brief descriptions of four possible methods.

8.8.1 Sun Method

Virginia, which is at a latitude of approximately 38°, is north of the Tropic of Cancer and south of the Arctic Circle. Therefore, the sun rises in the east, describes an arc to its noon position in the south, and continues down to set in the west. The sun's noon height above the southern horizon varies from 75° at midsummer noon to 52° at midwinter noon. Thus a glance at the sun's position and a knowledge of the season and time of day may provide a rough indication of direction.

8.8.2 Sun and Stick Method

If accuracy is important, and time is available, the relative motion of the sun across the sky may provide an accurate direction indication by the following method:

1. Place a tall stick upright in the ground.
2. Mark the tip of the stick's shadow at several intervals (timing is not of major importance).
3. Draw a perpendicular from the stick's base to the line drawn in step two. The "T" thus formed has its arms pointing east and west, and the base pointing south, as shown in figure 8-18. (When used south of the equator, the direction indicated by the base of the "T" is north, not south.) This method has limited usefulness in Virginia survival situations, since this kind of accuracy is usually not necessary--the sun method will do just as well and take less time.

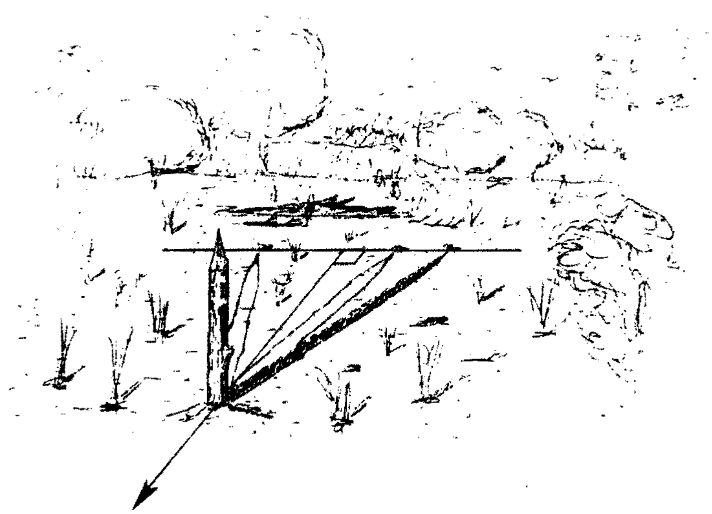


FIGURE 8-18: Stick and sun method of determining direction

8.8.3 Sun and Watch Method

This method is not as accurate as the sun and stick method, but is much quicker. It requires a watch or clock that is running properly. If the hour hand of the watch is pointed towards the sun, the midway between 12 on the watch and the hour hand points south (see figure 8-19a). If after 6 pm or before 6 am, the larger angle between 12 and the hour hand should be used. Error is reduced if the watch is held horizontally tangent to the earth's surface at the equator (figure 8-19b). At 38° north, the watch would thus be tilted down 38° from horizontal towards the south. This method works south of the equator, but the indicated direction is north.

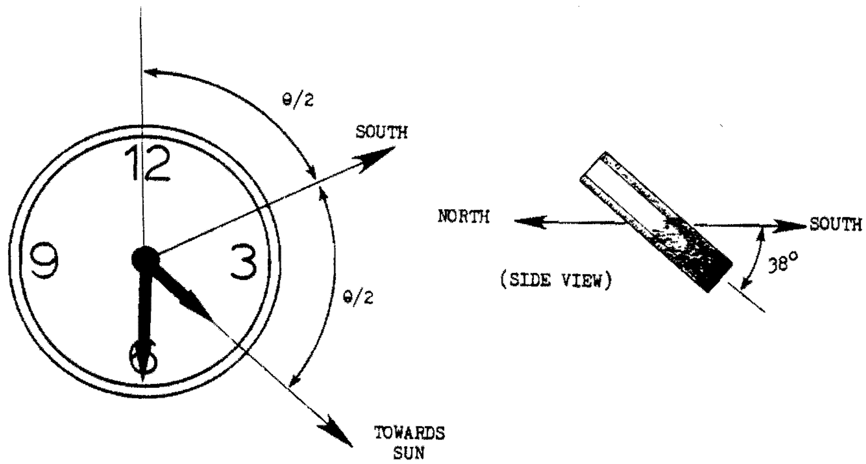
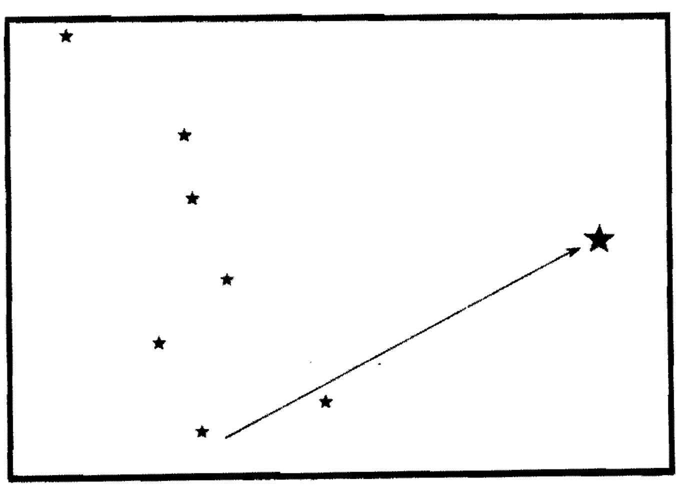
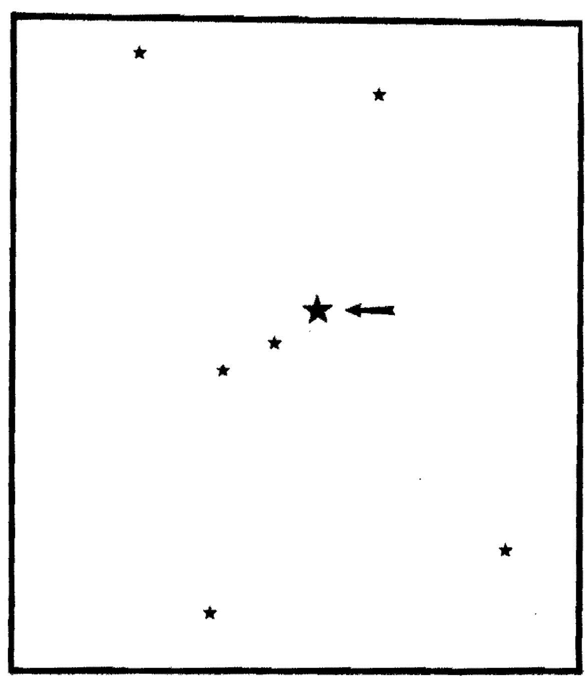


FIGURE 8-19: Watch and sun method of determining direction



a. The Big Dipper indicates the North Star



b. The right-hand star in the "belt" of the constellation Orion always rises directly in the east and sets directly in the west

FIGURE 8-20: The use of the stars to determine direction

8.8.4 Star Observation Method

In the northern hemisphere Polaris (the North Star) provides a quick reference to north. The North Star is located in the night sky as shown in figure 8-20a. It is always within about 1° of true north. The striking constellation Orion (The Hunter) spans the celestial equator, with the right star in the "belt" being precisely on the equator. This star always rises precisely in the east and sets precisely in the west. Orion is illustrated in figure 8-20b.

8.9 REFERENCES

Civil Air Patrol. Emergency Services; CAP Manual 50-15. Maxwell Air Force Base, 1972.

Kjellstrom, Bjorn. Be Expert with Map and Compass. New York: Charles Scribner's Sons. 1976.

Rutstrum, Calvin. The Wilderness Route Finder. New York: Collier, Macmillan. 1967.

United States Air Force. Survival; Air Force Manual 64-5. Washington, D. C.: U. S. Government Printing Office. 1964.

United States Army Engineer School. Student Pamphlet: Military Orienteering. Fort Belvoir. 1973.

United States Geological Survey. Topographic Maps. Arlington: USGS. 1973.

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)

Expanding
Circle Search

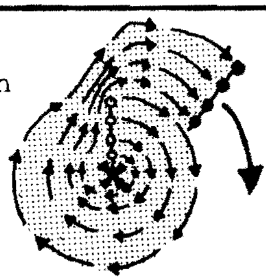


Figure 9-1

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 <u>scratch search</u> (see below) may be sent <u>across</u> the victim's probable line of travel, rather than <u>along</u> 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.

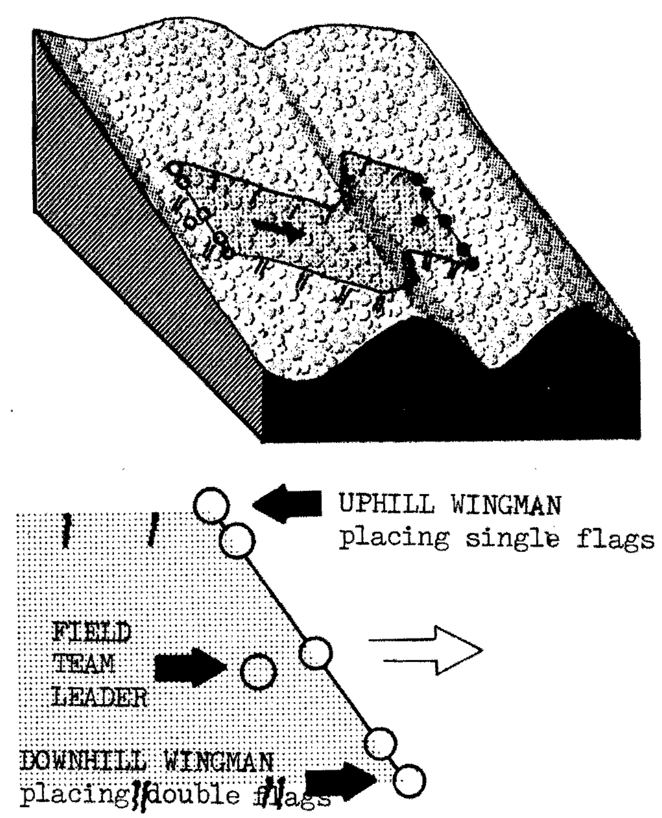
9.5 SWEEP SEARCH

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

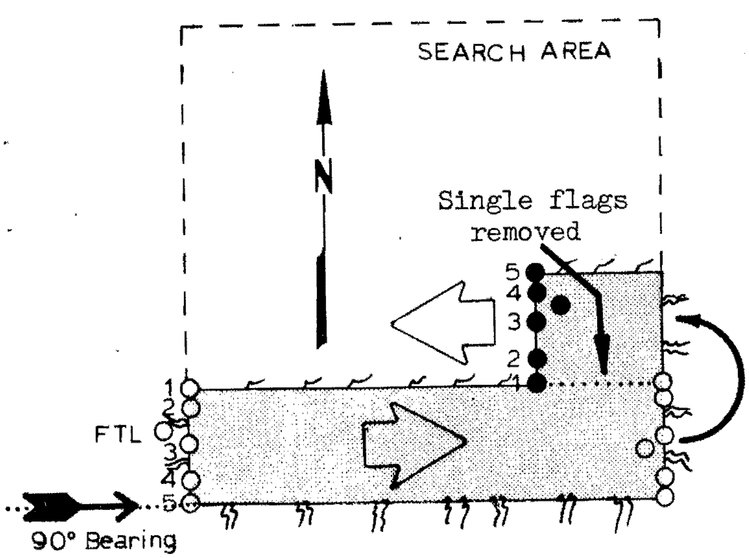
A line search is a saturation search of a large area by a large team. The team is lined up with all searchers equally spaced (see below for information about spacing) with the exception of the FTL, who stays out of the line, and two wingmen, who stay next to the end searchers. The FTL is responsible 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 (bearings 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.

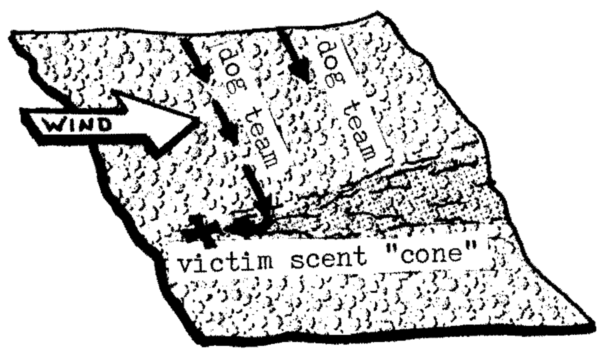


Figure 9-4 Search Dog Use

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 <u>no squelch</u>. 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 $\frac{1}{4}$ 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 reflections.

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.

9.16 REFERENCES

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.

American Rescue Dog Association (ARDA). American Rescue Dog Association, a special edition of ARDA News. Arner publications, Westmoreland, NY: 1977

Appalachian Search and Rescue Conference (ASRC). Search Tactics. preliminary edition, 1977. ASRC, Alexandria, VA.

Ibid. Operations Manual. Draft Edition, March, 1977. ASRC, Alexandria, VA.

Ibid. Search and Rescue Operations Plan (SAROP). First Edition, May, 1976. ASRC, Alexandria, VA

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

Geisinger, Jensen, and Krieder. Land Search and Rescue. 1969. Pennsylvania Wing, Civil Air Patrol

Glen Canyon National Recreation Area. Search Manual. No date. Glen Canyon NRA, UT

Idaho Mountain Search and Rescue Unit. Idaho Mountain Search and Rescue. No date. IMSARU, Idaho

Kutulas. Search and Rescue Manual. March 1971. Utah Peace Officers Standards and Training, UT

May. Mountain Search and Rescue Techniques. First Edition, 1972. Rocky Mountain Rescue Group, Boulder, CO

Kelley. Mountain Search for the Lost Victim. First Edition, 1976. Search and Rescue Magazine, Montrose, CA

National Association for Search and Rescue (NASAR) Papers:

- # 76-108 Kelley. "The $250,000 Message".
- # 77-1010 Dunlevy. "Winter Ground Search for Lost Skiers".
- # 77-1015 Doran. "The ABCs of Dog Search and Rescue".

Robbins. Man Tracking. First Edition, May 1977. China Lake Mountain Rescue Group/ Search and Rescue Magazine, Montrose, CA

Syrotuck. Scent and the Scenting Dog. No date. ARDA/ Arner Publications, NY

Ibid., Some Grid Search Techniques for Locating Lost Individuals in Wilderness Areas. 1974. ARDA/ Arner Publications, Westmoreland, NY

Wartes. Explorer Search and Rescue. Seattle Explorer Search and Rescue, WA

National Association for Search and Rescue (NSAR). Search Management Graphics. 1978.

CHAPTER TEN

FIRST AID AND EMERGENCY MEDICINE

10.0 GENERAL

The topic of first aid and emergency medicine is a controversial one in many CAP units. The primary disagreement is between proponents of the view that CAP search and rescue efforts should end with the positive identification of a crash site, and those who believe that the CAP should provide emergency rescue and evacuation services. The necessity of more than minimal first aid training for CAP personnel is questioned by some on the assumption that Emergency Medical Services (EMS) agencies in Virginia such as volunteer rescue squads provide rescue services, and there is therefore no need for CAP duplication of their services. Many CAP members,including the Virginia Wing Ad Hoc Committee on Ground SAR, agree that duplication of rescue squad services is to be avoided. However, most rescue squads do not have an interest in, or training for, the wilderness-type rescue work in which CAP GSAR teams specialize. Advanced first aid and emergency medical training are important for such wilderness-oriented rescue teams. To support this, we point out the work of the National Association for Search and Rescue in developing a national Wilderness Paramedic curriculum for search and rescue teams providing advanced medical and surgical care.

10.1 FIRST AID AND EMT TRAINING

First aid and emergency medical training are important facets of GSAR training. Since adequate training resources are to be found outside the CAP, standards set by first aid and EMS organizations are utilized by the GSAR standards rather than formulating new standards. The various first aid and EMT (Emergency Medical Technician) courses and certificates are briefly explained below.

American National Red Cross

1. Standard First Aid and Personal Safety. This sixteen hour (minimum) course covers the basics of first aid at a simple level. The course is designed for the average citizen. An eight hour "multi-media" equivalent is also offered.
2. Advanced First Aid and Emergency Care. This fifty-six hour (suggested minimum) course was the result of a total revision of Red Cross first aid training in 1972. The new Standard First Aid and Personal Safety course (described above) is roughly the equivalent of the old "Advanced First Aid" class. The totally new Advanced First Aid and Emergency Care course was designed for ambulance attendants and others with a primary responsibility for emergency care outside of medical facilities. The course does not emphasize medical terminology, and a careful distinction is made between first aid and medical care.
3. Cardio-Pulmonary Resuscitation (CPR). This 10-15 hour course provides training and certification in first aid for airway obstruction, artificial respiration, and CPR for cardiac arrest victims.

American Heart Association

1. Basic Cardiac Life Support (BCLS) is roughly the equivalent of the Red Cross CPR course, although some four hour familiarization courses are offered.
2. Advanced Cardiac Life Support is a course in definitive emergency treatment of cardiac emergencies designed primarily for physicians, nurses, and advanced EMTs.

Emergency Medical Technician (EMT) Courses

The U.S. Department of Transportation (DOT), in an attempt to reduce the mortality and morbidity resulting from transportation accidents, started in a training program for ambulance attendants. Drawing upon the work of the Red Cross and some special ambulance attendant courses set up by the American College of Surgeons Committee on Trauma, the DOT set up a standardized eighty-one hour basic course in emergency care, known as the EMT-A (Emergency Medical Technician-Ambulance) course. Originally, this was planned to be a supplement to the Red Cross Advanced First Aid course, but disputes between the Red Cross and DOT resulted in them becoming two separate courses. The EMT course, in addition to the material included in the Advanced First Aid course, stresses anatomy, medical terminology, diagnostic procedures, and the use of medical equipment usually carried on an ambulance (e.g. oxygen, bag mask, airways). The major items included in Advanced First Aid, but not in the EMT course include water extrication and rescue, bandaging details, and improvised splinting.

EMT courses and certification are offered by each state, and the National Registry of EMTs provides a nation-wide testing and certification procedure for EMTs.

Advanced EMT Training

Many state and county jurisdictions have initiated programs of advanced training for EMTs, training them to provide advanced medical treatment, including intubation, defibrillation, administration of drugs and IV fluids, and some minor surgical procedures. These programs vary from jurisdiction to jurisdiction.

Recently the DOT has established a standardized EMT-Paramedic course consisting of seventeen modules, and recommends that all jurisdictions adopt these standards. The National Registry of EMTs has just (1979) established testing and certification procedures for EMT-Paramedics. It is possible for jurisdictions to set up advanced EMT programs utilizing only selected EMT-P modules, if so desired. The Cardiac EMT program in Virginia is such a program.

Wilderness EMT Training

The Emergency Medicine Committee of the National Association for Search and Rescue is working towards standardized training for EMTs working with mountain and wilderness rescue teams. The present plan is to set up outlines and lesson plans for advanced training modules above the basic EMT (EMT-A) level. These modules will be oriented towards wilderness conditions, as contrasted with the urban conditions assumed of the DOT EMT-Paramedic.

10.2 HYPOTHERMIA

Hypothermia is of primary concern to all GSAR personnel, both as a disease to be treated in victims, and as a hazard to team members. Unfortunately, it is slighted in most first aid and EMT texts and classes. The short-term survival book recommended by the GSAR Committee (Surviving the Unexpected Wilderness Emergency) deals adequately with the causes and prevention of hypothermia. Note, however, that asprin lowers the body's "thermostat" by directly affecting the brain, alcohol causes dilation of peripheral blood vessels, and tobacco causes vasoconstriction in the periphery. Use of these drugs or others may predispose one to hypothermia or frostbite.

Recent developments concerning hypothermia should be part of every GSAR team member's knowledge. Hypothermia is simply defined as a state of sub-normal body core temperature. There are two primary classifications of hypothermia. First, chronic hypothermia develops slowly (i.e. many hours) and is usually found in those suffering from some debilitating condition or disease (e.g. chronic abuse of alcohol). It is complicated by dangerous fluid and electrolyte imbalances. Signs sometimes found are edematous appearance, and an acetone breath odor. The other type is acute hypothermia, brought on by more severe conditions, and developing over a short period of time (i.e. several hours or less). Acute hypothermia is the type most often encountered in outdoor situations.

Acute hypothermia is further divided into progressive stages based on signs, symptoms, and body core temperature.

Stage I (mild) hypothermia (37-35° C core temperature). This stage is characterized by chilling of the periphery (i.e. skin on arms, hands, legs, and feet) and shivering that can be controlled. The heart rate, stroke volume, cardiac output and blood pressure go up, due in part to vasoconstriction in skin. Blood flow in the tips of the fingers can decrease to one percent of normal. Blood flow is not continuous, but periodic. This variation serves to prevent frostbite. Reduction in blood flow to the periphery reduces heat loss. Shivering serves to produce heat through muscle action, and may raise the metabolic rate to about five times normal for short periods. This tends to deplete body energy sources.

Stage II (moderate) hypothermia (32-35° C). Stage II is characterized by violent, uncontrollable shivering, and loss of some mental and physical coordination. Amnesia and slurred speech are common. Peripheral circulation is reduced to a bare minimum. Thermoregulation is somewhat impaired at this temperature.

Stage III (marked) hypothermia (32-28° C). Stage III is characterized by cessation of shivering and muscle rigidity. Heat production begins to fall as energy sources are exhausted. Blood pressure may be undetectable by BP cuff. Respirations are shallow and irregular. Heart stops beating occasionally. The victim will have greatly impaired consciousness and coordination. When the core temperature is below about 35° C, and especially below 32°, it is doubtful if the victim can regain a normal temperature without outside help.

Stage IV (severe) hypothermia (28-25° C). A victim in this state will appear dead, but may still be successfully resuscitated without brain damage. People have survived core temperatures of 18° C. Since low temperatures reduce the brain's need for oxygen, long periods of anoxia (up to half an hour or more) may be tolerated without brain damage. Therefore: "He's not dead until he's warm and dead."

Treatment

One treatment is common for both acute and chronic hypothermia: stop further loss of heat. Treatment in the field consists of rapid rewarming for acute hypothermia of Stage I or II. Stage III and IV acute hypothermia, and chronic hypothermia should not be treated in the field. The victim's body temperature should be kept consistant (avoid rewarming, but stop further heat lost). Since the heart is susceptible to deadly arrythmias when cold, the victim must be transported with a minimum of jars and shocks. A single jolt could send the heart into ventricular fibrillation or some other form of cardiac arrest.

Although airway management is of great importance, esophageal and endotrachial intubation should be avoided as they may stimulate cardiac arrythmias. Artificial respiration may be administered, but avoid over ventilation. If there is any heart beat, do not institute external cardiac compression or advanced life support measures such as defibrillation or drugs, even if pupils are fixed and dialated. If CPR is begun, it must be continued until the victim is warm enough for definitive cardiac lifesupport to be effective.

Rewarming

In the field treatment of Stage I or II acute hypothermia, rewarming is the method of choice. Giving hot drinks will put warm fluid right into the core (but beware of the danger of aspiration). Placing a victim maked in a sleeping bag with one or two other warm people will provide a method of slow rewarming.

If rapid rewarming, such as with a tub of hot water, beware! Rapid rewarming of the peripheral parts of the body can cause:

1. Rewarming shock; caused by relative hypovolemia because of peripheral

vasodilation, and secondary to dehydration.

2. Afterdrop; whole core actually drops after rewarming begins. This is due to the sudden return of cold blood from the periphery.

3. Possible arrythmias, due to the sudden return of anoxic, acidotic blood from the periphery.

Do not attempt rapid rewarming unless you understand these problems, will monitor vital signs to check for them, and are prepared to handle the consequences of each.

If rapid rewarming is to be done, and heat must be applied to the outside of the body, only areas of high heat exchanges with the core should be used. These are the head, neck, lateral chest, and groin. Possibly, hot packs may be applied to these areas (not directly against the skin!). The victim may be placed in warm (105° F) water, with the extremities dangling out. A towel may be placed around the neck and saturated with warm water.

Use great care when rewarming, and remember the first principle of first aid: "First, do no harm."

10.3 REFERENCES

Avery, W. M. and Fairall, L. A.: "Hypothermia--The Silent Killer"; The EMT Journal January/February 1979.

Dunn, Hal: "Hypothermia"; Beyond the Roadhead, by Stan Bush; December, 1978.

Fear, Gene: Surviving the Unexpected Wilderness Emergency. Survival Education Association, Tacoma. 1972.

Fear, G. and Mitchell, J.: Fundamentals of Outdoor Enjoyment. Survival Education Association, Tacoma. 1977.

Lathrop, Theodore: Hypothermia: Killer of the Unprepared. Mazamas, Portland. 1975.

McSwain, Norman: "Thermal Control Due to Environmental Extremes" ; The EMT Journal, December, 1978.

CHAPTER ELEVEN

WILDERNESS RESCUE

11.0 GENERAL

Civil Air Patrol Ground Search and Rescue Teams have no authority to conduct rescue and evacuation operations. However, GSAR teams in Virginia are often in a position to offer their rescue and evacuation capability to those with the responsibility and authority for such operations. There will be many occasions when a CAP GSAR Team is the only unit present at a SAR incident with a rescue and evacuation capability. Seldom will the assistance a GSAR team has to offer be refused during a wilderness evacuation operation.

The type of rescue operations discussed in this chapter are of a very specialized type, characterized by the following condition: wilderness rescue operations are those carried out in weather and/or terrain such that rescuers must have the ability to manage themselves as if they were in a wilderness area. This simple statement has many ramifications, one of which is that rescuers must be as self-sufficient, as a mountaineer or wilderness winter backpacker is self-sufficient in terms of personal equipment, knowledge, and skills. In addition, all wilderness rescue and evacuation equipment must be capable of being carried long distances on the rescuers' backs, together with a considerable load of personal equipment. A final consideration to be offered at this time is that equipment must be adaptable to a wide variety of situations so as to minimize the weight of the rescuer's packs. The techniques and equipment generally found to be best for such rescue operations are those developed by the barious U.S. mountain rescue teams. For this reason, the topic of this chapter may be called "Mountain Rescue" even though the techniques and equipment are applicable to a wide variety of situations other than rescues in the mountains. Regardless of the name chosen, evacuation techniques utilizing a Stokes litter, climbing (or similar) rope, and modified climbing equipment are ideal for wilderness rescue situations. A wilderness rescue situation could be a plane crash or lost person high in the mountains, or miles from a passable road, or even just ¼ mile from a road if the terrain is rugged. The standards of technique for Virginia Wing CAP wilderness rescue and evacuation operations are those set forth by the Appalachian Search and Rescue Conference, Inc. in the ASRC Mountain Rescue Manual. Since that manual is an excellent text and reference, no attempt will be made to duplicate any of the material from it in this manual.

Technical rescue is a controversial subject in many CAP units. In particular, the single word "rappelling" can cause a great deal of heated debate. Vociferous detractors will point out the dangers of rappelling, including many injuries and several deaths. Proponents claim that it is a vital part of ground search and rescue and "Ranger" training. The Virginia Wing GSAR Committee believes that rappelling, if performed properly, is a safe technique. Although it is seldom used in most evacuation operations, it is occasionally useful and/or necessary for difficult rescues. However, many evacuation techniques are derived from (and closely related to) rappelling techniques, so a knowledge of rappelling is considered necessary for advanced GSAR training (i.e. Level III and above). Rappelling may be quite dangerous, if done improperly, even if it is not quite as dangerous as flying a light aircraft improperly. The GSAR Committee believes that the best way to calm the controversy surrounding rappelling, and to prevent rappelling injuries, is to educate CAP personnel as to proper rappel techniques, and the dangers of improper techniques.

The ASRC Mountain Rescue Manual provides all wilderness rescue information and standards of procedure necessary for Level II (team member) training and certification. Section 11.1 provides information about rappelling above that found in the Mountain Rescue Manual, as this is a subject of particular interest to the CAP.

Level III students will find much required information in the Mountain Rescue Manual, and may refer to May's Mountain Search and Rescue Techniques for those few items not found in the ASRC publication. Section 11.2 provides an update on ascenders from the information found in May. If there is a conflict between the ASRC manual and May, the ASRC Mountain Rescue Manual standards of procedure are those accepted by the GSAR committee.

11.1 RAPPELLING

Rappelling is a means of descending a rope in a controlled manner. It is also known as "abseiling" (German) and as "roping down" (British). Rappelling is used by those in many professions and activities; firemen, soldiers, mountain rescue team members, climbers, and cavers, to name a few. Each brand of rappelling has its own idiosyncracies. For example, firemen often use a leather seat harness with a Pompier hook, or large snaplink. Climbers, on the other hand, would laugh at the suggestion that they use such a rig; the size and bulk of it is by far too much for a climber to carry. For that matter, the classic "dulforsitz" or "hotseat" rappel used by climbers requires no special equipment other than a pair of leather gloves and a rope. On the other hand, many firemen will reject climbers' rappels as unnecessarily complex and slow to rig.

Rappelling is thought spectacular, and it holds a great attraction for many. However, it can be dangerous if done improperly, and accidents related to rappelling have resulted in many serious injuries and several deaths. It is interesting to note that many climbers regard rappelling as quite dangerous, and go to great lengths to avoid it. On the other hand, there are many who view rappelling as an end in itself, and regard it as a separate sport. The primary purpose of this section is to point out the dangers of rappelling, and how to judge the safety of a rappel method. We will begin by analyzing the classic "Ranger rappel."

The "Ranger Rappel" ("Army Rappel") (See figure 11-1.) This is a rappel method that has been taught to thousands through the Armed Forces; it takes its name from the U. S. Army Rangers. This method is designed for combat conditions where simplicity and speed are more important than rappel rig safety. (When someone is shooting at you, you don't want to take more time than absolutely necessary rigging into the rappel and getting down.) However, the Ranger rappel has certain characteristics which make it unsuitable for routine civilian use.

The use of (1) non-locking carabiners ("snaplinks") may permit the seat or rope to unclip from the carabiner (especially if the tension on the rope lessens, as when stopping on ledges). This may be prevented by using two non-locking carabiners, with gates opposing, or preferably a locking "D" carabiner (named for its shape) with a screw safety nut over the gate (see figure 11-2).

Any time nylon runs over nylon with sufficient force, (2) weld-abrasion occurs. The melting point of nylon is approached, and cross-bonding develops between the two nylon surfaces. Small bits of nylon are torn away from the stationary nylon by the moving nylon. This is quite a problem, and it is difficult to appreciate its severity until you have seen it happen. A piece of parachute cord can be used to "saw through" nylon webbing in under two seconds. The solution to this problem is to use a second locking "D" carabiner between the carabiner clipped into the rope and the seat. You may ask why a seat or rope of other material could not be used. The answer is that other materials may be used; but most other materials don't have the strength and resistance to the elements that nylon has. For example, the static breaking strength of a 7/16 " diameter nylon caving rope is around 6000 pounds. A manila rope of the same size has a strength of only 185 pounds. These strengths may seem tremendous, but knots, abrasion, and water all reduce the rope strength, and a rough rappell may cause jolts with instantaneous forces of up to 200% of the rappeller's weight. Manila and other natural fibers are subject to dry rot, which makes their long-term use of questionable safety. Therefore, as long as weld-abrasion can be avoided, nylon is the optimum choice for a seat, when weight

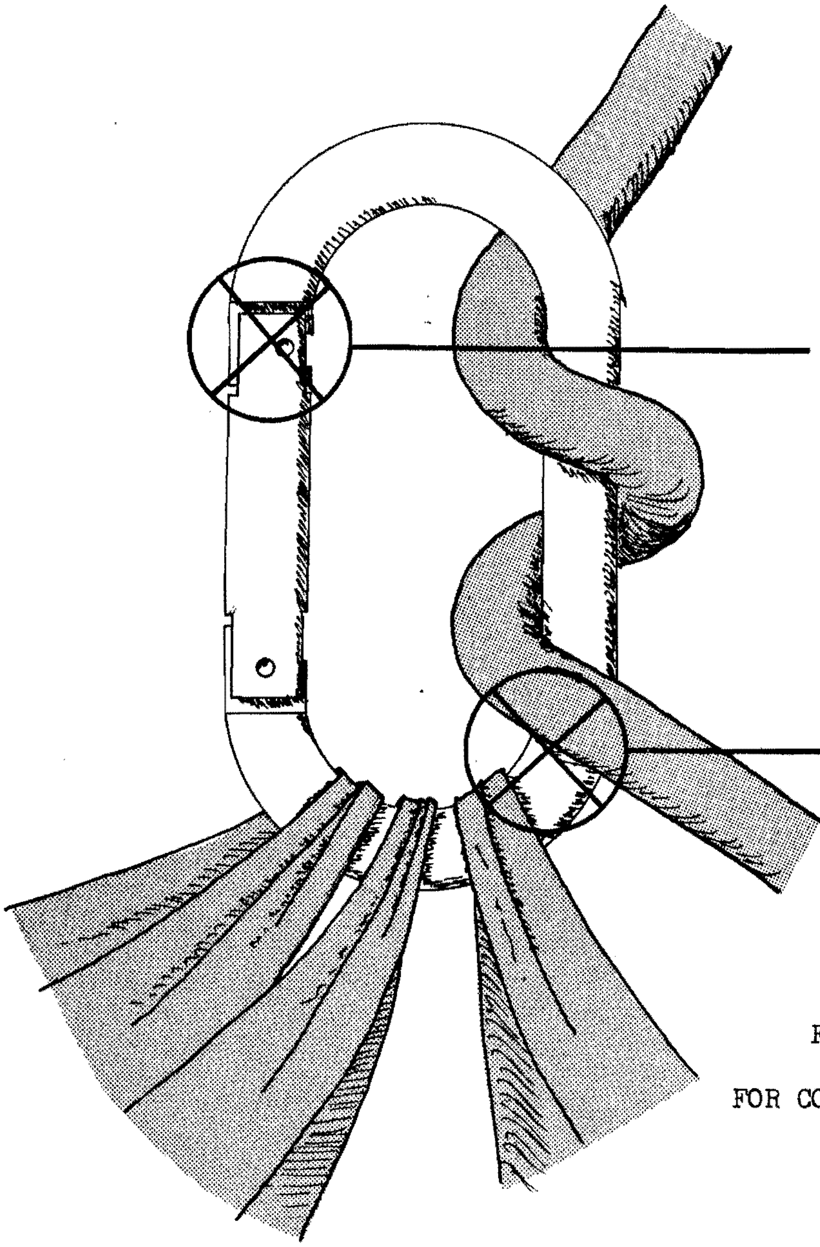


FIGURE 11-1: The Ranger Rappel

FOR COMBAT-RELATED USE ONLY!

and bulk are important considerations.

Manila or similar natural fibers have the advantage of being cheap and more resistant to heat than nylon, so firemen will often use manila for rescue work; however, the ropes are very carefully kept, and often retired after a single use. Those choosing manila for a rappeling rope without similar care are inviting disaster. For sport rappelling (e.g. climbing or caving), nylon is, again, the optimum choice. Nylon, as tough as it is, is still subject to abrasion and damage from other sources, such as battery acid (often found on the floor of car trunks), or excessive heat, such as the rear window shelf of a car in the summer. As with any piece of equipment by which your life will be handing, you should be familiar with its history. Sometimes ropes will be damaged without external evidence. Use of laid (twisted) ropes rather than kernmantel (braided) ropes permits its examination of the rope by partially untwisting a small section of it.

To return to the Ranger rappel and the problem of weld abrasion, consider the seat harness usually used for this rappel (figure 11-3). Known as the "diaper" seat, it is simple and quick. The rappeller "sits" in a pre-tied loop, bringing three bights of the loop together in front from each side and between the legs. The loops are then clipped together with a carabiner. If this harness is cut in any one place, the rappeller will fall out of it. A seat harness design with tied leg loops, such as the ASRC seat (shown in the ASRC Mountain Rescue Manual) must be cut in two or more places for complete failure to occur. Also, the diaper seat tends to leave the rappeller hanging in it by knees and armpits if care is not taken to keep the knees down.

Thus the classic "Ranger rappel" has the following major dangers:

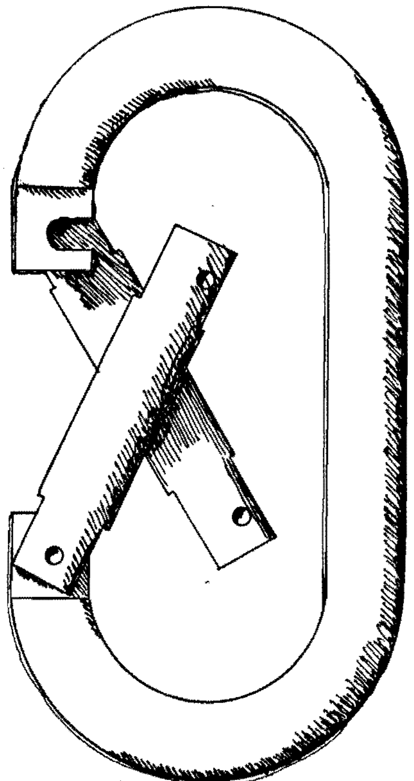
1) A non-locking carabiner may easily allow the seat or rope to become unclipped.

2) The use of a single carabiner makes weld-abrasion of the seat very likely.

3) The diaper seat will fail after only one cut.

Each of these hazards may be avoided by a simple expedient: the use of a locking carabiner, the use of two such carabiners, and the use of a better seat harness design.

Thus, the unmodified "Ranger rappel" is unsafe and not appropriate for routine civilian and ground search and rescue use. One of the rappel methods described in the ASRC Mountain Rescue Manual would be more appropriate for such use. Each of these rappel methods may be evaluated for the same dangers, but may pose additional unique hazards.



11-2
FIGURE 1■-2: Two Carabiners in True Opposition

The use of a safe rappel method is not sufficient to ensure safe rappelling. Safe practices must be followed as well. The following list provides some major considerations.

Ropes must be of adequate size, strength, and material. They must have been kept away from damage-causing chemicals, radiation, and abrasion.

Anchors for the rope must be of adequate strength and security, and the rope must be securely and strongly tied in.

Helmets and Leather Gloves should be worn for protection. Helmets should be securely attached with a non-stretch chin strap.

Belays should be available for each rappeller (see the ASRC Mountain Rescue Manual for appropriate methods).

Smooth descents should be made. Bounces and jumps multiply stresses manyfold, and increase the chance of mechanical failure.

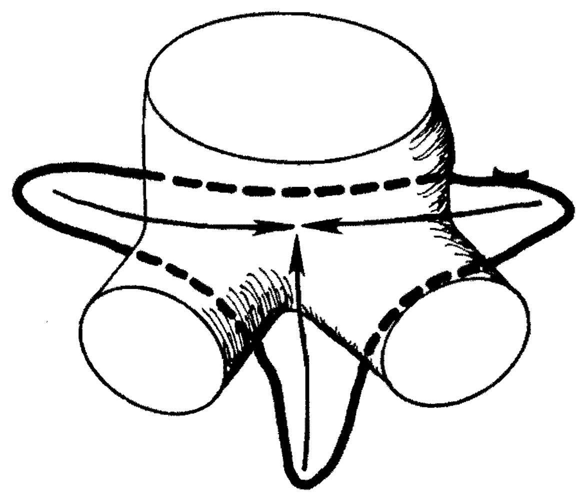


FIGURE 11-3: Diaper Seat

DANGER! WILL FAIL IF CUT AT ONLY ONE PLACE

Double Check every bit of rigging before using it. A second person should do the second check.

When these safety practices are followed, and a safe rappel method is used, rappelling is a safe and effective descent method.

11.2 ASCENDERS

11.2.0 General

Prusik and Headdon knots are by far the mose useful and reliable ascending devices for most wilderness rescue situations. They are strong intrinsically, as well as in their attachment to the rope, and are in general not prone to sudden failure.

One of the primary considerations in designing a system for ascending fixed lines is that of speed, and prusiks are notoriously slow ascenders. For this reason, many "fast" mechanical ascending devices have been developed. (A comprehensive review of ascending knots and devices may be found in Thrun's Prusiking.) Two types of mechanical ascenders are often used in climbing, caving, and rescue work. A description of each is given below, with discussion of its proper operation, uses, and hazards. The most important information given is the limitations inherent in each ascender, and the rescue situations in which mechanical ascenders are not appropriate.

11.2.1 Jumar Ascenders

The Jumar ascender consists of a cast frame, machined spring-loaded cam, and an aluminum or plastic spring loaded safety block (see figure 11-4). When the safety block is pulled down, the cam may also be pulled down, and a rope may then be inserted between the cam and the boot of the Jumar. When the safety block is up, the Jumar cannot come off the rope. Note however that the cam and safety interlock are designed only for use on ropes between approximately 3/8" and 1/2" in diameter. Smaller ropes will not be properly gripped by the cam, and may slip out of the Jumar. Larger ropes will not fit into the Jumar.

Jumars may be quickly and easily clipped into a rope or removed from one. They are also difficult to accidentally dislodge from the rope, once the safety block is up. This proves to be of great advantage in situations such as ascending ropes with many obstacles (e.g. ascending a rope clipped into many anchors, or with knots along its length). Unfortunately, Jumars are of cast, rather than machined construction, and are therefore inherently brittle. Once a Jumar has been dropped a significant distance, there is a chance that hidden cracks may greatly reduce its strength. Because of this, and the basic uncertainty of a Jumar's strength, their safety in rescue work is often questioned. One suggestion for increasing the safety of a system using Jumars is to tie in to the hole at point Y in figure 11-4, rather than around the frame at point Z as recommended by the manufacturer.

Recently, several spring-loaded cam ascending devices similar to the Jumar have appeared in the U. S. climbing scene (e.g. CMI and Clog ascenders). Some of these have machined bodies, and therefore may be strong enough for rescue use.

11.2.2 Gibbs Ascenders

Gibbs ascenders differ from Jumar ascenders in that they have cams that are not spring-loaded. This means that the ascender slides up the rope more easily, but an "out and down" pull on the tie-in hole must be made to make them grip the rope (not so with spring-loaded ascenders). One disadvantage is that they are somewhat slow and cumbersome to attach and remove, as the cam and body must be separated each time. It is also possible to inadvertantly assemble the Gibbs incorrectly,

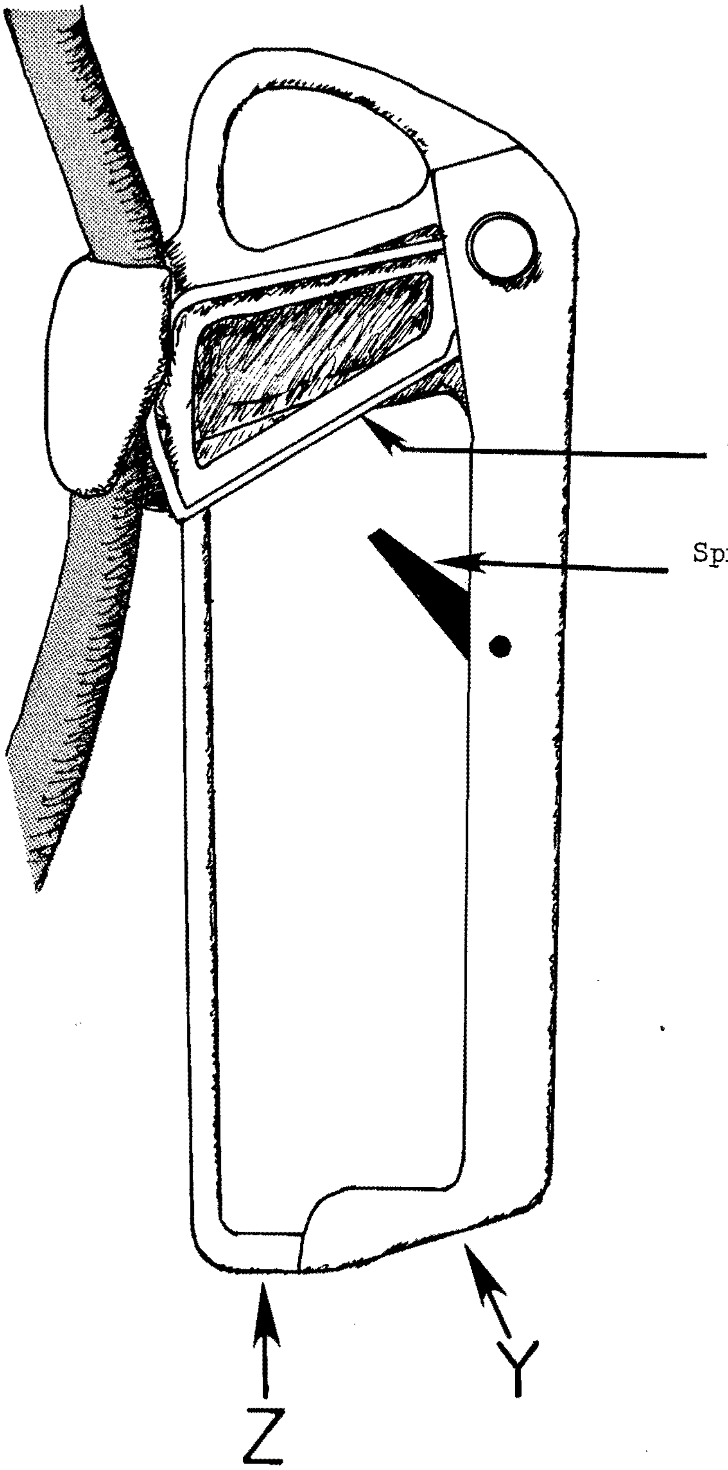


FIGURE 11-4: Jumar Ascender

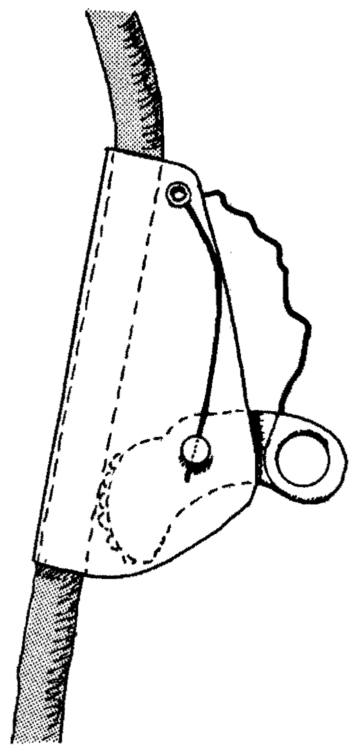


FIGURE 11-5: Gibbs Ascender, correctly assembled.

with the cam upside-down. Each Gibbes ascender is individually tested to 1000 pounds, so they are somewhat more reliable than Jumars (see figure 11-5).
11-5

11.3 REFERENCES

Appalachian Search and Rescue Conference, Inc. (ASRC). Mountain Rescue Manual. First edition, Alexandria, VA: 1979.

May, W. G. Mountain Search and Rescue Techniques. First edition, Boulder, CO: September, 1972.

Thrun, Robert. Prusiking. National Speleological Society, Huntsville, AL: 1971.

(The Mountain Rescue Manual contains a detailed bibliography.)

CHAPTER THIRTEEN

COMMUNICATIONS

13.0 GENERAL

The word communications, as discussed in this chapter, is the science and art of conveying information from one point to another. To many SAR people, "communications" equates with "radios." It also applies to the entire spectrum of signalling, from semaphore signals with flags, to the use of flares along a road to communicate to drivers that there is a hazard ahead. CAP GSAR teams may often be in situations where non-radio communications are essential. An example is when a CAP search aircraft overhead has spotted a crash site, but has no radio contact with the team.

A further consideration under the subject heading of communications is that of conveying information properly, whether over the radio or in person. The way to insure that information is conveyed correctly is to use one of the major capabilities of civilized humans: writing. This, combined with succinct messages that are easily repeated, read back, and checked for accuracy, will allow for rapid and efficient communications. These two principles will enable even the newest GSAR team members to communicate more effectively than many radio "experts."

This chapter will limit its discussion to specifics or the use of radios in the field, and the non-radio signals of general use to GSAR team members. It is assumed that CAP members will be familiar with general radio procedure through the training and testing required to obtain a CAP Radio Operator's Permit (ROP), so none of this material will be included in the chapter.

13.1 USE OF RADIOS IN THE FIELD

13.1.0 General

Radios, just as any electronic device, are fairly delicate. Special consideration must be taken when using them in the type of environment GSAR teams will be experiencing. Several topics are presented below.

13.1.1 Radio Controls

A hand-held radio may have several controls. A description of some of the relevant controls and features follows.

Volume. Any radio will have a volume control, often with an incorporated on/off switch. The volume control affects the volume of sound emitted from the speaker, and nothing else. It in no way affects the power or volume of the transmitted signal. Power is used by the speaker, so keeping the volume low will help conserve battery life.

Squelch. The squelch is a device to remove the unnecessary and irritating background static from the speaker when the radio is not receiving a signal. When no (or a weak) signal is being received, the speaker is inactivated by the squelch circuit. Whan a strong signal is received, it overrides the squelch circuit, and the rectified signal is heard through the speaker. The higher the squelch is turned up, the stronger a signal must be to break the squelch and be heard. Obviously, if the squelch is turned all the way up, weak signals will not be heard. The squelch is usually adjusted to just above the point where background noise is heard over the speaker.

Channel Guard or Private Line (PL). These features found on some radios are a special type of "sub-audible tone" squelch. When this switch is turned on, only transmissions with a special (non-audible) tone will break the squelch. Be sure that this switch is not turned on when it should not be on, as important transmissions might be missed.

Tone Squelch. When a tone squelch is "on", the squelch will break open only immediately following a specific tone or combination of tones. As soon as the squelch closes, and the speaker becomes silent, the tone squelch resets. As with the PL described above, be certain the tone squelch is not on when it should not be on.

Tone Signal. Some radios, especially 100 milliwatt CB type radios, have a special switch to enable the user to transmit a steady tone rather than voice. Obviously, if this is turned on, no voice transmission may occur. However, these tone signals do appear to cut through background noise better than voice, and may be utilized with Morse code when necessary.

13.1.2 Batteries

Electric storage cells are limited in the amount of energy they can provide. Alkaline cells provide more energy than corresponding carbon-zinc cells (most every day "dry cells" are carbon-zinc type). Alkaline cells also perform better at low temperatures than do carbon-zinc cells, which have a very diminished output at temperatures near 32°F (0°C). Alkaline cells are heavier, and cost more than carbon-zinc cells, but may actually be cheaper and lighter (especially when used in cold weather) in the long run. One alkaline cell is the rough equivalent of two carbon-zinc cells in terms of battery life, but costs roughly twice as much.

A fairly new type of electric storage battery contains lithium cells. These cells are about half the weight (or less) of a corresponding alkaline cell, and produce tyice as much power as an alkaline cell (four times that of a carbon-zinc cell). They also produce twice the voltage of alkaline or dry cells, so only half as many are required (e.g. three lithium 'C' cells instead of six carbon-zinc 'C' cells). Lithium cells are only slightly affected by cold, but also are relatively expensive. Their great storage value makes them competitive with alkaline and carbon-zinc cells in terms of money per unit of power, and the weight savings makes them quite attractive.

Mercury cells have a large storage capacity, but are heavy and expensive. Often, commercial-grade hand-held radios have optional mercury battery packs, but they are not as generally available as are the other types.

Nickel-Cadmium cells are heavy, do not store much energy compared with lithium or mercury cells, and do not produce quite the voltage that carbon-zinc or alkaline cells do. (It takes eight alkaline or carbon-zinc cells to make a nominal twelve-volt battery, but ten nickel-cadmium cells.) They have one great advantage: they can be recharged a multiplicity of times. Most hand-held radios use nickel-cadmium cells, with one of the other types as an option.

It is a good idea to carry a spare set of batteries for each radio. Also, the following practices may contribute to long battery life.

a. Scheduled Check-ins. Keying the receiver of a radiouses up power. By turning on the radio only at specified times, battery use will be reduced. This of course may not be appropriate when the mission is progressing at a rapid pace.

b. Minimize Transmit Time. The radio consumes much more power when transmitting than when receiving. Keep messages brief and clear.

c. Keep Battery Contacts Clean. A small piece of emery cloth or steel wool will serve to clean the contacts, and may be kept in the radio's battery compartment, if carefully placed.

13.1.3 Range and Antennas

Most radios work well only when there is "line of sight" between two radios. Anything in the line of sight (e.g. a hill or ridgeline) will interfere with communications. The obvious solution is to move to a higher location or from behind the obstacle, perhaps even climbing a tall tree. It is also true that with Very High Frequency (VHF) radios, echoes may cause strange dead spots or "good" spots. Moving a few feet one way or another may nake the difference between no communicationand "full quieting" (perfect radio contact). Minor changes in height, such as holding the radio a few feet higher or lower, may also make a sizeable difference in the quality of communications.

Many VHF hand-held radios have an extendable quarter-wave whip antenna. This type of antenna requires a ground plane for efficient functioning. When a quarter-wave antenna is attached to a car, the roof provides an excellent ground plane. When put out on a mast, as for use as a base antenna, several ground-plane radials extend out from the base of the antenna to simulate a ground plane. Hand-held ¼ wave antennas need a ground plane, too, and usually rely on the holder's body and the earth proper to provide a ground plane. Thus ¼ wave antennas work reasonably well when held vertically. It is possible to build five-eighths wave antennas which require no ground plane, but 5/8 if a two-meter wave is rather long to navigate with through the woods. It is possible to design a cheap, efficient, flexible VHF antenna of about two meters length which will be very efficient, and which may be attached and hung upright from a tree for a check-in. One great advantage of having supplemental antennas is that a better antenna effectively increases the receiver sensitivity as well as the effective transmitting power.

Extendable antennas should not be routinely carried with the antenna out, as it could easily become bent or broken. However, the antenna should be fully extended whenever transmitting. If an extendable becomes broken, a ¼ wave section of coathanger wire may be inserted as a temporary replacement.

Flexible rubber coil antennas ("rubber duckies") are available for VHF and CB (or 26.620) radios. The performance of those antennas does not approach that of ¼ wage whips, but they are compact and resistant to mechanical damage. "Clamp-on" ones are available to fit over the stubs of broken CB-type extendable whips.

13.1.3 General Care of Radios

Most hand-held radios are not designed to withstand water, and care must be taken not to get them wet. Leather cases offer some protection against dirt and water, and it is also possible to put tape on the seams of the radio. For extremely wet conditions, a plastic bag may be wrapped around the radio, and fastened with a rubber band around the antenna and the neck of the bag. The controls may easily be worked through the bag.

Radios, especially crystal controlled ones, are susceptible to damage from shock and vibration. Crystals and other components are delicate. The only ways to cope with this are to handle the radio carefully, or to carry a pocketful of spare crystals and parts.

13.2 SIGNALLING DEVICES AND METHODS

Signalling devices and methods may be roughly divided into two categories: (1) attention attracting and (2) message conveying. Mirrors harness the brilliance of the sun and redirect it for your use. Military or survival-style mirrors produce a flash visible up to twenty miles away. On the other hand, the flash could conceivable blind a pilot temporarily, so avoid overuse.

All types of signal mirrors require practice. The simplest type is a 3" by 4" metal mirror with a small hole in the middle. An easy way to use it is to hold two fingers of an outstretched arm in a "V" with the fingers pointing up, and cover the target between the two fingers. Hold the mirror in the other hand, sight through the hole and direct the light beam to one of the fingers. Sweep the light back and forth across the target, using the light on the two outstretched fingers as a guide.

Pyrotechnic signals produce a bright light or smoke by burning certain chemicals. All pyrotechnic devices pose a great fire hazard and must be used with great care.
Smoke bombs are best used in an open area against a contrasting color background. The canister should be placed upright in a cleared area at least three feet in diameter, to lessen the chances of starting a brush fire.
Aerial flares fire a burning projectile several hundred feet into the air, and also present a fire hazard. The projectile is about the size of a .38 caliber slug, and can kill at close range, so extreme care should be used. Always fire the flare as straight up as possible, so it will burn out before it comes down. Otherwise, a fire may be unknowingly started quite some distance away.
Road flares may be used to mark landing zones or any other important position.

Panels and paulins are used to convey a message to an aircraft above. By laying these in specific patterns, the aircraft pilot or observer may read your message.
Panels should be strips of bright material (orange) at least two feet by ten feet. Orange tube tents are cheap and can be cut up to make very nice panels.
A paulin is a ten foot by ten foot square, with the sides of contrasting colors. The sides or edges are folded over to produce the different patterns.
Both types may need to be pinned down if it is very windy. (See figures 13-1 and 13-2.)

Body signals. The other way to pass a message to an aircraft is with the use of body signals. This could be considered a whole body sign language. Since a person is considerably smaller than a signal panel, everything possible should be done to make the signaler easily visible. He should be standing in an area large enough so that the aircraft can get a good look. Remember that the pilot must keep up a minimum airspeed. (See figure 13-3.)

Air-to-ground signals using the motions of an aircraft are shown in figure 13-4. These signals are universally accepted. Additional signals, given below, have been proposed*. These have not gained wide acceptance as yet, but are quite useful. GSAR team members should be familiar with them in case a pilot overhead should attempt to use them.
"Follow Me" The aircraft circles the team, then flies past at low altitude in the direction to be followed.
"Stop" A figure eight over the location to stop at, with the figure perpendicular to the line of the team's travel.
"Go Back" One low-level pass in the opposite direction of the team's travel.
"Turn Left" Circle the intersection counterclockwise, then go in the indicated direction.
"Turn Right" Circle the intersection clockwise, then go in the indicated direction.
When the team has to traverse difficult terrain, the plane should make multiple passes over the team in the indicated direction.

Message drops are sandbags with an attached colorful streamer. The aircraft attaches a note, then drops it on a low-level pass.

Dye markers stain water a bright orange-yellow. They should be used only in relatively still water so the current will not rapidly dissipate the dye.

Audible signals Noise makers can be used for signalling. Whistles are used most commonly and the sound will carry considerably farther than a voice. Also they will not give out as easily as a voice will.

*These have been suggested by George Rees, Michigan Wing, CAP.

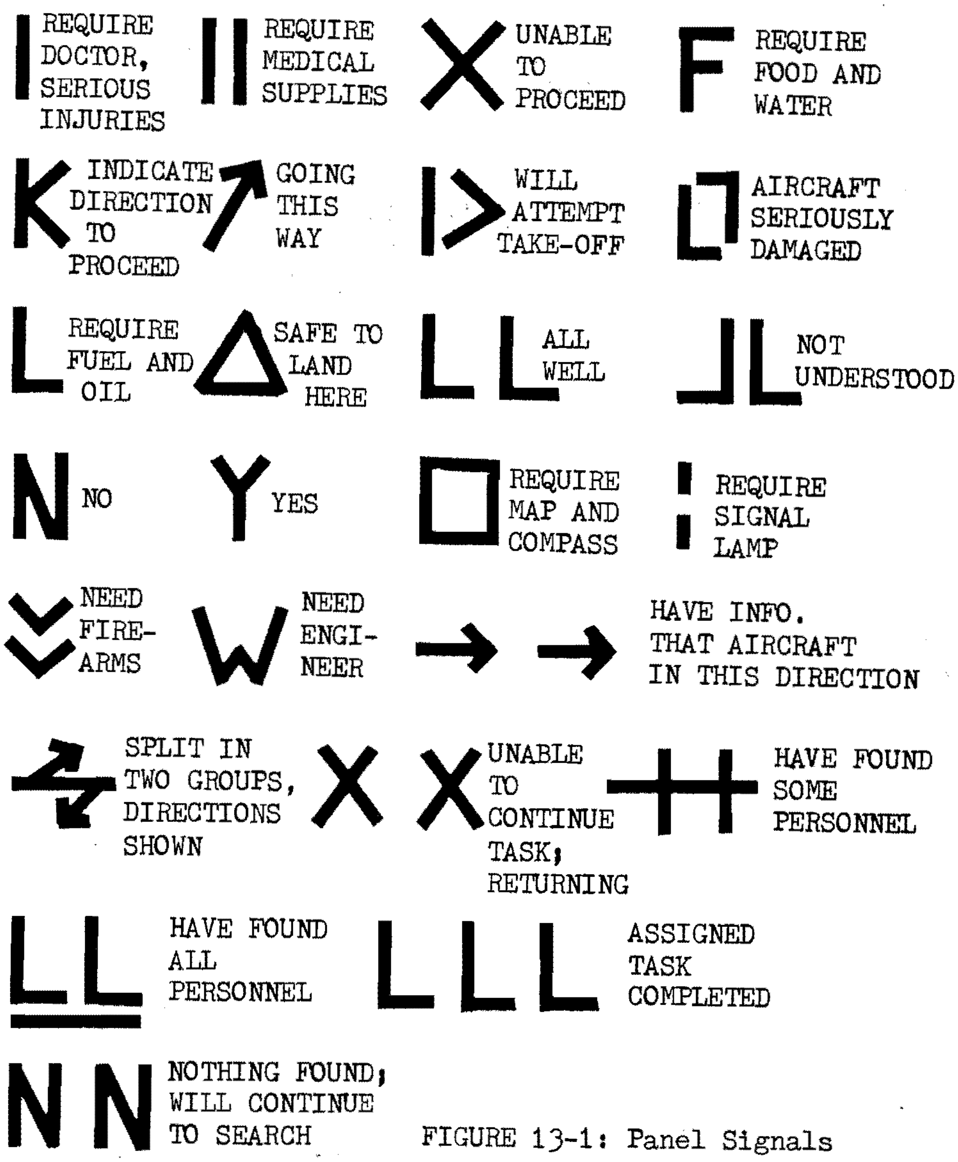


FIGURE 13-1: Panel Signals

Fires can be used to produce a smoke signal. Wet leaves on the fire will provide a dense white smoke, whereas rubber and/or oil will produce black smoke.

Codes. Many attention attracting devices may be used to send a message by the use of Morse Code (see figure 13-5). Also special codes, as given in figure 13-6 are generally accepted for GSAR use in this region.

13.3 REFERENCES

Bush, Stan. "Sending and Receiving Signals" Colorado Search and Rescue Board, Jan. 1978.

U. S. Army. FM 21-76 Survival, Evasion, and Escape. 1969.

U. S. Air Force. AFM 64-5: Search and Rescue Survival. 1969.

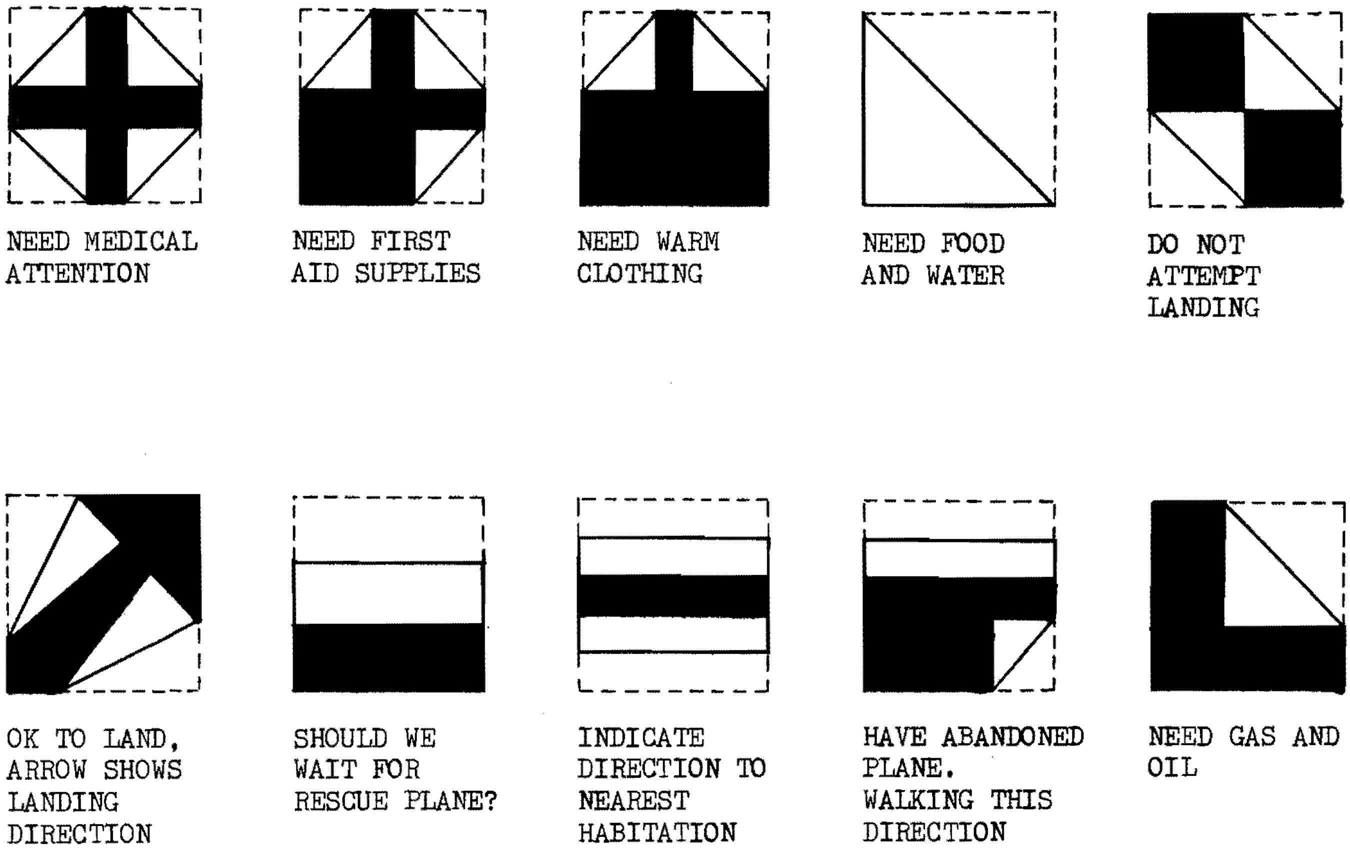


FIGURE 13-2: Paulin Signals

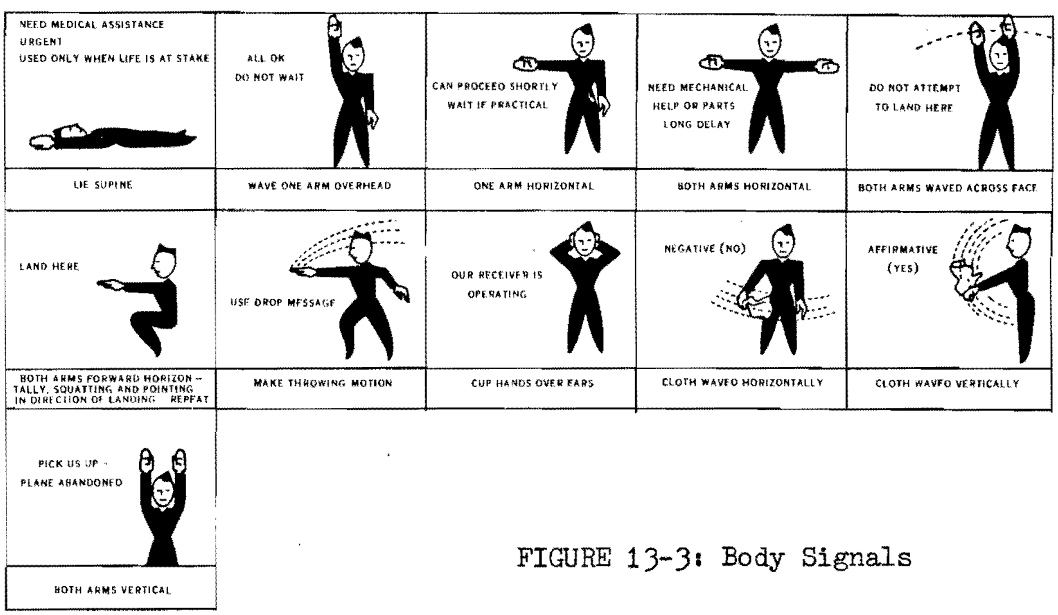
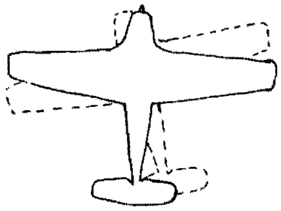
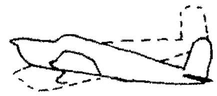


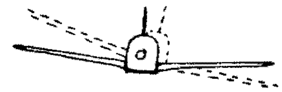
FIGURE 13-3: Body Signals



YAWING: Negative



PITCHING: Affirmative



ROLLING: Message received
and understood

COMPLETE RIGHT-HAND CIRCLE:
Message received, but not understood

FIGURE 13-4: Air to Ground Signals

A	• ▬	N	▬ •	1	• ▬ ▬ ▬ ▬
B	▬ • • •	O	▬ ▬ ▬	2	• • ▬ ▬ ▬
C	▬ • ▬ •	P	• ▬ ▬ •	3	• • • ▬ ▬
D	▬ • •	Q	▬ ▬ • ▬	4	• • • • ▬
E	•	R	• ▬ •	5	• • • • •
F	• • ▬ •	S	• • •	6	▬ • • • •
G	▬ ▬ •	T	▬	7	▬ ▬ • • •
H	• • • •	U	• • ▬	8	▬ ▬ ▬ • •
I	• •	V	• • • ▬	9	▬ ▬ ▬ ▬ •
J	• ▬ ▬ ▬	W	• ▬ ▬	Ø	▬ ▬ ▬ ▬ ▬
K	▬ • ▬	X	▬ • • ▬		
L	• ▬ • •	Y	▬ • ▬ ▬		
M	▬ ▬	Z	▬ ▬ • •		

WAIT	• ▬ • • •	QUESTION MARK	• • ▬ ▬ • •
PERIOD	• ▬ • ▬ • ▬	BREAK (DOUBLE DASH)	▬ • • • ▬
COMMA	▬ ▬ • • ▬ ▬	END OF MESSAGE ($\overline{AR}$)	• ▬ • ▬ •
SLANT BAR (/)	▬ • • ▬ •	GO AHEAD (K)	▬ • ▬
ERROR	• • • • • • • •	END OF TRANSMISSION ($\overline{SK}$)	• • • ▬ • ▬

FIGURE 13-5: Morse Code

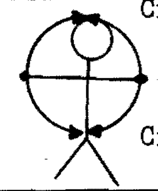
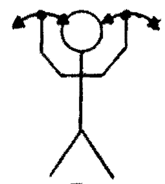
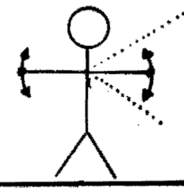
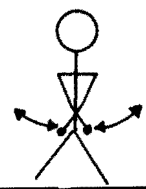
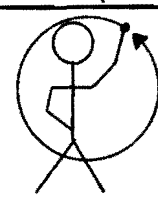
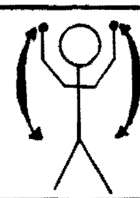
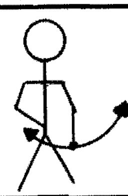
MEANING	WHISTLE/LIGHT/VOICE	HANDS/FLAGS/LIGHTS
Trouble; Help	— — — Help Help Help	 Cross hands (Obvious attention getter) Cross hands
Status One (Victim Found Okay)	——— • Staaaatus One	 Don't cross (Touchdown)
Status Two (Victim found hurt)	——— • • Staaaatus Two-two	 (Similar to trouble)
Status Three (Victim Found Dead)	——— • • • Staaaatus 3-3-3	 (Dead ball) Cross and uncross hands
Come to Me (or Send a Rescue Team)	• — Come Heeeeere	 (Roll)
Don't Come to Me (or Don't Send a Rescue Team)	• • — Don't Come Heeeere	 (Wave away)
Affirmative	— • — • ("C" in Morse Code)	 (Nodding)
Negative	— • ("N" in Morse Code)	 (Shaking)

FIGURE 13-6: The Appalachian Search and Rescue Conference, Inc. (ASRC) Code

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

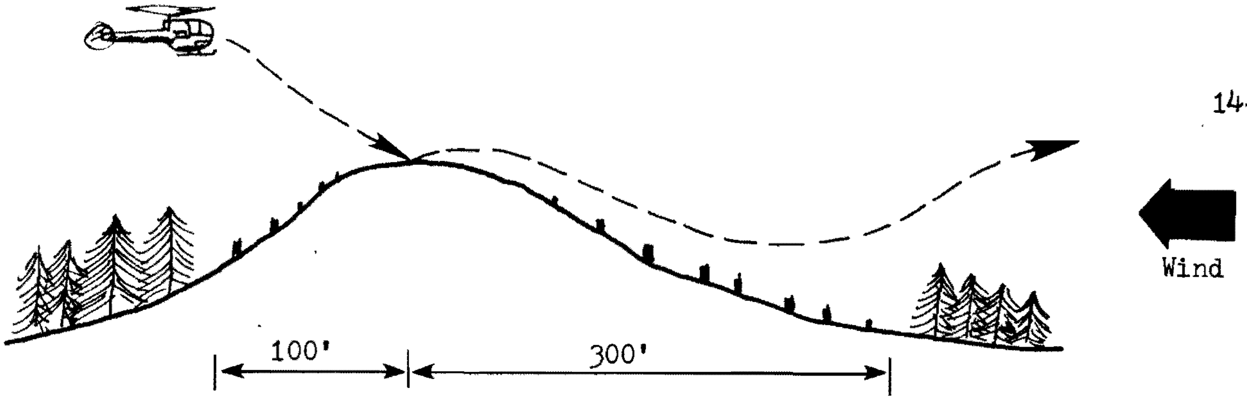


FIGURE 14-1: A ridge approach lane and take-off lane.

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

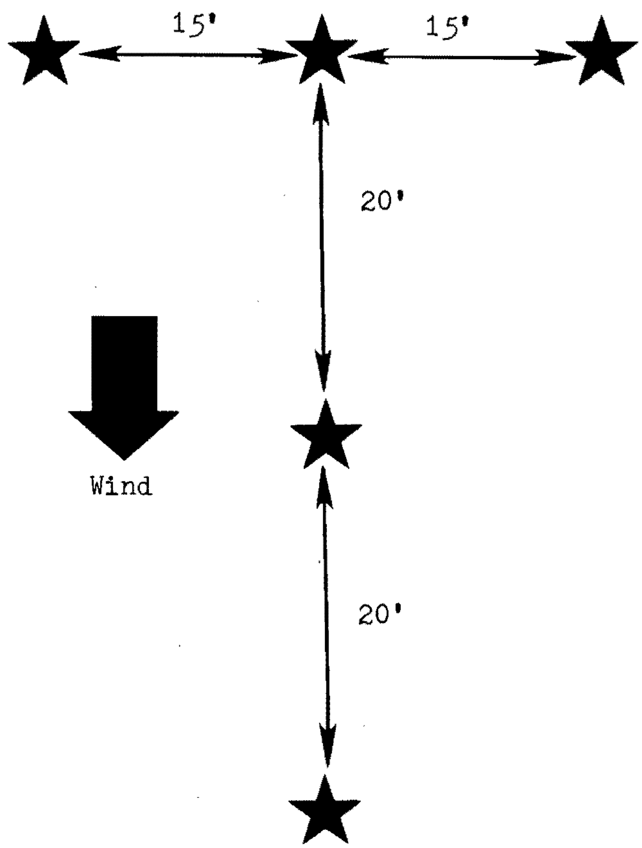


FIGURE 14-3: Marking the wind direction.

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.

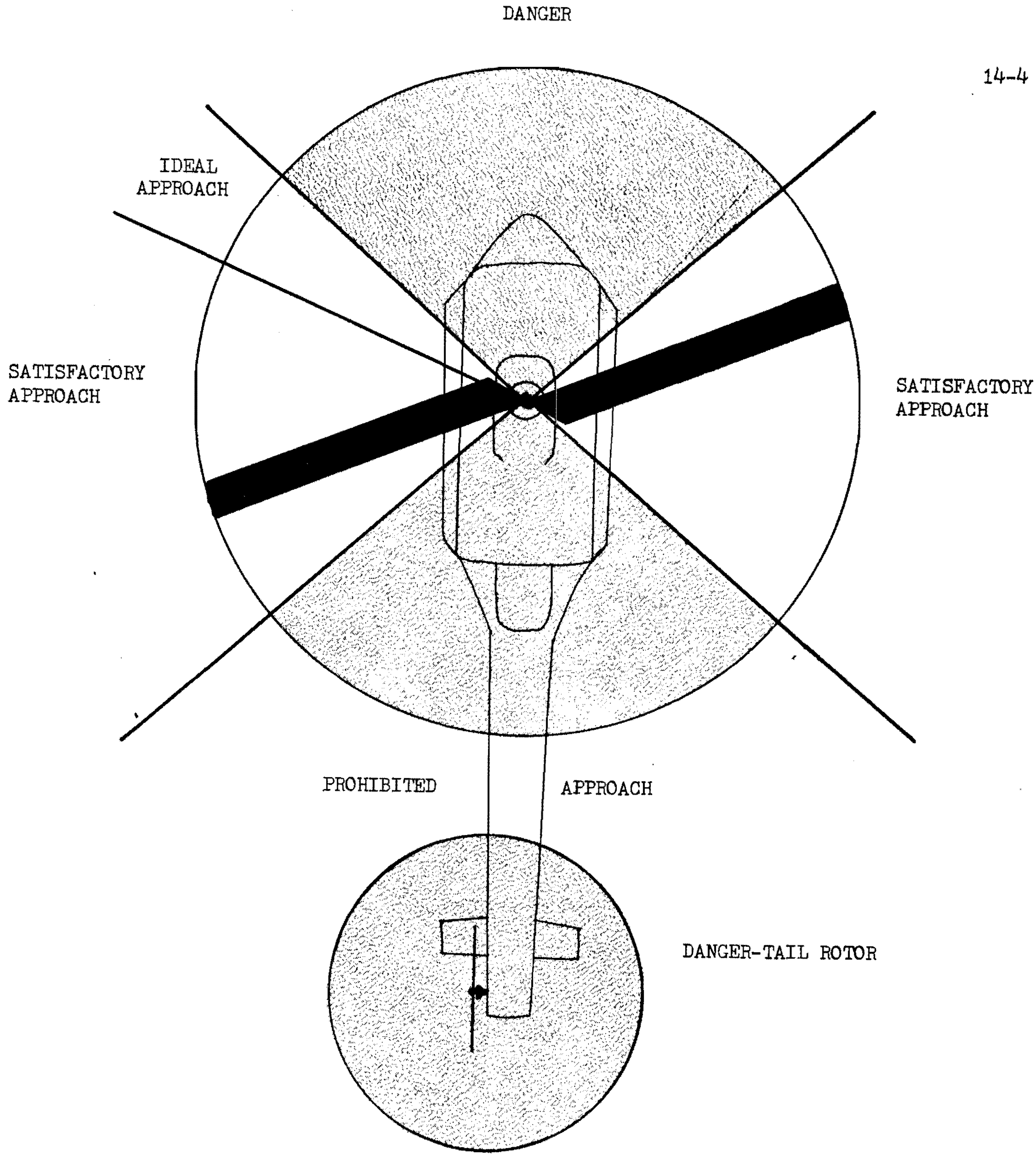


FIGURE 14-4: Approach zones.

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.

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 splinting 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.

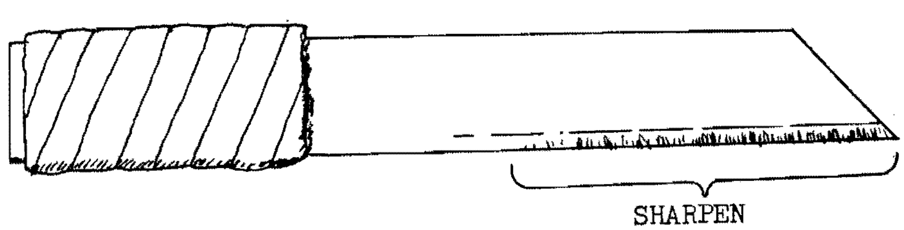


FIGURE 15-1: Leaf Spring Cutting Tool

Crash axe. The **device** made specifically for working **as a** leaf spring tool. It can be purchased from most rescue equipment supply houses for about $25.00.

Vise grips (6-8"*) are a very versatile type of pliers that can be used for holding or bending. They will lock onto anything with a very good grip.

Screwdriver set.* The reversable type save weight. These are very useful for dismantling something where it would be easier than tearing it apart with brute force, or for prying in close quarters. The team should carry one small set and one large set.

Come-along. Another very versatile tool for extrication. The tool is basically a portable winch with a very large pulling capacity. They come in $\frac{1}{2}$, 1, and 2 ton models. For rescue work, the 1 ton capacity is the smallest you should get. The cable allows you to pull around corners, through holes, etc. and the hooks on both ends allow you to secure it to a chain loop or loop the cable itself around and hook it to itself. The rachet type offers more versatility than the gear reduction types and is easier to use in close quarters.

Hacksaw is used where supports or rods are too big to chop through. At least 12 extra blades should be carried as these tend to break easily.

Fiberglass mallet.* This type of hammer will not cause a spark, even when striking steel surfaces. The head is made from hard plastic and has as much impact as the regular type. A regular hammer can also be carried for use when sparks are not a hazard. NOTE: this is not a rubber mallet like those used for hub caps.

Metal shears (12"*). Double action metal shears cut sheet metal faster than the leaf spring tool; however, they are only useful for thin gauge metals. Thicker gauges will still have to be cut with the leaf spring tool.

Others. There are many other tools such as bolt cutters, cutter pliers, adjustable cresent wrenches, shovels, etc. They make the work easier, but they all add weight. It's your choice: more tools or a lighter pack. Try to choose multi-purpose tools, and avoid carrying tools which do the same job. That way you buy fewer tools (saving money) and carry less weight.

15.3 EXTRICATION TECHNIQUES

Jammed doors.

If the frame of the aircraft is bent, the door will probably be jammed, making it necessary to force it open. Probably the quickest means is to use a pry bar near the door latch. If the space between the door and the frame is too small, it must be widened before a prybar may be inserted. Start by using a screwdriver if necessary to widen it enough to get a rip bar in. Drive the rip bar into the slot and twist it to widen the crask further. At this point, the prybar should fit easily. (See figure 15-2a). A quicker but less reliable technique is to bash the door panel with a hammer about 3-4" in from the edge. This sometimes will drive the door panel in and cause the edge to flare out leaving a wider gap (see figure 15-2b).

When all else fails, the come-along can be used to pull the door open. Widen the door gap enough to get the hook securely on the door, and anchor the other end to a strong point at the front of the aircraft, such as the prop shaft. Be sure everyone is clear of the cable's radius in case the hook slips off, then start pulling. A short length of rope can be tied to the cable to keep the hook from flying too far if it slips off. This technique is much slower but will almost always work. Always stay clear of the door since it may pop open quite suddenly. To gain more outward force, the cable can be bridged over a log or something similar (see figure 15-3). A second person can assist with a pry bar as long as he <u>always</u> stays well clear of the door swing.

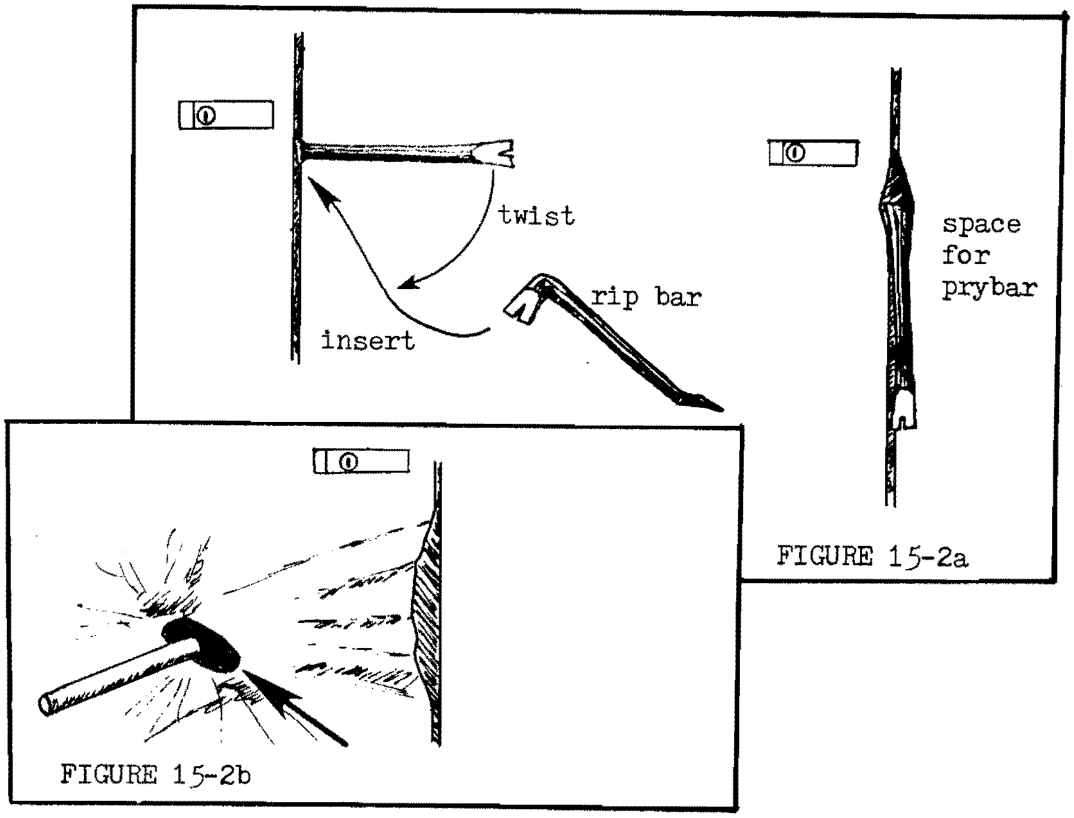


FIGURE 15-2a

FIGURE 15-2b

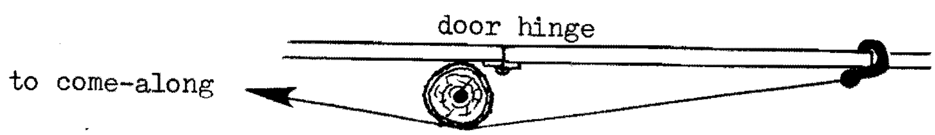


FIGURE 15-3: Using a come-along to open a jammed door.

<u>Gaining access through windows.</u>

Windows offer the quickest access to the victim if the doors will not open readily. Most aircraft windows are made of plexiglass which can be tough to get through. Three techniques that can be used are pulling the window out of its setting, cutting with a leaf spring tool, and freezing and shattering it. The latter has the disadvantage of using up your fire bottle. Shattering it also leaves sharp fragments that can cut easily, and must be cleared out of the way. Pulling the window out of the frame can be tried if the window will flex in enough to allow it to pop out. Then just work the remaining sides free. If the window is to be cut, use the leaf spring tool just as if you were cutting metal. Don't waste time cutting all four sides. Cut only three sides and break the last one.

REMEMBER, cutting and removing the window is slower but it does not leave sharp fragments around, whereas breaking it does. If time is important, the window may be shattered after a concentrated blast from a CO_2 fire bottle. Use enough CO_2 to make the window heavily frosted, then strike it quickly with a sharp pointed tool before it can warm up. This may not even be possible if the temperature outside is very high.

Removing the control column.

The impact of the crash will probably jam the control column and may also help to pin the victim. Removal of the control column may be necessary to free the victim. First, try to force the elevators down. The extra leverage may move the controls in.

The simplest procedure for removing the control column is to cut it with a hacksaw. Since the control column is not as massive as the ones in automobiles, the cutting should not be too difficult. Cut as close as possible to the instrument panel. Be sure to pad the raw edge of the pipe after it is cut.

Close quarters may make cutting difficult so bending may be the only answer. First remove the windshield and run the cable of the come-along in through the opening. Either wrap a chain around the column near the end and hook on to it, or wrap the cable itself around the column and hook it to itself. Anchor the other end to the propshaft and start pulling carefully. Blocks may need to be placed where the cable runs over the dash to keep it from caving in when tension is placed on the cable, and to insure a high lift angle. Partially cutting the column will make the bending easier. This cut should be made on the bottom as near to the instrument panel as possible. (See figure 15-4.)

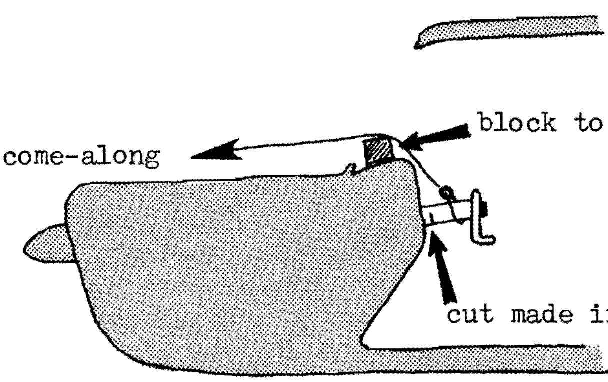


FIGURE 15-4: Using the come-along to bend the control column.

Pulling the seat back.

Jammed seats may present a problem for extrication. The tremendous forces of impact can shear off the seat latching mechanism allowing the seat to slide to the full forward position. If the tracks then get bent, the seat will be jammed in that position. To pull the seat back, first make sure the victim is packaged (i.e. backboarded, collar on, etc.) Next wrap a chain around the entire seat frame as low as possible. Hook the come-along to the chain and secure the other end to a strong point and start pulling. If there are no strong points available inside the aircraft, a hole may be cut in the side of the aircraft and the cable passed in through it. The victim should be supported as much as possible to insure that he is not bounced around when the seat breaks loose. If this technique is used, you may find it is necessary to anchor the aircraft itself to keep from dragging it. Most of the time, the seat can be forced back along its tracks, but it may be necessary to pull it completely loose from its supports.

Pulling out bulkheads.

The come-along is the tool of choice for moving caved in bulkheads. If a chain can be passed around the part that is to be pulled out, or the hook can be secured to it the process is simple. Just anchor the other end of the come-along to something secure (a tree for example) and pull.

If the above cannot be accomplished, cut a small hole in the bulkhead just large enough to pass the hook through. Push the hook through enough to allow a pry bar to be passed through the eye of the hook. This will prevent the hook from pulling back through and give you something solid to pull against. As before, the aircraft may need to be anchored to prevent the whole thing from being dragged, instead of just the bulkhead. (See figure 15-5.)

If something solid can be found to pry against, a pry bar might work to some extent, but you will usually not be able to gain enough leverage to do much good.

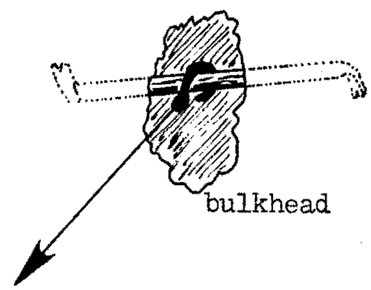


FIGURE 15-5: Pulling out bulkheads

Large scale cutting.

When all else fails, the team may resort to removing entire sections of the aircraft to remove a victim. This is a strenuous, time consuming operation and should be used only as a last resort. Whenever possible, you should make use of existing openings and seams. Do not waste time cutting all the sides: bend the last one. This makes one less sharp edge to worry about. On some low wing aircraft, the support posts can be cut and the entire roof section pulled back like a convertible. (NOTE: this should not be tried with high wing aircraft due to the fuel tanks in the wings and the fuel lines running down the support posts.) REMEMBER, the exposed edges of the metal will be sharp. Use caution around them.

15.4 GENERAL SAFETY

All personnel involved in the extrication procedures should wear gloves, hard-hats, and eye protection at all times.

The ground cable of the battery should be removed if it can be reached. This lessens the fire hazard from a spark. (NOTE: if the positive cable is removed, there is a danger of causing a spark if the tool touches the frame.) All personnel not directly involved with the extrication should be well clear of the aircraft at all times.

15.5 CONCLUSION

With a little ingenuity and common hand tools, the team should be able to handle most extrication problems relatively easily. Many junk yards are willing to let you practice on junked cars provided that you follow their safety regulations. Volkswagons and small compacts are excellent because the working room closely approximates that of a light aircraft. In addition, most rescue squads hold regular practice sessions in extrication. An arrangement might be made to let your team train with them.

Whenever or wherever you practice these techniques, utmost concern should be given to safety. Injuring team members defeats the whole purpose of this training.

15.6 REFERENCES

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

Grant, Harvey: Vehicle Rescue. Robert J. Brady, Bowie, 1975.

Ohio Trade and Industrial Education Service: Victim Rescue. Ohio State University Division of Vocational Education, Columbus, 1976.

United States Department of Transportation: Emergency Medical Technician: Crash-Victim Extrication Training Course, Course Guide, US Government Printing Office, Washington, D. C. (No date given)

CHAPTER SIXTEEN

FIREFIGHTING

16.0 GENERAL

When aircraft go down, they are often still full, to some extent, of high octane fuel. Since the fuel tanks almost always start leaking on impact, it is possible that GSAR teams will be faced with a fire when they arrive. The more recent the crash, the higher this possibility. This, combined with the possibility of a fire in one's home or office, makes basic firefighting a very good skill to have.

Before we can learn how to fight a fire, we must understand exactly what a fire it. The process we call burning is actually the process when some substance, a fuel, combines with oxygen in the presence of heat. These three things, fuel, oxygen, and heat, form what is called the fire triangle (see figure 16-1). All three must be present to have a fire. Remove any one, and the fire cannot continue to burn. This is the basis for all firefighting techniques.

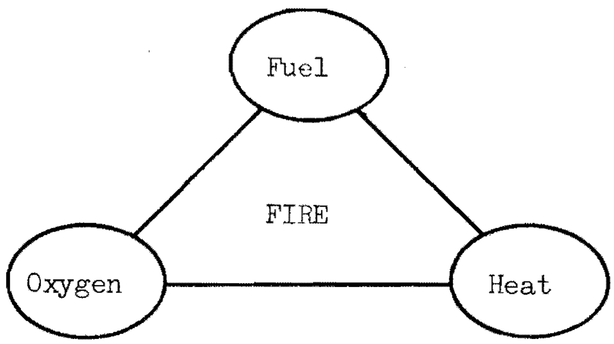


FIGURE 16-1: The Fire Triangle

16.1 CLASSES OF FIRES

There are a vast variety of things that will burn. To simplify matters, these are classified into four broad groups as listed below.

Class A--Common combustibles (e.g. paper, wood, cloth)
Class B--Flammable liquids (e.g. gasoline, oil, grease)
Class C--Electrical fires (e.g. radios, fuseboxes)
Class D--Burning metals (e.g. magnesium, sodium, potassium)

Since the techniques for fighting Class D fires are beyond the capabilities of most GSAR teams, they will not be discussed in this chapter. For firefighting purposes, all combustables fall into one of these catagories.

16.2 TYPES OF FIRE EXTINGUISHERS

There are three general types of fire extinguishers:

Stored pressure. This type is pressurized when it is filled and stays pressurized until it is used. It can be recognized by a valve, handle, and a pressure gauge.

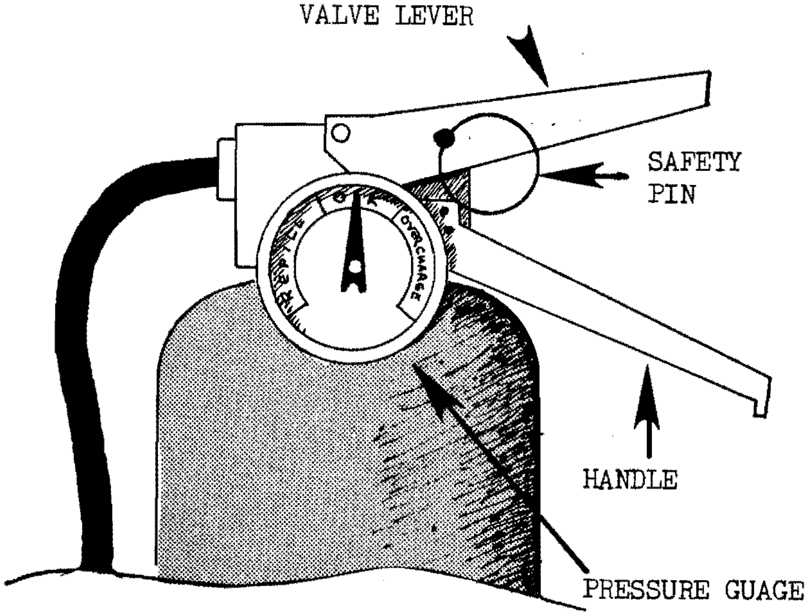


FIGURE 16-2: Stored Pressure Extinguisher

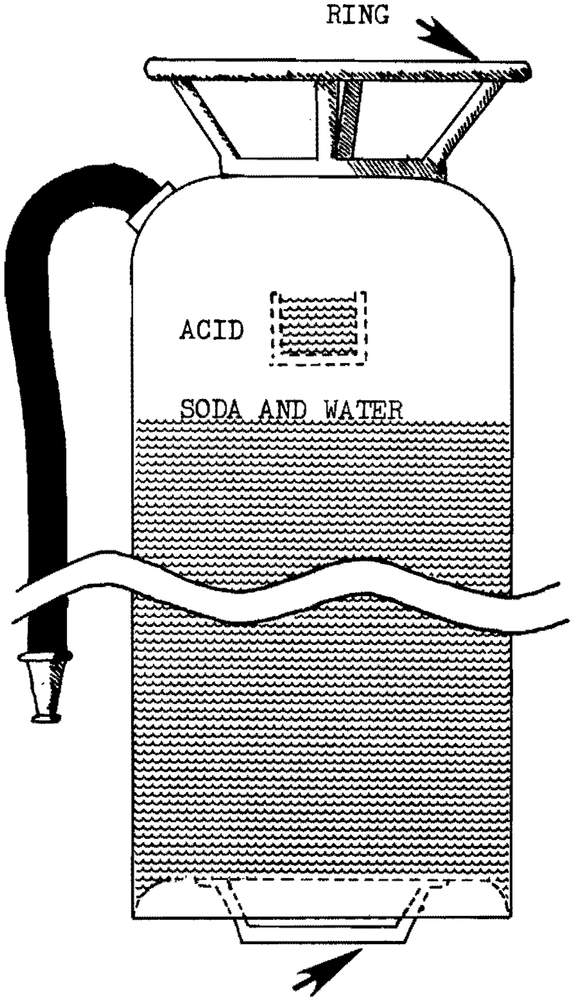


FIGURE 16-3: Soda-Acid Type, Pressure at Use Extinguisher

The valve lets you start and stop the flow at will. To use, remove the safety pin, aim the nozzle, and squeeze the valve. The pressure gauge should be checked periodically when the extinguisher is stored. (See figure 16-2.)

Pressurized at use. This type contains an agent or device to pressurize the extinguisher quickly when needed. It can be recognized by a hand ring running around the top and a handle on the bottom (see figure 16-3). One type contains an acid in one compartment and a soda solution in the other. To use, the extinguisher is inverted, allowing the two solutions to mix and create gas, and therefore pressure. Once the flow is started, the contents must be used without pause. If you turn the extinguisher right side up, the gas pressure is lost. The other type contains a pressure cartridge and a plunger on the top. To use, it is inverted, the plunger is slammed into the floor, thus puncturing the cartridge, and pressurizing the extinguisher. This type must also be used without pause.

Remember: If the tank is already pressurized, it will have a valve lever. If it must be inverted to be pressurized, it will have a ring around the top and a handle underneath.

Manual. This type is merely a tank and a hand operated pump. To use, you just aim the nozzle and pump.

Any fire extinguisher should be checked periodically for pressure, being "in date" according to manufacturer specifications, and for possible nozzle obstructions. Any extinguisher should be cleaned and recharged after use.

16.3 TYPES OF EXTINGUISHING AGENTS

As was said previously, there are four classes of fires, each class with its own burning characteristics. No one agent can work equally well on all classes. For this reason, several agents are used, each with its own properties.

Water. One of the oldest fire extinguishing agents. It works well on Class A fires, but since oil floats on water and water is hazardous around electricity, it is not commonly used on any other class. It works by cooling and cutting off oxygen. (A fine mist sometimes works on Class B fires.)

Dry chemical. This probably comes closest to a universal extinguishing agent. It is effective on Class B, Class C, and, to a lesser degree, on Class A fires. It works by smothering the fire with a fine sticky powder.

Carbon dioxide (CO_2). It works by displacing the oxygen. It is effective on Class B and Class C fires. It does not work well on anything but very small Class A fires because its smothering effect is very short. It only displaces the oxygen for a few seconds, which is not long enough to put out deep seated embers found in Class A fires.

Foam. This type is used on Class A and Class B fires. It works by cooling and smothering the fire. Since it is water based, it should not be used for Class C fires. (Note: light water works the same as foam.)

Sand and dirt. They work on all classes. They work by smothering.

16.4 GENERAL TECHNIQUES

1. There's not a lot of agent in a fire extinguisher, so don't waste it!

2. Sweep the flames back with a side to side motion. Cover the fire with an even blanket of the agent.

3. With CO_2, cover the entire fire with a heavy cloud, or it may reflash as soon as the cloud dissipates.

4. Don't blast burning liquids, as this may spatter them. Only fog them with a fine mist, or cover lightly with foam.

5. Always cut power to a Class C fire first, then fight the fire.

6. If an aircraft is involved, the passengers are your primary responsibility. Get them out first, then if the fire won't go out easily, back off! Your little fire bottle is no match for twenty gallons of AVGAS.

16.5 COMMON FIRE SOURCES IN AIRCRAFT

GSAR team members should be aware of the following possible fire causes in aircraft. These may also be causes of fires in ground vehicles.

Engine fires may be caused by the following, especially during start-ups:

1. Oil leaks or spills
2. Fuel leaks or spills
3. Flammables on the manifolds (e.g. birdnests), or
4. Electrical wiring.

Fuel tank fires may occur during fueling or after a crash. These fires cannot be fought by any means at the disposal of most GSAR teams. Remove the victims, if possible, and run.

Brake fires may result from hard stops.

Interior fires may involve the instrument panel or interior wiring (Class C fire), or upholstery and carpet (Class A fire).

In any vehicle or aircraft fire, try to:

1. Approach from another direction than the fuel tank, and from upwind if possible.
2. Turn off the ignition and disconnect the battery.
3. Crimp broken fuel or hydraulic lines.

Above all, rescue the occupants, as a first priority.

CHAPTER SEVENTEEN

RADIOLOGICAL MONITORING AND DECONTAMINATION

17.0 GENERAL

Written agreements between the Office of Emergency Preparedness and the Civil Air Patrol make it part of the GSAR teams' job to become proficient in radiological monitoring and decontamination. This skill is learned specifically through the Virginia Office of Energy and Emergency Services, at courses taught locally. The basic sixteen hour course is half correspondence, and half practice. Cadets under eighteen may take the course, but may not do the field work that utilizes an actual radioactive substance.

The GSAR team leader should remember that, like any skill, radiological montoring and decontamination must be practiced, and personnel should be allowed to practice with the equipment so as to retain their knowledge and skill. Proper care, maintenance, and storage of monitoring instruments will assure proper working condition when they are needed.

While it is true that actual use of this skill will not occur often if ever (one hopes), in case of a nuclear accident or war situation there will not be time to fix broken equipment or train operators in use of the equipment. It thus becomes important that the skill be learned and practiced now, towards the day when it might suddenly be needed.

17.1 EFFECTS OF NUCLEAR WEAPONS

When a nuclear weapon is detonated, it creates the same effects as conventional chemical explosives, but with one important addition. The difference is radiation, and the magnitude of the energy released and the effects of heat and blast are much more pronounced than with chemical explosives.

Simply put, when a given amount of a radioactive substance such as U-235 reaches a critical mas (i.e. amount), the mass releases a tremendous amount of nuclear energy quickly and violently. The resulting energy is first seen as extremely intense light, the thermal wave. This light does two main things: first, it superheats the surrounding air as it passes through, causing a rapid expansion outward of this air, and secondly, it directly causes burnable material to ignite, simply from the intensity of the light.

This rapidly heated air moving outward away from the point of detonation is the blast wave. The blast wave, moving at high speed, will knock down all but the strongest buildings. As the superheated air rises, the outside air is pulled back toward the detonation point. This is the suction phase. These two phases occur rapidly within seconds of the initial blast. Finally, a shock wave, resulting from the impact of the weapon on the earth's surface, will travel outwards. Not unlike an earthquake, this shock wave is slower than the thermal or blast wave, but may extend further.

With the release of energy from the atoms of the U-235 other atoms in other material are caused to become radioactive. The debris created by the blast effect are swept upward with the expanding air to form the characteristic mushroom cloud. The cloud contains particles that range in size from the smallest of dust motes to particles the size of table salt. Since the release of nuclear energy has caused the atoms of the debris to become radioactive, they pose a particularly dangerous form of weapon effect. This cloud of particles is swept away by the wind, with the particles slowly settling to earth hundreds of miles away from the impact point. The coarse particles settle down quickly, and some fine particles remain suspended in the atmosphere indefinitely.

The effects of thermal wave and blast wave are felt only in the immediate area of the blast point. The size of this area depends on the altitude at which the weapon was detonated, the terrain, the weather, and the size of the weapon. Contrary to popular belief, only about two percent of the total land surface of the United States would be destroyed by the initial effects of nuclear weapons during nuclear war. This is based on studies done by the Department of Defense and uses knowledge of the number of prime targets in the U.S. as well as the known capability of other nations. It should be obvious that the greatest danger to life comes from the fallout that will occur hours after the weapon's detonation. This is the danger that we as GSAR personnel must be ready to shelter against and detect with our radiation monitoring instruments.

17.2 PROTECTION FROM FALLOUT

As devastating as nuclear weapons are, and as deadly as the effects of radiation are, there are several things we can do to protect ourselves. The first is time. Since the radioactive atoms are unstable, they decay at a fixed rate, depending on the particular atom that was created by the blast. This leads to the empirical seven/ten rule. For every seven hour increase in time since the blast, there is a decrease in radiation by a factor of ten. We measure this radiation with equipment called survey meters or geiger counters. The equipment measures the energy released as the atoms decay, returning to their more stable forms. The unit of measure we call a roentgen. If at H(or the time of explosion) hour the outside radiation was measured at 600 roentgens, in seven hours the radiation level would fall to 60 roentgens. By fourteen hours since the explosion the rate would have dropped to six roentgens. Thus the longer we can shelter ourselves from the radiation, the less the radiation danger would be.

To shield ourselves from the radioactive fallout we must consider the types of radiation of which we are talking. Essentially three types are present after an explosion: Alpha and beta particles, and gamma rays. Alpha particle radiation can be stopped by a single sheet of paper. Beta radiation requires an inch of wood or a sheet of thin aluminum to stop it. Gamma rays require thick lead or concrete to be stopped. You should note that dense materials are required to stop the gamma rays. Thus shelter or shielding should utilize the densest material available. Dirt, concrete, steel, and lead are examples of these dense materials. Our teams then need to take shelter where this material protescts them from the fallout particles. Thus shielding is the second protective measure.

The third protective measure is distance. The farther we are from the particles the more protection we gain. This can be accomplished by being in the center of buildings, or deep underground, or just a long way from the fallout.

These three methods of protection are seldom used by themselves, but in combination. Time will carry on regardless of what we do. We can construct shelters using dirt, concrete, or other dense material to protect ourselves by shielding, as well as distance. Shelters can be built quickly before fallout begins as it may be hours before the radioactive cloud of material reaches our location after a distant detonation. Ideally, however, we should have shelters already constructed with the view toward taking shelter when it is needed. CAP ground teams can work out arrangements with OEES prior to an attack. It should be noted that most of us as civilians are going to be concerned about our families before we react as a CAP unit. It thus becomes vital to be sure that your family knows the location of public shelters in their area, or that you have a shelter at home.

17.3 DECONTAMINATION PROCEDURES

It is vital to remember here that, unlike the horror movies of the fallout fifties would have had us believe, exposure to radiation from radioactive fallout DOES NOT MAKE YOU RADIOACTIVE! Removal of the particles of fallout will reduce the level of radiation. It becomes important, then, for CAP GSAR teams to understand what must be done to decontaminate themselves, or their vehicle, by removal of the fallout particles.

What is needed is an area away from the shelter, but where the radiation levels are as low as possible. Additionally, water, brushes, brooms, vacuums, and perhaps steam should be on hand. Another area needs to be set aside for storage of clothing, vehicles, or aircraft that have become so contaminated that they cannot be cleaned. Remember, however, that in time these contaminated articles will become less radioactive by the 7/10 rule, so they may be used again.

The first step is to brush, shake, or vacuum off the particles on the person, aircraft, or vehicle and wash the outside. Then a Radiation Monitor (RM) will check to see if the levels of radiation are acceptable. If they are not, the process will be repeated, this time checking areas where the fallout particles would collect like dirt. On a person this might be fingernails, hair, seams of clothing, or other body cavities. On an aircraft or vehicle places like open spaces, grease spots, exhaust ports, or oil spills are likely places. Again, washing, scrubbing with soap and water, vacuuming, steam cleaning (but never use steam inside an aircraft or vehicle) may remove the particles. A second check by the RM will determine if the process needs to be repeated or if the person needs to strip and be thoroughly washed. An aircraft or vehicle may be passed or placed in the quarantine area for future use.

This is by no means an exhaustive treatment of decontamination procedures. It is, however, a basic treatment which will allow you to reduce the danger to your team. Further information is available in the sources listed in the reference section (17.5).

17.4 PEACETIME ACCIDENTS

Normally the local police, fire, and OEES offices have plans written and are trained in the use of radiological monitoring equipment in the event of a nuclear materials accident. Today vast amounts of radioactive materials are used in industry and hospitals. These materials are stored and moved about on our road, rail, and air transportation systems daily. The local authorities should be aware of this and have planned for a nuclear accident in their area of jurisdiction.

CAP will not normally be called to aid in this type of radiation problem. If, however, the local authorities do not have this capability it may well be that your unit can aid the community by developing such resources for them. It is not our primary duty, though, and should be checked out with your Task Force Commander and Wing.

17.5 REFERENCES

SM-11.22-2 Radiological Defense. Defense Civil Preparedness Agency, Department of Defense, June, 1974.

SM-11.22.1 Radiological Monitoring for Instructors, Student Workbook. Defense Civil Preparedness Agency, Department of Defense, April, 1968.

SM-11.21.1 Radiological Monitoring Student Workbook. Defense Civil Preparedness Agency, Department of Defense, October, 1975.

FG-E-5.6/1 Users' Manual, Meteorological Data for Radiological Defense. Defense Civil Preparedness Agency, Department of Defense, July, 1970.

A Review of the Department of Transportation (DOT) Regulations for Transportation of Radioactive Materials. U.S. Department of Transportation, Materials Transportation Bureau, Office of Hazardous Materials Operations, August, 1976.

Radiological Defense Planning and Information. Virginia Office of Emergency Services, September, 1976.