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NO. 7

ELT GROUND SEARCH

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ELT GROUND SEARCH

by

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Edited by T. E. Jensen.

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This is No. 7 in a series of articles intended to provide technical and logistical information of value to Civil Air Patrol Ranger Team Commanders or the commanders of other Land Search Teams involved in land search and rescue.

ELT GROUND SEARCH

BACKGROUND

In recent years a major change has come into the Search and Rescue effort, as applied to downed aircraft, through the use of the **Emergency Locator Transmitter** (ELT). In an ideal situation, the ELT will lead specially equipped search aircraft to the area of a crash site, the search pilots will then visually pinpoint the crash location and direct the ground search team (Ranger Team) to the wreckage. Since ideal conditions do not always prevail, the tried and proven search methods employed by Ranger Teams have not been totally outdated. This new search method has also, however, been adapted for ground use, adding a potent new technique for use when visibility prevents aircraft from flying or from making the final visual pinpointing. This new addition to our arsenal gives ground search teams a greatly increased ability to more quickly locate the target, thus giving a greater potential for saving lives.

CAP Ranger Teams have always taken pride in being professionals at search and rescue. This Team Commander's Notebook is intended to help a Ranger Team extend that professionalism. The necessary equipment is listed in Appendix I. It is now up to each Ranger Team to obtain that equipment and start training their people to operate effectively in an ELT Search.

THEORY

The basic locator "system" consists of a radio transmitter (ELT) attached to the aircraft, and a directional receiver (ELT Locator) with the search team.

The ELT, required on U.S. non-military aircraft by FAA regulations, is a low-power transmitter, with self-contained batteries, that is automatically turned on at the time of a crash by an impact switch. This switch is factory adjusted to turn on the transmitter at an impact greater than 5 g (5 times the force of gravity) at which time the ELT will begin to emit a distinctive "ELT signal" on a frequency of 121.5 MegaHertz (MHz). This signal sounds like a combination of a siren and a buzzsaw wobbling up and down in volume. Once you hear it, you will never forget the sound. For test and training purposes, a steady tone at 121.6 MHz, or some other training frequency, is usually used.

Having its own battery, the transmitter is independent of the aircraft power system. Thus, if the aircraft battery is damaged or torn loose, it will have no effect on the ELT. This transmitter/battery combination is designed to provide a 75 milliWatt signal (very low power) for a minimum of 48 hours. This will give about a 25 - 30 mile reception range for search aircraft at an altitude of 3500 feet (above ground level) and considerably less for a search team at ground level. The limited battery life makes it imperative that an ELT Locator Team be ready to move out as soon as possible upon notification that an ELT signal has been heard.

The ELT is a rugged device, being designed to withstand impacts of up to 50 g and continue operating. The antenna, mounted externally on the aircraft, is the weakest link, being likely to be damaged or torn off. With a damaged or missing antenna the ELT transmitted signal is much weaker, making searching a harder job.

The ELT Locator used to home in on the ELT is a very sensitive radio receiver tuned to the same frequency as the ELT. It is equipped with a directional antenna and an indicator to show when the antenna is "aimed" at the ELT. The receiver is usually supplied with a speaker (and/or headphones) and a **Sensitivity** control so that one can hear a faint signal and then reduce its level as one gets closer to the target.

The ELT (and also, therefore, the ELT Locator) operates on a frequency of 121.5 MHz, the normal aircraft emergency frequency. This frequency is of great importance as it is in the range of frequencies known as "line of sight" - meaning that the signal acts much like a beam of light. ELT signals can be reflected by a hard surface such as a rock hillside, or can be blocked (shadowed) by hills or mountains. See examples in Figure 1.

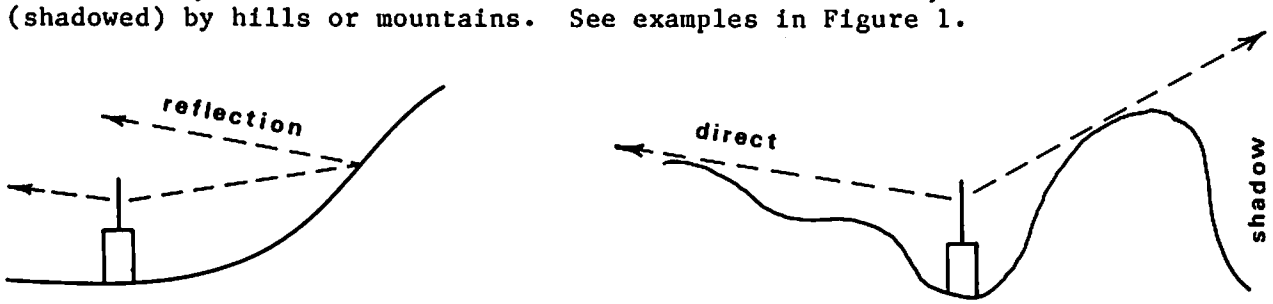

FIGURE 1

A knowledge of the bounce and shadow possibilities of a signal at this frequency is essential in conducting an ELT Search. More on this later.

INSTRUMENT OPERATION

Set up the ELT Locator according to the manufacturer's directions. A thorough study should be made of the handbook that accompanies the locator to prevent damage and ensure familiarity with its operation and handling. An extra bonus is that often the handbook will contain considerable data on field use and techniques. The handbook supplied with the Little L-Per is a very good one and is recommended reading.

The following sections apply to the L-Tronics Little L-Per and certain other units. Consult the handbook for details for your specific unit.

A. Direction Finding Mode (DF)

To begin, the **Volume** control and the **Sensitivity** control should be advanced (in a clockwise direction) about three-fourths of the way to full on. Upon hearing the signal, reduce the **Sensitivity** setting (counter-clockwise) until the signal does not cause the meter to go off scale on either end. Adjust the **Volume** control for a comfortable listening level.

Being certain that you are holding the unit in a vertical position, start turning around until the meter needle comes to the center position or is "zeroed". Adjust the **Sensitivity** control as needed to keep within the meter range. You now know that a signal (real or reflected) is being received from directly in front of you or from directly in back of you. Note that the signal direction is perpendicular (at right angles) to the plane formed by the

antennas. (See Figure 2.)

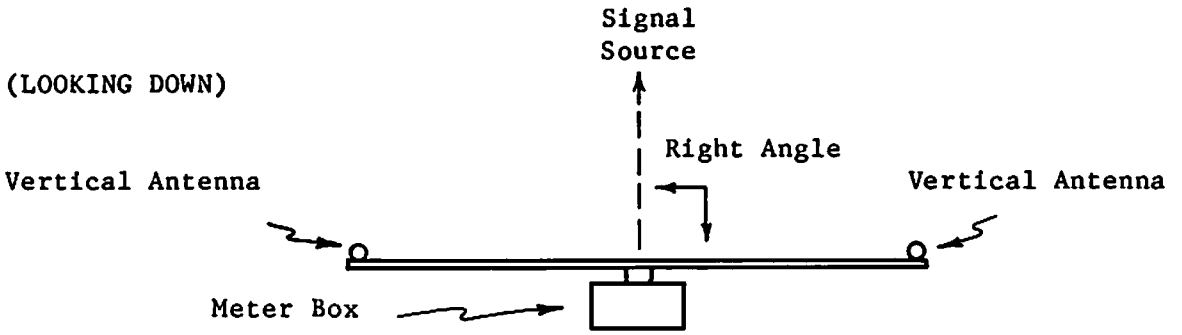

Figure 2.

To determine whether the signal is coming from the front or back, start rotating again away from the "zero" position and note the direction the needle moves.

If the needle moves away from center in the SAME direction that you are turning, continue turning until the needle centers again. This should be 180 degrees from your first position. The signal is now coming from directly in front of you.

If the needle moves away from center in the OPPOSITE direction from the way you are turning, stop and return to the original position. The signal is coming from in front of you.

Zero position. The signal is either in front of you or behind you.

Needle moving in the same direction as you are turning. Signal is behind you.

Needle moving in the opposite direction from the way you are turning. Signal is in front of you.

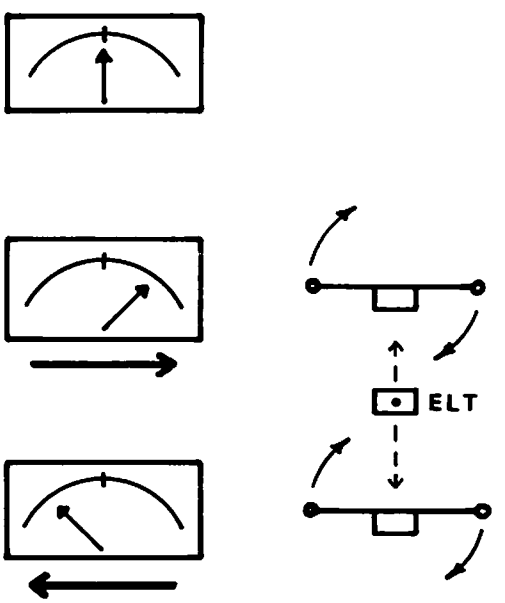

Figure 3.

These instructions are illustrated in Figure 3, and can be summarized by the following simple rule:

> Follow the needle - When the needle is not centered, always turn or rotate in the direction indicated by the needle deflection to bring yourself to facing the signal.

One point to remember as you get closer to the target is to reduce the **Sensitivity** to keep within the limits of the meter deflection range. This adjustment to the **Sensitivity** control (not **Volume**) is necessary to avoid false readings.

B. Receive Mode

In this mode of operation, the signal is not received at right angles to the antenna: instead the maximum signal, as indicated by the meter, will be found when the cross bar holding the antenna elements is pointed at the signal source and the antenna elements are in line, one behind the other, with the direction to the signal source. The meter needle is not, however, used at the center point: you orient the antenna for maximum (to the right) needle deflection as you rotate. You must still adjust the **Sensitivity** control to avoid exceeding the meter limits and getting false readings. See Figure 4.

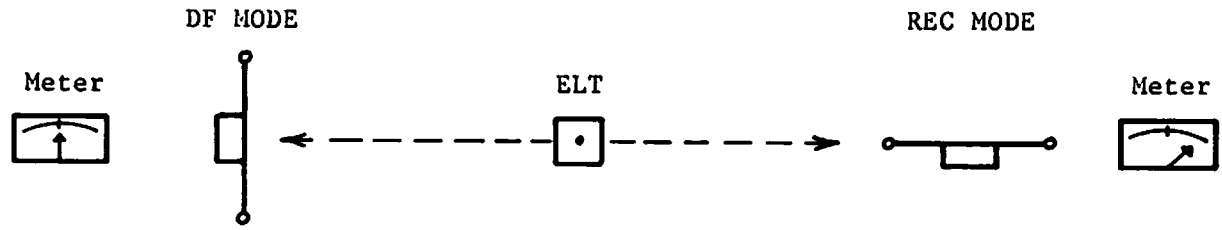

Figure 4.

Look at the antenna mount on the locator and you will find an arrow that indicates the signal direction when the antenna is lined up. Set up the unit as you would do for DF Mode except that the Mode switch will be turned to the REC (Receive) position.

Start turning around with the unit and watch the meter for maximum (to the right) deflection as you adjust the **Sensitivity** control to keep within scale limits. When you reach the point of maximum meter deflection, move back and forth to be sure it is really the maximum signal. The direction of the signal source is now indicated by the arrow on the antenna mount.

In the REC Mode the accuracy of aiming the antenna is not as great as with the DF Mode. The DF Mode will give the most precise indication of direction. The REC Mode can be useful to verify the signal direction obtained by the DF Mode if you have any front/back doubts.

The REC Mode can also be used as a rough gauge of signal strength. If you note the position of the **Sensitivity** control each time you take a reading, you can estimate the signal strength by comparing the point at which this control must be set to give a full-scale meter reading. The lower the setting of the **Sensitivity** control, the stronger the signal. Usually the signal strength will

increase as you approach the target - but not always.

Another important use of the R&C Mode is to determine the orientation of the ELT antenna. Normally it is expected that the ELT antenna on the aircraft will be vertical and that we will receive the maximum signal when the locator's antenna is also vertical. This may not be true as a crashed aircraft may not be upright.

The orientation of the antenna of the ELT determines the "polarization" of the signal. A signal from a vertical antenna is said to be vertically polarized and that from a horizontal antenna is said to be horizontally polarized.

To determine the orientation of the ELT antenna, swing your receiver's antenna from a vertical to a horizontal position while the antenna is aimed at the signal source. If the strength of the signal increases, it is likely that the aircraft is on its side or nose, giving a horizontally polarized signal. If the strength of the signal decreases, the ELT antenna is probably vertical. See Figure 5.

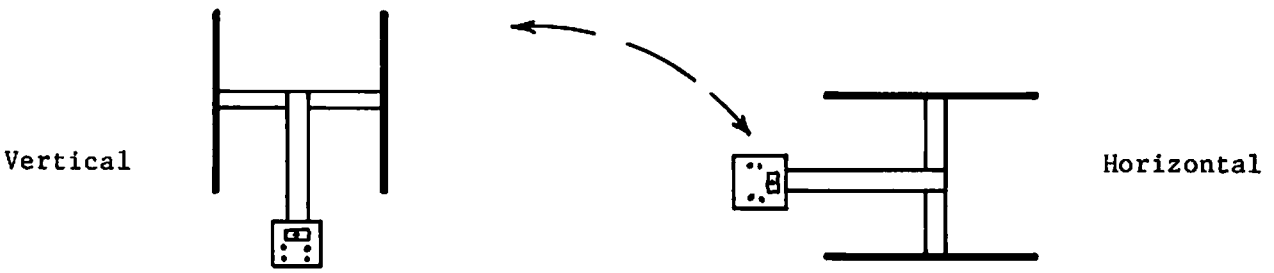

Figure 5.

The swing of the locator antenna from vertical may give you the answer to another important question: is the signal a reflection? If you see no change in signal strength as you swing the antenna, there is a good possibility that you are seeing a reflected or "bounced" signal. Some reflective surfaces will depolarize the signal so that you will not see a strength change. This is a good (but not failure-proof) check if you suspect a reflection.

FIELD USE

A. Selecting A Location To Take A Reading

The selection of a location from which to take your ELT headings will include many considerations. Failure to take note of them can result in misleading headings that prolong a mission through false data.

First: the location must be identifiable. You must be able to pinpoint the location of the team on a map and communicate this to the ELT Search Coordinator or another team. The identification can be made from a nearby landmark, highway route numbers, or compass bearings from more distant landmarks, and communicated using these same features or as latitude/-

longitude. The key is that the location must be communicable and reproducible with accuracy.

A clear field on high ground, free of power lines and reflecting surfaces such as buildings or steep hillsides, is an ideal location from which to take a reading. Be sure to move well away from your vehicle.

All personnel except for the locator operator and compass man should stay away from the area and remain still. This particularly applies to the communicator with his walkie-talkie radio. The antenna of such a radio can pick up and re-radiate the signal, giving false readings. If a radio is being carried by the operator or compass man, collapse the antenna and lay it on the ground. (Do not forget it when you leave the area.)

Note any possible reflective surfaces in the area, both visually and by map, and estimate any possible effects on the received signal. A good technique to verify the presence of reflections is to walk 10 to 20 steps at right angles to the signal heading and watch the meter. If the needle swings widely, you probably have unidentified reflective surfaces in the area (or you are very close to the target). This reading must be considered unreliable and a move made to a new location.

KEY POINTS:

- Is the location free of reflective surfaces?
- Is it identifiable on a map?

B. Determining The Heading

The aiming direction of the ELT Locator must be translated into a compass heading. With some locators, a compass is attached and the only requirement is that the operator read it. Other locators, however, require a separate compass and a second person to read it.

Standing behind the operator and trying to estimate the direction the locator is aimed is difficult and will rarely give a reliable heading. Also, in this position, the compass man is in line with the pickup of the locator and can introduce reflection errors. A more accurate method is shown in Figure 6.

Since the Little L-Per and some other locators work on the principle of phased vertical antennas that line up at right angles to the received signal, a compass reading should be taken from the side. The compass man should move to one side of the operator (preferably the operator's right), far enough away so as not to disturb the signal, and position himself directly in line with the two vertical antennas. A compass heading is taken along this alignment. Adding 90 degrees (subtracting if taken from the left) to this compass reading will give the correct compass bearing of the received signal.

If you are using the REC Mode, do not add 90 degrees, as the antenna is already aligned with the received signal. See Figure 7.

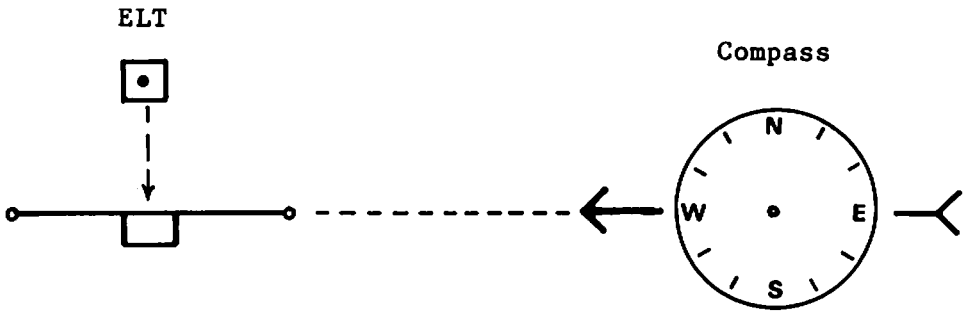

Figure 6.

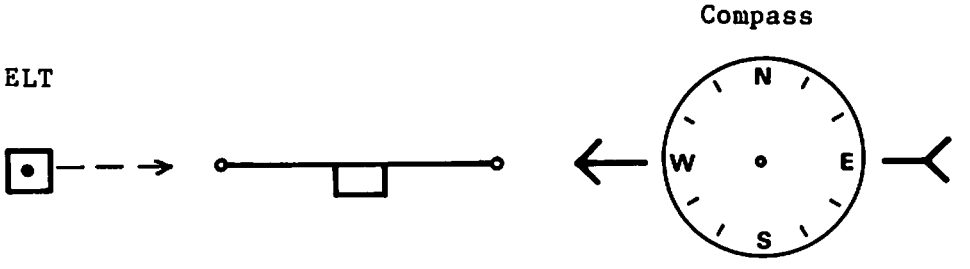

Figure 7.

An alternate technique will allow a single operator to take a bearing. This requires that a sighting device be mounted on the antenna. The operator then takes a sight on a distant object or landmark when his antenna is correctly aligned, lays down the antenna, and takes a compass bearing on the same distant object or landmark. Needless to say, the sight must be very carefully and accurately mounted on the antenna.

C. ELT Search By Triangulation

To maximize search efficiency, it is necessary to reduce to a minimum the amount of territory that must be searched visually on foot. This is especially true in mountainous and/or heavily over-grown areas. Proper use of the ELT Locator can do much to achieve this aim. The key is the use of triangulation techniques to localize the probable area prior to sending in the Ranger Teams for the final search effort.

Triangulation consists of obtaining bearings to the ELT from two or more locations, plotting the locations and bearings on a map, and determining where the bearings intersect. Under ideal conditions, the point of intersection will be the location of the ELT. The bearings may be obtained by two or more ELT Locator teams, or by one team moving to different locations. This sounds like a very simple procedure, and in theory, it is. There are many factors which can come into play, however, that add complications. Some of these will be discussed later.

In Figure 8A, a heading of 80 degrees has been obtained at position 1, and a line extended from this point in the proper direction. A second heading of 160 degrees is noted at position 2 which is also plotted. In this ideal case, the signal source lies at the crossing of the two lines.

Figure 8B shows a case where the lines do not intersect. This indicates that interferring factors are present - a bad compass reading had been made, one of the signals was a reflection, or the ELT has moved. It could even mean that a second ELT is in operation. To clarify the situation, additional bearings should be taken from new locations. A study of the terrain, visually and by map, will often reveal reflective possibilities to simplify this task.

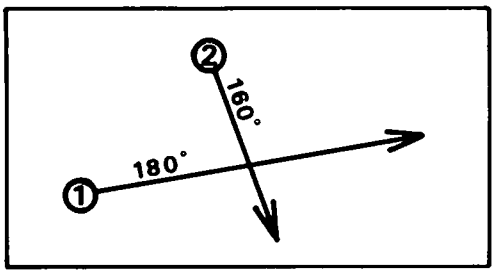

Figure 8A.

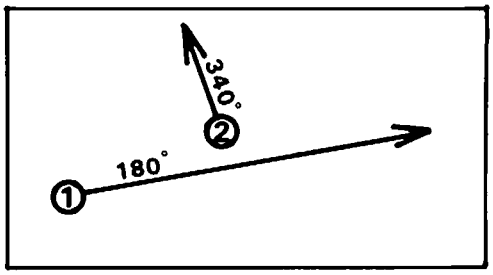

Figure 8B.

A real-life problem might appear as seen in Figure 9. Assuming level terrain to simplify things, an ELT team at point A picks up the signal for the first time from many miles away. They pinpoint their current location and determine that the signal is coming from 40 degrees magnetic. This is plotted on a map. Although the team could leave their vehicle at A and follow this heading cross-country, they elect, instead, to drive further north on the road and take another heading. At the crossroads (B), they stop and obtain a heading of 90 degrees magnetic. Plotting this on a map, they now have an intersection of the two headings. If everything is perfect, the target ELT should lie at this intersection.

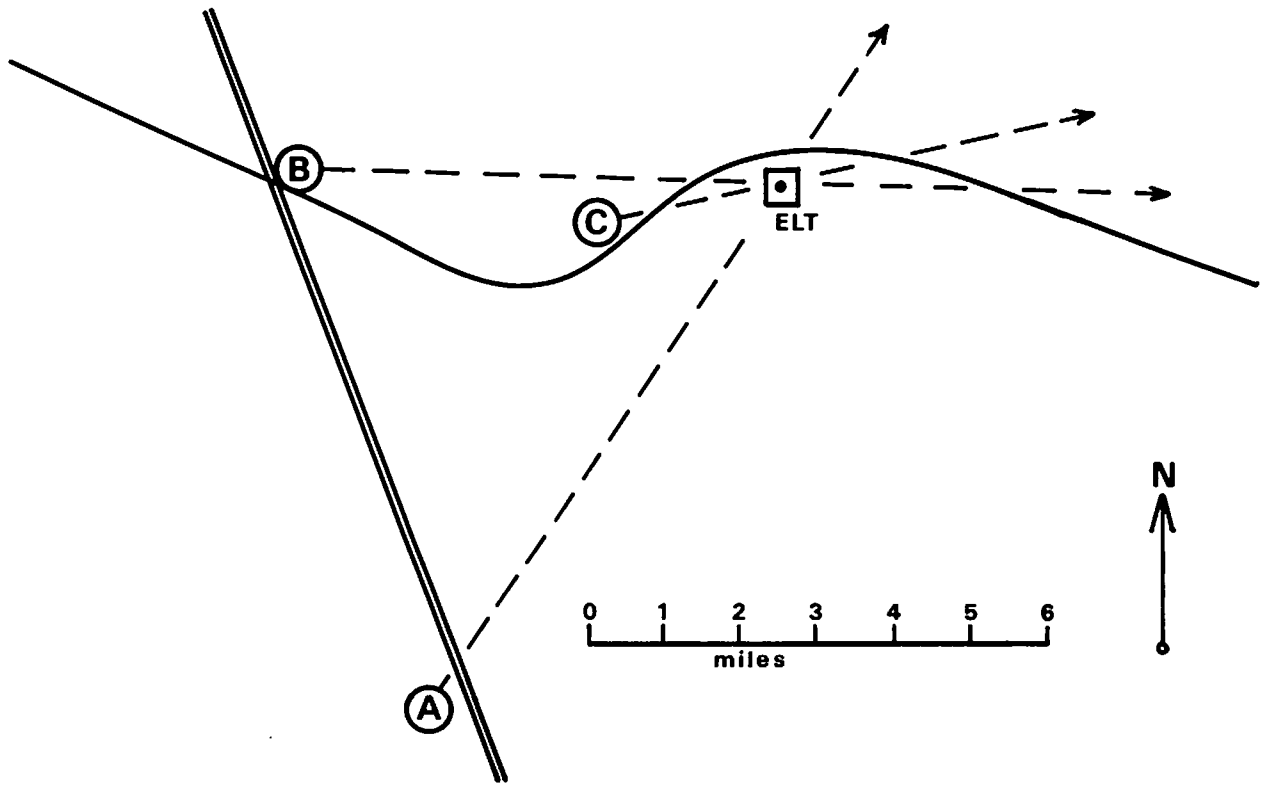

Figure 9 - Single Team.

Driving east from the crossroads, they stop at point C for a confirming reading. Here they get a heading of 80 degrees magnetic which overlaps the first intersection obtained. Firm now in their belief that they have the correct area, they drive down the road to the point nearest to the presumed signal location and proceed on foot.

Note that they used their vehicle to the maximum to get as close as possible before beginning their hike. This results in faster arrival at the target area, which could make a life or death difference to crash survivors. Compare the distance that they actually walked to the distance they would have had to walk if they had followed the direction of their first bearing from point A.

If more than one ELT Locator team is available, as in Figure 10, each team can relay their readings by radio to a central coordinator who will then plot them. Once plotted and interpreted, the teams can then be directed to new locations for additional readings or to the target area.

Notice that all the headings in Figure 10 do not intersect at exactly the same point. This is normal, as terrain effects and the inability to determine an exact heading will give an area of uncertainty. This area can be large with distant readings but will shrink as the team(s) nears the target.

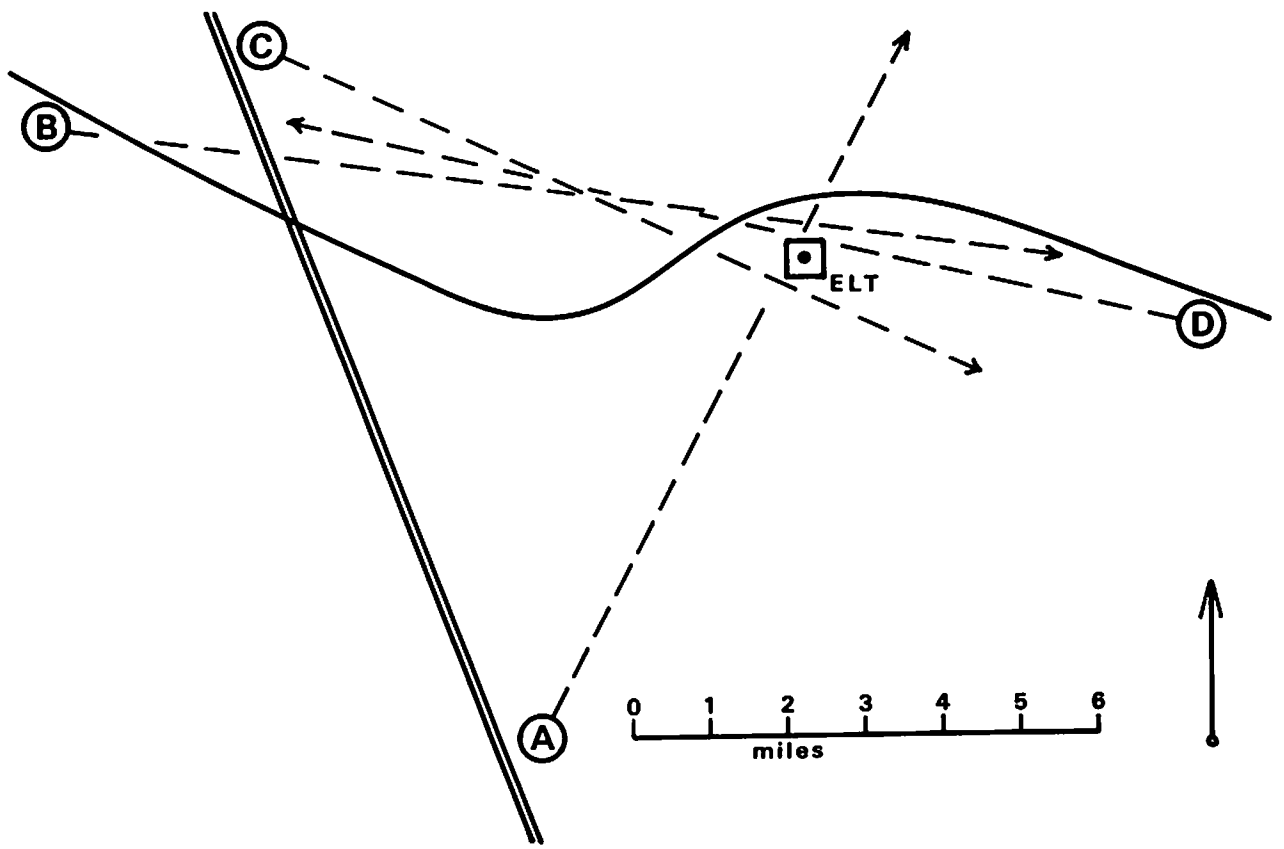

Figure 10 - Multiple Teams.

KEY POINTS TO REMEMBER IN TRIANGULATION:

- Know the team's exact position when taking a reading.
- Stay magnetic on all headings - there is no need to go true.
- Use the map and evaluate the effect of terrain on signals.
- Use vehicles and roads for maximum mobility.

A major advantage of triangulation is that it permits the team(s) to gradually localize the target area while moving rapidly by vehicle. Once reduced to a high probability area, the Ranger Teams can be moved in for the final search with a minimum of hiking and a greater assurance of a successful search and a more rapid find.

CARE AND MAINTENANCE OF LOCATOR

A. Pre-Mission Preparation

Consult the manufacturer's handbook for any specific maintenance items or cautions pertaining to your unit. Do this in the idle time between missions to ensure nothing is overlooked.

Store the locator in a cool, dry location where it will not be damaged. Remove batteries and store them separately. (This should be standard for all battery powered electronic equipment. Leaking batteries can ruin expensive equipment.) Inspect the unit for any possible damage after each use and repair before storing.

Obtain a spare set of batteries and store them with the unit in such a way that when the locator is picked up for a mission, the batteries will automatically go with it. A small paper or plastic bag fastened with a rubber band right on the unit works well. Buy quality batteries. The life of good brand-name batteries is extremely long, so there is no real benefit in buying cheap ones. Remember that someone's life may depend on your equipment and preparation!

B. Field Care

Be certain to follow the manufacturer's directions when setting up or taking down the unit for transport.

Like the walkie-talkie radio, one of the more vulnerable parts of the locator is the antenna system. Avoid trees and overhead wires while carrying the unit. When opening or closing it, be careful to collapse or fold the antenna correctly.

If your unit has a soft aluminum folding type of antenna, such as on the Little L-Per, inspect to see if the elements are bent. If so, carefully and gently bend them back until they are straight. If the unit uses telescoping antennas, extend them and collapse them carefully. A little wax will make them slide much easier and provide some water protection.

Some units, like the Little L-Per, have external cables and connectors. Treat these gently. Be certain that the connectors are seated and locked. Put no strain on the cables that would tend to pull them from the connector.

Check the position of all switches and controls before each reading. It is very easy for one of these to be accidently moved to a wrong position during transport. This can cause loss of signal or an incorrect heading. Check and double check.

Like most other electronic equipment, the ELT Locator can be damaged by water. Keep the unit protected by wrapping it in a poncho or other waterproof covering between uses in wet weather. Wipe off any water accumulated during use before rewrapping.

Extremely cold weather can cause batteries to lose power. This can be partly avoided by using quality alkaline batteries. Keep the unit warm by putting it under your coat next to your body if the unit is small enough. Remember, too, to keep your spare batteries warm in cold weather.

Hot weather can also kill batteries. The extreme heat that developes in a closed car in the sun, or in a locked car trunk, should be avoided. Store in a cool, dry location whenever you can.

SEARCH ORGANIZATION

A. Team Organization And Training

An ELT Locator team should not be confused with a Ranger Team. Each Ranger Team should develope the capability of using an ELT Locator, and should have the equipment available, but separate ELT Locator teams may also be of use. Since a minimum ELT Locator team consists of 2 people, 3 or 4 people should be selected for training for each ELT Locator available to ensure that there will be enough personnel available when needed. These people, even if not part of a Ranger Team, should be experienced Rangers, since they will often be moving with the Ranger Team once it is committed to the field. If possible, one should be a senior member to drive the ELT search vehicle if one is available.

The selected personnel should have a thorough knowledge of, and experience in, ground search techniques to permit efficient coordination between the ELT search phase and the follow-up ground search. Additionally, they must have a good working knowledge of the following areas:

- Navigation
- Map Reading - aeronautical, topographic and road maps
- Use of the Lensatic Compass (or equivalent)
- Radio Communications

Once the personnel have been selected, the specialiized training can begin. This can be done locally if an instructor is available, or at the Hawk Mountain Ranger Training Area where instruction is offered each Spring during

Communications Weekend, and each Summer during the annual Ranger School. Regardless of the source, the training must include:

- A review of map interpretation. Not only topographic maps, but also aeronautical charts, with emphasis on Omni bearings.

- The mechanical handling of the ELT Locator.

  Setup and takedown
  Operation of all controls
  Direction finding
  Field care and maintenance
  Battery changing

- The theory of ELT location.

  Signal characteristics
  Transmitters and aircraft location
  ELT Locator operation

- Coordination with other teams.

  Reporting information
  Radio communications

- Practice missions.

The subject of practice cannot be over-emphasized. ELT location is more of an art than a science. It requires knowledgeable interpretation of the headings to understand what the ELT is "saying". The ELT Locator is a stupid machine that can only tell you whether a signal is there and from what direction it is coming. It cannot tell if it is a real ELT signal, a reflected signal, or a signal from another source. Only intelligent and experienced operation can provide this information.

Additionally, ELT searches require close coordination between the ELT search teams as well as evaluating data from various sources. Only properly directed practice can combine all the training elements into a successful search operation.

B. Team Deployment

Ideally, a forward search base, located in the search area, should be set up by the ELT Search Coordinator. It is suggested that this base be set up at a high point to facilitate radio communications. The radio communications equipment must be immediately available to the ELT Search Coordinator to maintain team control. This is the actual control center (under the Mission Coordinator) during the ELT search phase.

On arrival in the area, the Ranger Teams will report to the Ground Team Coordinator. The ELT Locator Teams will report to the ELT Search Coordinator and follow his instructions. If a separate ELT Team vehicle is available, the main Ranger Team vehicle and the remainder of the Ranger Team will be held in or near the forward search base, ready for rapid dispatch when the final search

area is determined.

C. ELT Search Coordinator

The key to an efficient ELT search is the ELT Search Coordinator. This is a separate position under the Mission Coordinator divorced from the normal administrative workload. His job is to direct and coordinate the ELT Locator Teams in the field. To accomplish this, he must be in direct communication with the ELT Locator Teams so that he is always aware of their position and progress. If there is air support, he must have air/ground communications available.

Specific functions of the ELT Search Coordinator:

- Direction of the ELT Locator Teams.
- Plotting the ELT headings received from the ELT Locator Teams.
- Interpreting the resulting plots and evaluating probabilities.
- Advising the Ground Team Coordinator about shifting the Ranger Teams as the search area is better defined.
- Deciding when to discontinue vehicular ELT search and advising the Ground Team Coordinator when and where to commit the Ranger Teams for the final area search.

The ideal ELT Search Coordinator would have all the detailed knowledge of an individual ELT Locator Team member plus the following:

- Field experience as an ELT Locator Team member.
- Pilot or Observer rating, or equivalent flying experience.
- Extensive map reading and interpreting ability.
- Knowledge of VHF signal characteristics and terrain effects.
- Radio communications experience and ability.
- Ranger Team command experience.
- Ground search control experience.
- Ground navigation planning experience.
- Mission training in Operations or Ground Operations.

SAMPLE SEARCH PROBLEM

The following is a sample ELT search problem that duplicates, to a great extent, what might actually occur on a real mission. As reflected signals are one of the larger problems encountered in conducting an ELT search, they play a big part in this example.

Figure 11 shows a typical search area. In this search, three ELT Locator Teams have been directed into the area by ELT Locator equipped aircraft which cannot pinpoint the target due to multiple reflections from the surrounding hills. Visual air searches have proven fruitless.

Team A, coming in from the east (Figure 11), picks up a reflected signal from the northwest at their initial position. Due to terrain features, they are in a shadow of the actual signal.

Team B, arriving from the south, "sees" both the real signal and a reflection.

Team C, in the shadow of a hill, receives no signal at all.

The ELT Search Coordinator, with insufficient data to locate the ELT, follows the rule of keeping the ELT Locator Teams in their vehicles for rapid movement, and directs the teams, via the road network, to the locations shown in Figure 12.

In Figure 12, Team A is still in the shadow of the hill and receives the reflection from across the valley.

Team B is now getting a strong, direct signal from the ELT as well as a weaker, reflected signal from the opposite side of the valley.

Team C has moved from the shadow of their original location and has a direct signal from the ELT confirming the reading from Team B.

The ELT Search Coordinator can now analyze the situation based on the information provided by the intersecting headings. With the overlapping readings from teams B and C, he can now consider the chances to be high that they have the proper area. An extension of the reflected signals could, however, indicate the other side of the valley. With the heavily overgrown character of the terrain, he wishes additional confirmation before committing the Ranger Teams on foot. All teams, therefore, are directed to converge on the suspected location by vehicle, and Team A is requested to take a heading once they have moved in a southwest direction around the shadowing outcrop. A strong signal is heard by A from the south, intersecting the other team's headings, with an additional weak signal from the north. The location has been determined with a relatively high probability, and the Ranger Teams are committed on foot.

Although not mentioned before, the Ranger Teams have been brought into the area and staged nearby, awaiting confirmation prior to entering the field on foot.

It should be noted that a search like this one depends heavily on radio communication between the ELT Search Coordinator, the ELT Locator Teams, and the Ranger Teams.

Now consider what MIGHT have happened in an uncoordinated search.

Let's assume that this search was not coordinated by trained personnel, or was just not coordinated at all.

Team A, on getting their initial northwest reading (Figure 11), disembarks with their entire Ranger Team and starts following the heading (Rabbit Hunting) across the valley. If lucky, after some miles of walking, they might find a clear area in which to take a second heading. If they are now past the shadowing effect of the terrain, they will have a second signal direction back to the southwest. If interpreted correctly, they now have a few miles to walk back to the road. If not interpreted correctly, they continue toward the reflection and we can write off Team A as an effective part of the search.

Team B has two possible headings. They might rabbit hunt either. If a little smarter than A, they will move southeast along the road for a distance and take another reading. If properly interpreted, they will be on their way to the target. If not, another fruitless walk across the valley will begin.

Team C, with no signal at all, might go in any direction. If they follow the road south, they will start to duplicate Team B's headings and will be faced with the same problems.

In short, lack of coordination has left three Ranger Teams floundering without direction. This could result in long delays in finding the target - or not finding it at all.

REMEMBER:

- Use a coordinated search operation.
- Don't "rabbit hunt" - triangulate.
- Ensure good communications between all elements of the search.
- Move teams only under the direction of the ELT Search Coordinator.
- Utilize wheeled vehicles and roads to the maximum possible extent.
- Don't commit the Ranger Teams until you have the high probability area located.
- Train your personnel before the mission.
- Train your ELT Search Coordinator.

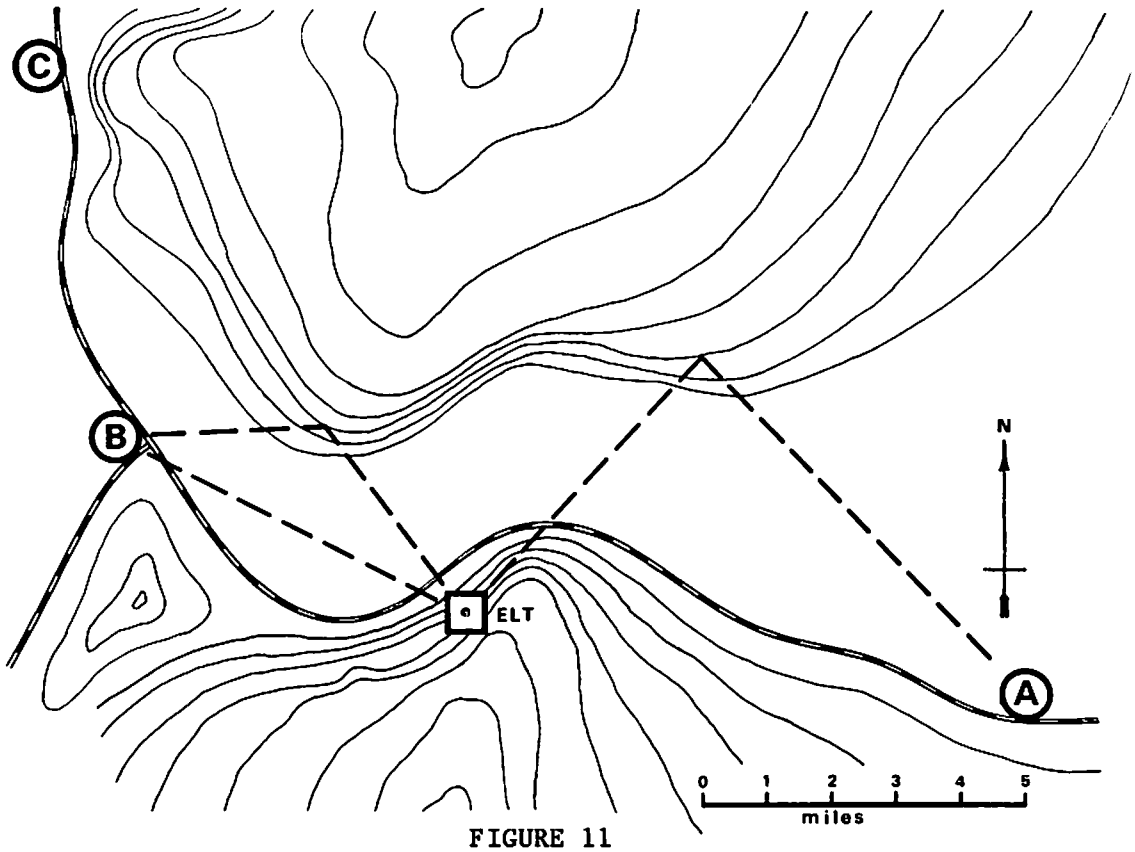

FIGURE 11

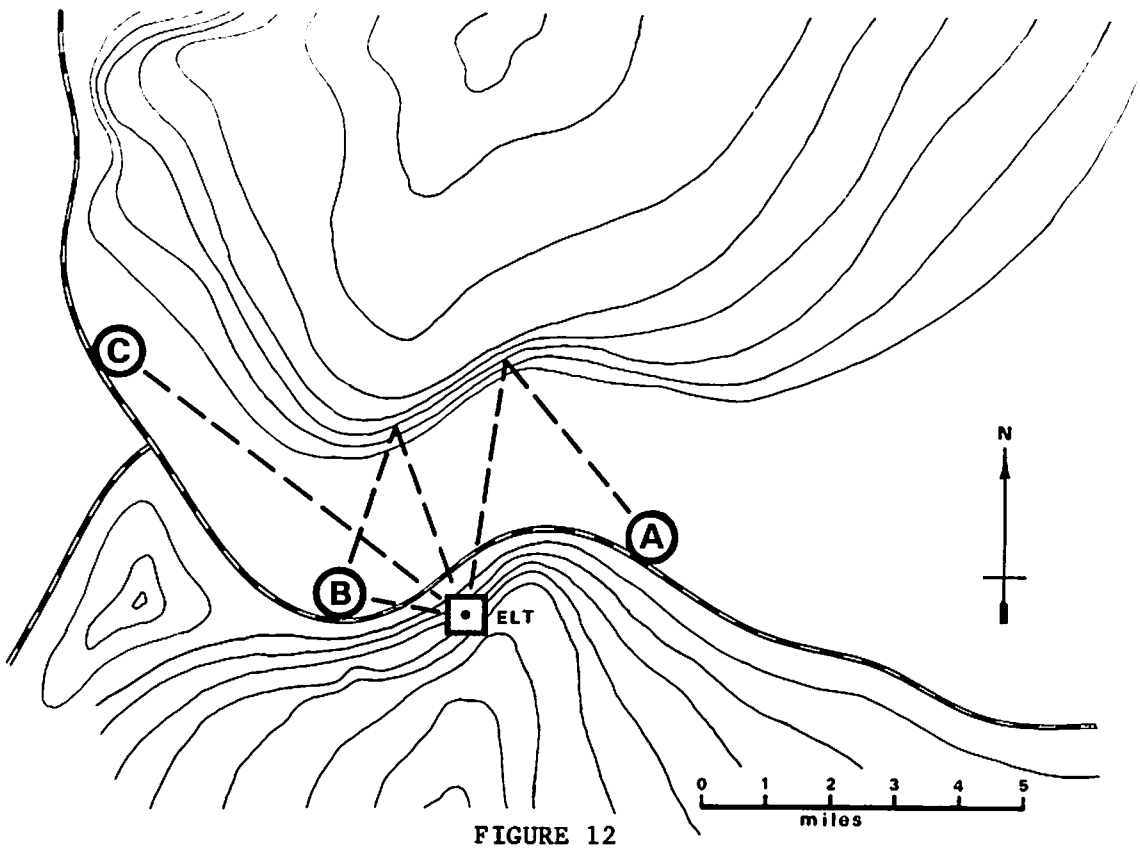

FIGURE 12

APPENDIX I

ELT TEAM EQUIPMENT

Small, versatile vehicle

- Four wheel drive if possible
- Radio equipped - 26.620 MHz and FM

ELT Locator

- Spare batteries
- Backup locator (Such as the Radio Shack VHF receiver)

Maps

- Aircraft sectional maps or State Aeronautical Charts
- Topographic maps
- County or other detailed road maps
- Official state road map

Navigation kit

- Lensatic compass or equivalent
- Protractor
- Straight edge or ruler
- Pencils, pens

Flashlight

- Spare batteries
- Spare bulb

Walkie-Talkie Radio - 26.620 MHz

- Spare batteries

First Aid Kit

Note: Much of this duplicates the normal Ranger Team equipment, but is necessary since the ELT Locator Team will probably be separated from the main part of the Ranger Team until a high probability area is determined.