

TEAM COMMANDER'S NOTEBOOK

A SERIES OF ARTICLES FOR C.A.P. RANGER TEAM COMMANDERS

NO. 1

AIR-GROUND COORDINATION

BY GLEN D. KREIDER



**PUBLISHED BY THE RANGER SECTION,
PENNSYLVANIA WING, CIVIL AIR PATROL**

ACKNOWLEDGMENTS

This manual incorporates appropriate directives concerning pilot-Ranger Team coordination, originally published by Col. Philip Neuweiler, Pennsylvania Wing Commander. For his pioneering efforts in this area, we are all grateful.

Many of the procedures described in this manual were developed and tested in a joint effort among pilots and Ranger personnel of Group 1300 (Pennsylvania Wing) Civil Air Patrol.

As a Ranger, the author acknowledges gratitude to the many participating pilots who have provided valuable insights "from the other side of the fence". Without their assistance, this publication would necessarily have been far more restricted in scope.

Glen D. Kreider
Capt. CAP

Copyright © 1969 by Glen D. Kreider. All rights reserved. No part of this material may be reproduced in any form without the written permission of the Ranger Section, Pennsylvania Wing, Civil Air Patrol.

This booklet may be ordered from: Squadron 3101, Civil Air Patrol, P.O. Box 3147, Bethlehem, PA 18017.

3rd Printing—July 1986.

AIR-GROUND COORDINATION

* * * * *

STATEMENT OF THE PROBLEM

On October 12, 1968, a CAP search aircraft spotted the wreckage of a missing aircraft and evidence of survivors on a mountaintop in Central Pennsylvania. The pilot returned to his base and briefed the Commanders of two Ranger Teams concerning the location of the victims. The Teams immediately departed for the rescue -- with outdated topographic maps that they had not checked against a current road map. No trouble was anticipated, since the Teams had a radio in their lead vehicle, and a search aircraft was assigned to fly "cover".

While enroute, the Teams (using their outdated maps) followed a highway which -- unknown to them -- had been completely rerouted and re-numbered. The search aircrew saw the Teams' impending dilemma and tried to call the lead vehicle. No answer. Radio malfunction. The pilot then tried to stop the convoy by "buzzing" it. No response. The Ranger Commander could not interpret the meaning of the plane's gyrations. A message drop might have been effective, but this did not occur to the pilot.

The pilot then informed the nearest Base Commander of the situation. Two more Teams were dispatched to make the recovery -- after an impromptu training session in air-ground coordination for the benefit of both the pilots and the Ranger Teams. The two new Teams departed and soon made the recovery. The original Teams eventually discovered their error and took corrective action, but much time had already been lost as a result of communications problems. The original teams must necessarily be charged with a FAILURE to complete their mission.

The above incident drives home the following points:

- Radios are unreliable -- NEVER make the success of a mission depend solely on maintaining radio contact.
- Air-ground communications can be maintained without radios, if both parties are practiced in the proper techniques.
- Holding back a reserve Team is a key move in the event of unforeseen problems.

The incident also indicates the need for more in-training cooperation between pilots and Ranger Teams. Had the parties in question practiced together, they might have realized the need for a simple set of directional signals from air to ground, and vice-versa. An important by-product of such joint practices is the development of an awareness on the part of one party concerning the problems faced by the other.

**"COMMUNICATIONS" INVOLVES MUCH MORE THAN THE MERE
"KEYING" OF A MICROPHONE BUTTON ...**

Good Radioless Communications involves -

- Advance practice
- Awareness of problems encountered by others in the search effort
- An attempt to view the situation from the eyes of others

Fortunately, the mission in question was a SARCAP, and it accomplished precisely what SARCAPS are designed to do: it exposed a major flaw in the existing search plan. The following sections constitute an attempt to fill that gap and thus, hopefully, increase the rescue effectiveness of Civil Air Patrol.

COMMUNICATIONS: THE VITAL LINK

On every REDCAP or SARCAP, several distinct units are in operation: land search teams in the field, bases of operation with their administrative and executive personnel, aircraft flying search patterns, and the like. However, a true mission is more than the mere sum of all these parts: it is a unique organization of the parts into a working whole.

The recognition of this "fact of life" -- the many-faceted nature of the mission -- will help you better understand the vital need for an effective communications system linking all the pieces together. It is your responsibility as a Ranger Team Commander to keep your Headquarters completely informed of your location and activities. Failure to accomplish this could easily result in failure of the mission.

**YOU ARE ONLY A PART OF THE MISSION ...
KEEP IN TOUCH WITH THE OTHER PARTS!**

**A piece of complex machinery will
certainly fail, if one part doesn't
operate in harmony with the rest.**

One vital link connecting the various units participating in a mission is the radio. Radio equipment is subject to damage or malfunction, however, and -- in the case of Team/aircrew operations -- neither the pilot nor the Ranger Team Commander should assume that the other party will always have an operative radio. For this reason, the discussion that follows is divided into two parts -- air-ground coordination with and without radio.

AIR-GROUND COORDINATION WITH RADIO

The most desirable search situation is one in which all elements -- mission headquarters, aircrews, and Ranger Teams -- are interconnected by radio links. Thus, every squadron should strive towards the goal of obtaining radio equipment for both aircraft and Ranger Teams. This discussion will begin by assuming that Team and aircraft are equipped with functioning radios.

Even under the optimum circumstances in which both aircraft and Ranger Teams have radios, the location of the Ranger Team in the field must be known both to mission headquarters and to the search aircraft crews. The mere fact that a Team in the field is radio-equipped is no guarantee that it can be instantly located by a searching aircrew.

With Radio: Guiding the Aircraft to Your Location

When the Team is located in an advanced field position (away from the main base of operations), search aircraft are often quite visible to members of the Team. Unfortunately, the reverse is not always true and, without the Team's assistance, considerable time might be wasted by the pilot in trying to locate the Team.

You can assist the pilot in finding your position quickly by following this procedure:

1. Imagine that you are the pilot, and try to estimate in which direction the Team is located from the search aircraft.
2. Give this information to the pilot, telling him to turn so-many degrees to his right (or left).
3. Carefully observe his movements. With slower-flying aircraft in a cross-wind situation, you might be misled concerning the plane's actual flight path. So, be prepared to transmit changes in direction quickly, to help the pilot find you.
4. If the aircraft flies overhead and misses you, tell the pilot the instant he passes overhead. Then give him appropriate directions to bring him back to your location.
5. In your initial radio contact, don't forget to identify any landmarks that might be nearby. They will help the pilot to spot your location.

With the aircraft in sight of the Team, it should not take more than a minute or two for the aircraft to "home-in" on a Ranger Team. Obviously, the Team can assist the aircraft still further by making itself more visible in various ways, as noted in the following paragraphs.

Pilot Action at "Find-Time"

Once a "find" has been made, the pilot must firmly establish the crash location, radio this information to his base, and then (if he is the only pilot available) proceed to the location of the Ranger Team to give verbal directions to the crash area. With radios, the pilot's major task is maintaining visual contact with the Team. Such contact, of course, will be facilitated by the large, yellow cross painted on the Ranger vehicle, along with other attention-getting techniques discussed below.

With radios, heavy reliance is placed on verbal instructions to move the Team from its position to the crash area. Turns, changes in direction, affirmations and other information are indicated verbally. (Example: "You are approaching a Y-intersection. Take the left fork of the Y ... (a moment later) ... That's correct. Now, proceed on your present route until I give you another instruction"). To reinforce these verbal directions, the pilot may opt to go through the maneuvers which constitute the "Visual Direction Code", as well. It should be apparent that, during this crucial period of the rescue effort, all other stations on the same frequency MUST maintain strict discipline by keeping OFF the air.

The Jumpoff Point: Verbal Directions from the Pilot

The "jumpoff point" is that point beyond which vehicle travel is impossible. From this point, the Team must leave the vehicle and "trek in" to the crash. When the pilot indicates that the jumpoff point has been reached, he next finds the approximate magnetic heading from vehicle to crash and transmits this information to the Team. If visual contact with the Team on foot can be accomplished (as under Winter conditions, or in sparse terrain), the pilot can give directions verbally, in the following manner: the pilot (or, really, the observer) always assumes that the Team is facing in a twelve o'clock direction. That is, we might assume that the Team is in the center of the face of a clock, looking toward the twelve-o'clock position. When viewing the situation in this way, giving directional information to a Ranger Team on foot is relatively simple. Suppose that the observer wishes to indicate to the Team that the crash site is approximately 30° to the right of the Team's (projected) line of travel. The observer would simply indicate to the Team that the crash was located at about "one o'clock" from their present location. The Ranger Team would then make an appropriate adjustment in their direction of travel. The Team's new direction of travel (after making the correction) is assumed to be twelve o'clock once again, and further directional information will be based upon this assumption.

**IN SHORT: THE RANGER TEAM IS ALWAYS ASSUMED
TO BE TRAVELLING IN A TWELVE O'CLOCK DIRECTION**

With this reference information, it is relatively easy for the observer to direct a Team without compass from vehicle to crash in an expeditious manner.

Signalling Aids. Note that, even under conditions when foliage is no problem, individual Rangers should be wearing highly visible garments (daglo vests, orange baseball- or hard-hats, etc.) to help the observer keep them in sight. The use of other techniques, such as carrying a spread-out signal panel in "stretcher" form to increase visibility, are encouraged when such tactics don't seriously hamper the progress of the Team. Smoke bombs and signal mirrors are particularly effective in announcing the Team's current position to the aircrew.

With Radio: From Jumpoff Point to Crash

Even when both Team and aircraft have radios, the normal procedure for the pilot is to proceed from the Ranger vehicle to the crash site, bank sharply over the site, return to the Ranger vehicle, and continue the procedure until the Team reaches the crash. In the process, the pilot takes a "fix" on the crash from his position directly over the Ranger Team, and relays this information to the Team. As a double-check, the Team Commander also takes a heading on the direction of the aircraft as it moves from the Team to the crash site. It is imperative that the aircrew MUST NOT ABANDON THE RANGER TEAM UNTIL IT HAS REACHED THE DOWNED AIRCRAFT AND SIGNALLED THAT EVERYTHING IS UNDER CONTROL. At this crucial moment, the aircrew might well be the Team's only radio relay to the nearest base of operations.

Under conditions of dense foliage, it is especially important that the pilot follow the procedure outlined above. The Team will catch glimpses of the aircraft occasionally, and will thus be reassured of the correctness of their heading. It is wise for the Team Commander to inform the pilot of the Team's current location at frequent intervals. These messages might be like the following: "Flightstone 13, this is Rollingstone 184. We just crossed a small stream about 1/2 mile from the vehicle and are encountering steep terrain. We are now detonating a smoke bomb to indicate our location. Do you see our signal? Over..." With this information, the pilot can readily transmit any corrective action needed by the Team. Such pilot-Team dialogue also assures both parties that the mission is proceeding smoothly.

AIR-GROUND COORDINATION WITHOUT RADIO

GENERAL CONSIDERATIONS

Generally speaking, a Ranger Team should not leave the base of operations without a radio, before the find is made. Unfortunately, it may be the case that a search becomes intensified in an area many miles by road from the nearest airport. If it is highly likely that the find will be made in such a remote area, it makes good sense to have Ranger Teams establish a field base, in close proximity to the area of highest probability.

In establishing such a base, the Ranger Team Commander is responsible for guaranteeing that his position is:

- Readily visible from the air;
- Near some prominent LANDMARK (to help aircraft locate the advance base quickly!);
- KNOWN to the main base (so that the base can dispatch support aircraft quickly; without uncertainty).

Where to Locate?

Obviously, a clearing along a major road near some prominent landmark (radio tower, lake, etc.) would be the best place to establish a field base. Make sure that the location of your vehicle will make it stand out from the terrain. Thus, avoid parking near other vehicles, when possible.

Keep in mind that your Ranger vehicle is a small target from the air; make its location as conspicuous as possible. The yellow cross on the top of all Ranger vehicles identifies it as a rescue vehicle; make sure that your Team's cross is BIG! When the vehicle is parked, awaiting the arrival of air support your Team should lay out signal panels in some meaningful design (e.g., "K", which means "indicate direction to proceed") to help draw the attention of search aircrews. An orange-and-white parachute is an equally-good "attention-getter". While enroute, the Ranger vehicle (if it is an open-bed truck) might have a signal panel lashed securely across the truck bed, to help the observer keep visual contact with the land vehicle.

Team Actions Before Leaving the Main Base

To guarantee that the Base Commander knows the precise location of the Team, the Team Commander must submit in writing that position BEFORE LEAVING THE BASE! This information must accompany the appropriate release forms required by CAP regulations. (Tip: pick up a set of these forms from the Operations Officer as soon as you arrive on base, and fill them out immediately, to avoid delay later!)

In the excitement following a "find", Teams have been known to "charge out" to the area of activity, without informing the appropriate officials of their destination! This indicates very poor discipline -- with both the base Commander and the Ranger Commander at fault -- and must be suppressed! Confusion and waste of time always accompany such action. Normally, Ranger Teams leave base only upon specific orders from the Base Commander (or Mission Coordinator).

While the Team is waiting at the Base, the Ranger Team Commander should make note of all aircraft which are -- or will be -- participating in the search. Color, type, and license number might be useful later, when the Team Commander has to determine whether a given aircraft is part of the operation, or just a transient aircraft. Binoculars are a particularly strong asset to the Commander in making such identification in the field.

Field-to-Base Communications Without Radio

If it becomes necessary for the Team to change its location, the Team CO must report its new location PRECISELY AND IMMEDIATELY to the main base. If radios are not available, a telephone call will do the trick. Courtesy and a brief explanation of the urgency of the call will open most doors to your needs. When feasible, the field base should be located near telephone facilities, so that base can be in direct contact with the Ranger Team when necessary. If such facilities are available, the Ranger Team Commander must inform base headquarters immediately of that telephone number. One Ranger should then be assigned to monitor the telephone (that is, be within listening range) to accept any further orders from base.

KEEP IN TOUCH WITH BASE

- Report position of field base to the Base Commander before leaving the Base
- Report all CHANGES OF LOCATION immediately
- Give Base the telephone number, and assign a Ranger to monitor the phone
- Carry a radio and telephone alert list
- In Summary: Make sure that Base knows your location at all times and that you keep the lines of communication open

It is possible that base itself is not equipped with telephone facilities. In such a case, carrying a radio-telephone alert list of CAP members who have radios in the vicinity of the base is essential. Simply call someone on that list who HAS radio equipment, and ask that person to relay your information to the main base by radio.

The preceding paragraphs should make it abundantly clear that operating without a radio can become quite complicated and requires constant vigilance and -- at times -- considerable imagination. The key idea is to BE SURE that the main base knows the PRECISE location of your Team at all times. If base doesn't know where a particular Team is located, that Team is -- for all practical purposes -- USELESS to the mission.

Team-to-Aircraft Communications Without Radio

Without radios, it is considerably easier for an aircraft to transmit a message to the Ranger Team, than vice-versa. This is accomplished by message drop containers, which are required equipment on all search aircraft. Under rare conditions, the ground Team can relay messages to search aircraft by means of message pickup techniques (described in LAND SEARCH AND RESCUE). More frequently, however, the only means of non-radio communication with search aircraft are the somewhat limited ground-air signals (body, panel, or strip).

In the use of written messages, both Team CO and aircraft observer alike must be as explicit as possible in transmitting messages. There can be no room for misinterpretation. Even a missing punctuation mark in a message dropped to the Team can change the entire meaning of the message and lead to the proverbial "wild-goose chase".

Pilot Actions: Reporting the Find

Once the "find" has been made by search aircrews, the most delicate phase of radioless ground-air cooperation begins. Since the aircraft presumably is without radio, it will be necessary for him to land at the base of operations and transmit information of the find to his Commander after he has firmly established the location in his mind (or, preferably, on his maps). If the base is equipped to handle the newly-authorized frequency (123.1 MHz), the coordinates of the find can be transmitted directly from aircraft to base... or, in lieu of transmitting an exact set of coordinates, the pilot can simply relay information of the find and request additional air support to pinpoint the crash location while he proceeds to locate the Ranger Team and lead them into the target area.

Problems from the Pilot's Perspective

Ideally, the pilot should be able to pinpoint the jumpoff point and transmit this information via coordinates or a marked map which is dropped to the Team. Armed with this information, the Team could then move to the jumpoff point and await guiding aircraft (or move directly into the field, using appropriate navigational aids). Often, however, it might take considerably less time to actually have the aircraft lead the Team to what the pilot deems an appropriate jumpoff point. Outdated maps, or areas with few landmarks or a proliferation of intersecting dirt roads are just a few reasons why using aircraft to direct the Team by road to the jumpoff point might be more feasible. Naturally, if the Team is near an airport and can talk first-hand with the pilot who spotted the crash, some confusion would be eliminated. But if the Team is at a field base, the problems of conveying complex directional information -- even in writing or by telephone -- are magnified even further, making aerial directions the least complicated and most rapid way of getting the Team into the area of the find.

Again, it might be thought that the search aircraft could carry topographic maps with them on the search and, when the find is made, mark the precise location of the crash on the map and drop it to the nearest Ranger Team. This is unrealistic, however, for at least two reasons. First, pilots and observers typically operate with different types of maps and navigation equipment. They are usually unfamiliar with use of geodetic maps and all their details. Even if they were familiar with these maps, many features such as dirt roads might be obscured from their view by heavy foliage, making it difficult for the observer to plot the precise location of the crash. Second, many aircraft, and bases of operation as well, will not have geodetic maps which cover the search area in question... hence, they are forced to rely on the more familiar (to them) but less detailed aeronautical charts to guide their search.

AIRCRAFT VISUAL DIRECTION CODE FOR GUIDING LAND VEHICLES

From his vantage point in the sky, the pilot of the search aircraft can almost always determine an appropriate jumpoff point for the Ranger Team; thus it becomes the task of the aircrew to "lead" the land vehicles from their field base or main base of operations to that jumpoff point. The following paragraphs describe some simple but effective techniques that have been developed to accomplish this phase of the mission. For sake of discussion, it is assumed that the Ranger Team is located at a field base, awaiting the arrival of a search aircraft for further directions.

Mobilizing the Team

Once the search aircraft achieves visual contact with the rescue vehicle, the pilot makes two or more low (BUT SAFE!) passes over the vehicle and in the intended direction of travel. The Ranger Team interprets this maneuver as an indication to proceed immediately in the direction indicated by the aircraft. That is, if the plane makes its passes in a southerly direction, the Team should proceed south along that road, until further directions are indicated by the aircraft.

The Ranger Team will follow the directions given by any aircraft. Therefore, it is imperative that base designates one particular aircraft to lead the Team. If that aircraft runs low on fuel or encounters engine difficulties or other problems, another aircraft should be given EXPLICIT orders to relieve the guiding aircraft and continue leading the Team to the target area. If it appears that the guiding aircraft must make an immediate return to base -- for whatever reason -- and that there will be a delay in assigning another aircraft to lead the Team further, the aircraft should STOP THE TEAM (in a manner to be described below). Otherwise, the Team will assume that they should continue to proceed in the direction indicated. If an indication to STOP is given, the Team will be alert to further directions from the search aircraft. The STOP should be made in such a position that the land vehicle is very visible from the air. This may mean that the driver will have to proceed a short way down the road, possibly to get out from under a dense overgrowth of pines.

After the pilot of the search aircraft determines that the Team is underway in the correct direction, he should climb to a higher altitude -- preferably well ahead of the ground vehicle and in the general direction of the target -- and "wait" for the ground vehicle to approach the first turn (or the jumpoff point, if no turns are necessary). If the distance between turns is particularly long, the pilot should return to the team vehicle and make another pass from behind, in the direction of travel. This gives the driver CONFIDENCE that he is going in the right direction.

Indicating Turns

When the Ranger vehicle approaches an intersection or turnoff of any kind, the Ranger CO will assume that the original direction of travel is appropriate, UNLESS INFORMATION TO THE CONTRARY IS RECEIVED FROM THE SEARCH AIRCRAFT. To alert the Ranger vehicle of an impending turn, the pilot approaches the vehicle from behind, makes a low pass over the vehicle, and

then banks sharply over the intersection, in the direction of travel. The Team interprets this low pass as meaning that a change in direction is coming up; hence, they must be especially alert to the maneuvers of the aircraft.

If the intersection is a complex one (as in Figure 1) and the pilot wants the Team to follow Route A, then he would execute a sharp bank in the direction of that road and continue following the new branch for a short distance. The "navigator" of the Ranger vehicle should be alert to the position of the aircraft during such turn-indications, so that when the vehicle enters the complex intersection, he will be able to direct the vehicle driver to the correct road.

Needless to say, the search aircraft must wait until the vehicle is reasonably close to the intersection before giving a turn indication, so that the Team can clearly see his directional indication. After he has indicated the direction change, the aircraft should climb to a higher altitude and determine whether his direction was correctly interpreted by the surface vehicle.

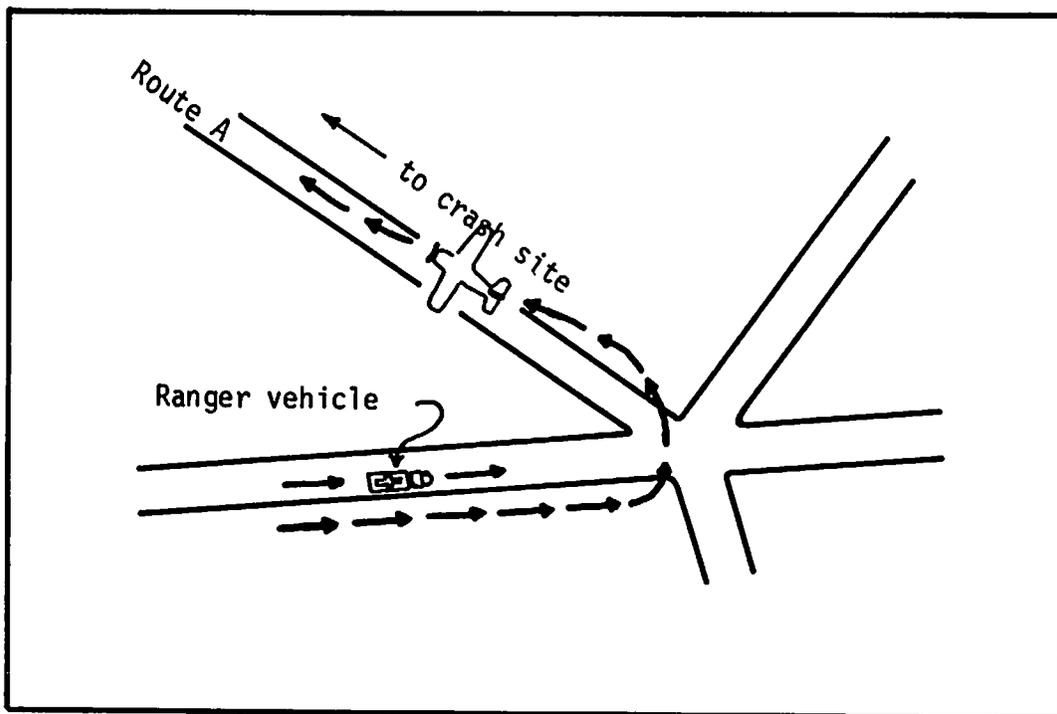


Figure 1 - Indicating a Turn

The Vehicle "Navigator". Obviously, the driver of the Ranger vehicle cannot both drive and keep track of the disposition of the search aircraft at the same time. Consequently, one responsible Ranger with the ground team should be appointed to perform this function as vehicle "navigator". This individual should ride in the seat next to the driver, to afford him maximum visibility and direct verbal contact with the driver.

Stopping the Team

If the vehicle has missed the intersection or has proceeded on the wrong road, it must be STOPPED by the aircraft. The pilot accomplishes this by making a low pass toward the vehicle, opposite to the vehicle's direction of travel (that is, HEAD-ON). When the navigator in the Ranger vehicle sees the aircraft approaching him head-on and low, directly above the road, he should stop the vehicle and await further directions from the aircraft (See Figure 2).

When the Ranger vehicle has been stopped, the procedure described earlier is necessary to get him started in the right direction. Namely, two passes down the road in the proper direction indicates that the Team should turn the vehicle around and proceed, being alert for further directions. Once the Team is again moving in the correct direction, the aircraft can climb to a higher altitude and be prepared to transmit the next change of direction when necessary.

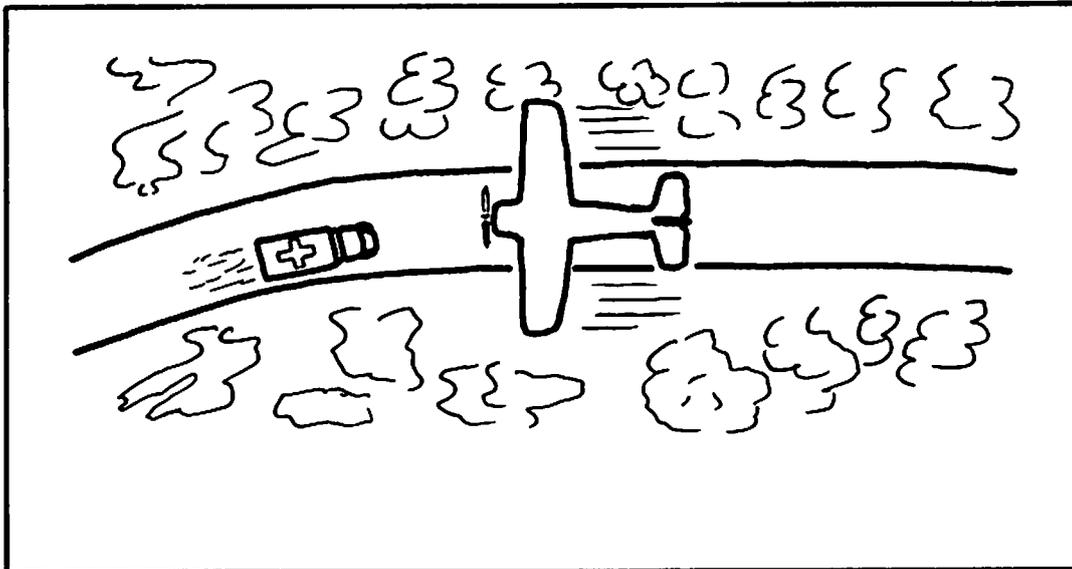


Figure 2 - Halting a Vehicle

Indicating the Jumpoff Point

When the land vehicle approaches the crash vicinity, the pilot will give a STOP signal to the vehicle. At this point, the vehicle occupants will not know why they have been stopped, so they will look for the aircraft to gain some additional information. The pilot transmits this information by making a wide bank (after giving the STOP signal) and flying directly over the vehicle, in the precise direction of the crash. When over the vehicle, the aircraft might either drop a message indicating that the jumpoff point has been reached, or he might employ one of the audio signals mentioned below to alert the Team CO that this is something more than an "ordinary" stop.

The pilot should attempt to stop the Ranger vehicle reasonably far from any intersections, so that the Team will not be confused into thinking that a turn is being indicated. (Actually, no such confusion is likely with experienced Teams, since a turn under these circumstances would be indicated by the aircraft sweeping twice low in the direction of travel to get the vehicle moving again, followed by a bank in the direction of the turn). If there is any indication of confusion, a message drop will clarify the point that the Team has arrived at the jumpoff point and should prepare to enter the field.

LEADING THE TEAM FROM JUMPOFF POINT TO THE CRASH SITE

As soon as the Ranger vehicle stops, the pilot begins his passes from vehicle to crash site. When he approaches the site, a sharp bank (right or left), accompanied by one of the audio signals (discussed below) will indicate to the Team its approximate location. Circling the downed plane, although a common practice, is usually useless and confusing to ground teams. After passing over the downed plane, the search aircraft then returns to the Team, makes a 180° turn, passes over the Team vehicle again in the direction of the crash, banks sharply over the crash, and continues this routine as long as conditions (weather or fuel) permit. This procedure is especially applicable if the crash site is within a few hundred yards of the jumpoff point.

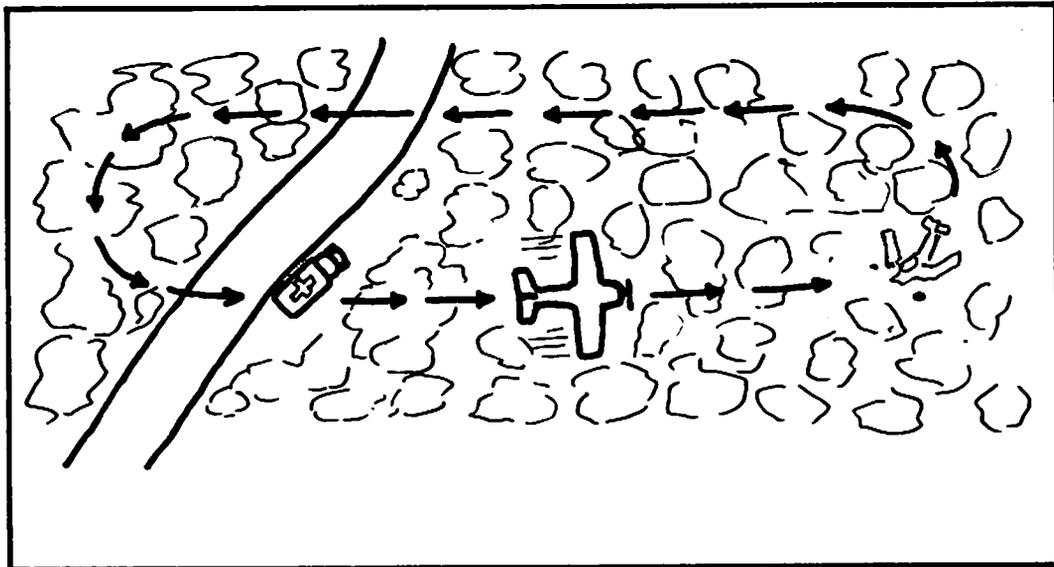


Figure 3 - From Jump-Off to Crash Site

Take a Heading Before Entering the Field

If the crash site is located a considerable distance from any observable roads, then a few additions to the above procedure are in order. Since all aircraft are equipped with a magnetic compass, the pilot should establish the magnetic heading from vehicle to crash site and transmit that

information to the Team via message drop, along with a rough estimate of distance to the crash and other pertinent information (such as "...the crash site is just beyond a small stream on a heading of about...", or "...the location of the crash is near the top of the ridge in a heading of _____ degrees, from your present location...", etc.). Such information can be used to good advantage by the Team to help indicate proximity and hence determine when to fan out into a skirmish pattern.

Instead of depending entirely upon the pilot to supply a magnetic heading, the Team CO should also take a bearing on the approximate direction of the crash (based on two or more of the pilot's passes from vehicle to crash site), to augment or confirm the pilot's reading. If the Team CO knows the precise location of his jumpoff point and the azimuth to the crash, plus other pertinent data such as distance or location with respect to other landmarks, he can plot this information on the geodetic maps and thereby arrive at a fairly good approximation to the crash area. If the crash is a considerable distance from the jumpoff point, a topographic map might indicate more appropriate routes (e.g., "jeep" trails) to the crash area that are not visible from the air. The decision to try these routes should be based upon careful deliberation of the alternatives by the Team CO, however, since unnecessary delay might cost a life. In any event, the original jumpoff point must be clearly marked so that, if other routes prove infeasible, the Team can return to it and use dead reckoning to locate the crash.

Attracting Each Other's Attention

Making the Team Visible to the Pilot. Under conditions of dense ground cover, the aircraft will have difficulty "spotting" the ground Team on foot. But normally, the Team will be able to see him, especially in his low passes from Ranger vehicle to the crash. The Team should indicate to the pilot its progress by occasionally detonating a smoke flare, if these are available. A cheaper method would be to burn a chunk of old tire in a smoke torch (or on the end of a stick), if this will generate enough smoke to penetrate the foliage overhead. Other methods of attracting attention of the pilot under conditions of dense foliage are discussed later.

From The Air: Audio Signals. The aircrew may need to transmit some important information to a Team enroute, even though it does not know the Team's precise location in the field. If a message drop is planned, the pilot must get the attention of the Team. Typically, the Team is only able to catch glimpses of the guiding aircraft, and often the Team members are intent on watching where they are placing their steps, as well as looking on the ground around them for signs of the wreckage. Hence, the pilot must create a signal which the Team members will hear, rather than see. This can be accomplished in two ways: by changing the pitch of the propeller (causing a very audible change in the sound of the aircraft); or, in cases where the pitch is fixed, by reducing (or advancing) the throttle momentarily a few times, after sufficient altitude has been achieved as a safety precaution.

Responding to the Aircraft's Signals. When the aircraft has made an indication that it wishes to transmit information to the Team, it should climb to a higher altitude and wait some kind of response from the Team indicating its location. Similarly, when the Team hears any such irregularities in the sound of the aircraft, every effort must be made by the Team members to attract the attention of the pilot. Perhaps the most effective way to attract the pilot's attention is through the use of signal mirrors. Smoke torches and flares also make the Team more "visible" to the pilot.

A less obvious but sometimes very effective way of attracting the pilot's attention in medium-heavy cover is to vigorously shake a few trees which are tall enough that their tops are visible from the air. You may have observed that, during or before a storm, the leaves of certain trees flop in such a way that their lighter-colored undersides stand in sharp contrast to the darker green upperside. Maples are especially visible in this respect, but others (such as birch and aspen) are equally good. Obviously, shaking a very small tree in a forest of large ones would be useless, as would an attempt to shake a tree in a heavy wind as an indication of one's location. But on a fairly calm day, such gymnastics are quite visible from the air, and it might be just this irregular action that catches the eye of the observer.

Message Drops. When the Team has been alerted for a drop, every member must search the sky for evidence of the message container. When the container is sighted on the way down, an attempt should be made to fix its location, before Team members "charge into the woods" in search of it. At least one person should concentrate on keeping visual contact with the container on the way down, so that when it drops out of sight (in the case of an off-target drop) he can direct other members to its approximate location. A magnetic heading to the drop site should be immediately taken if the container is not in sight on the ground.

Normally, the aircraft will continue to make passes from vehicle to crash site until it receives some indication that the Team has arrived at the crash site (and that everything is under control), or until low fuel or weather force the aircraft to return to base. In the instance of low fuel, base should dispatch another aircraft immediately to take up the task of guiding the Team into the crash location. In case weather precludes further flying, the Ranger Team is "on its own", and must use other techniques to effect a successful completion of the mission (some of which are discussed in LAND SEARCH AND RESCUE).

Be Prepared: Be Inventive!

Certain special conditions might be encountered which will alter slightly the procedure set forth above. In such cases, especially when radio communications are not available, message drop equipment is indispensable; every search aircraft should be equipped with at least three or four drop containers for emergency use. For example, the crash might be located a few hundred yards from a power line or pipeline cut, which is too steep or muddy to be driven by the Ranger vehicle. In such a case, the quickest way to get

the Team to the crash might be to stop them at a point where the cut intersects the nearest road, and instruct them (by message drop or radio, whichever is available) to proceed up the cut until the aircraft drops another message container, marking the approximate entry point into the woods. That point of entry would then be thought of as the "true" jumpoff point by the search aircrew and team alike, and the pilot would fly from that point directly to the crash, bank sharply, return, pass over the point again, proceed to the crash, and so forth. Such variations, where they definitely contribute to the speedy accomplishment of the mission, are very desirable... but the Team must know explicitly what is happening. Without a radio, the only way this information can be transmitted is via message drop.

SUMMARY

Experience has indicated the need for more cooperation between search aircrews and Ranger Teams in routine training missions, so that both can operate in complete harmony during emergency situations. The necessity and the techniques of establishing communication "links" among all parts of the search effort were discussed. The usefulness of radio communications was stressed, but it was acknowledged that communication can be maintained without radio if all elements have trained together and are aware of all communication problems. It was stressed that a Team Commander who fails to maintain these vital communication links has made his Team utterly useless to the mission.

The preceding sections delineated a simple but uniform "communications system" between search pilot and Ranger Team members which is not dependent upon radio equipment, but which is nevertheless quite effective. This system should be adopted by all units and implemented immediately. The main features of this code have been summarized in a table on the back cover.

The optimum search situation is realized when all elements of the search effort are interconnected by radios. But even under these ideal conditions, certain conventions must be observed to insure the speed and success of the mission. These procedures were discussed earlier in the text.

Directing the Team from the jumpoff point to the actual crash location is a difficult operation. Again, communication links must be established. Ranger Teams must periodically keep the pilot "informed" of their position. Without radios, this is accomplished visually by wearing bright garments, discharging smoke bombs, spreading out signal panels, using signal mirrors, and even by shaking trees. In turn, the aircrew can transmit information to the Team by message drop -- preceded, of course, by some audio warning: change of pitch, or interruption of engine (throttling). Obviously, the pilot must find the Team before a drop can be effective. Finally, the very direction and gyrations of the aircraft have meaning to the Team on its way to the target.

The concept of developing effective communications in search and rescue missions cannot be overemphasized.. What might appear to you (the Team Commander in the field) or to the pilot "up there" as a fairly straightforward situation, could easily appear to be utter confusion to another party. That Ranger Team is moving entirely too slowly, in the eyes of the search pilot! What that pilot doesn't see, of course, is the dense growth of underbrush that is hampering the Team's progress. From the other point of view, the pilot who is "so inconsiderate; he expects us to rush over this rock field..." might actually be encountering severe buffeting. And, even if the pilot and Ranger Commander know exactly what's happening at the moment, Base (or Wing) might be completely in the dark, if no one thinks enough to give them periodic progress reports. It is easy for a Team Commander to overlook the fact that it is the responsibility of higher headquarters to coordinate the many parts of the mission. Such coordination is impossible without feedback from the field.

So, once again that vital thread of communications causes the whole mission to "hang together". With it, near miracles are performed. But without it, the mission will fall into so many useless, confused pieces.

AIRCRAFT VISUAL DIRECTION CODE FOR GUIDING LAND SEARCH TEAMS

Aircraft Action

Aircraft approaches Ranger vehicle low and head-on while vehicle is moving.

Aircraft approaches Ranger vehicle from rear and then turns sharply right (or left) in front of vehicle while vehicle is in motion.

Aircraft makes two passes in same direction over a halted Ranger Team.

Desired Ranger Team Action

Stop vehicle and await further instructions.

Turn vehicle to right (or left) at the same spot, and keep moving.

Move out in the direction of the two low passes. (Follow aircraft and obey any further signals -- the pilot is taking charge of directing the Team.)

INTERNATIONAL GROUND-AIR EMERGENCY CODE

	Require doctor -- serious injuries.		Probably safe to land here.
	Require medical supplies.		All well.
	Unable to proceed.		Require fuel and oil.
	Require food and water.		No -- negative.
	Require firearms and ammunition.		Yes -- affirmative.
	Indicate direction to proceed.		Not understood.
	Am proceeding in this direction.		Require engineer.
	Will attempt to take off.		Require compass and map.
	Aircraft badly damaged.		Require signal lamp.