IV

AERIAL RECONNAISSANCE

1. Definitions.

a. Methods. The two methods used to conduct aerial observation are:

(1) Direct observation, which is visual observation, sometimes aided by the use of binoculars, telescopes, and mechanical ranging devices.

(2) Indirect observation, which is observation employing radar, infrared, photographic and other electronic means.

b. Categories. Aerial observation includes aerial surveillance, aerial reconnaissance and special missions employing both direct and indirect methods to conduct these missions.

Aerial Surveillance. Aerial surveillance is the systematic observation of air or surface areas to gather information to be processed into intelligence. Aerial surveillance missions provide the supported commander with current information by keeping a systematic and repeated watch over a well defined area for the purpose of detecting, identifying, locating and reporting any information of military value. These missions are normally flown on a regular schedule.

(a) Route Reconnaissance. Route reconnaissance is the careful survey of an air or surface route for military purposes. A route may be a road, railroad, waterway, airspace or other lines of communication. It is performed on a point-to-point or town-to-town basis over a selected route which may pass over several search areas. For details see FM 5-36.

(b) Area Search. An area search is a mission conducted to obtain specific information about a general area, monitoring any movement within an area or detecting military activities. The limits of the area to be searched will be designated and will vary in size dependent upon the tactical type terrain and information sought.

(c) Specific Search. A specific search is the observation of a point or a limited number of points to gather specific information about military, paramilitary, or significant civilian activity.

(d) Special. Special reconnaissance missions are other observation missions that may assist the commanders in the accomplishment of his overall missions. These missions include such tasks and techniques as recon by fire, contact, recon, aerial column control and camouflage inspections.

1. Reconnaissance by fire is accomplished by firing on likely or suspected enemy positions in an attempt to cause the enemy to disclose his presence by movement or firing.

2. Contact reconnaissance is a mission undertaken to locate friendly units that are isolated or cut off from the main force, eg., a long range patrol out of contact with higher headquarters.

3. Aerial column control is the airborne control of surface or airmobile columns by visual or radio contact to enhance rapid movement over unfamiliar terrain, detect obstacles and to minimize the danger of surprise by the enemy.

4. Camouflage inspection is the aerial observation of friendly units to determine the condition and effectiveness of camouflage.

5. Other observation missions as directed by the commander or the tactical situation, eg., reconnaissance of a landing zone, topographic survey, radiological survey, and reconnaissance for the escort of airmobile forces.

2. Route reconnaissance.

a. In order to conduct a route reconnaissance, certain information must be provided the aviator/observer team. This information is the route designation and the limits of the route.

(1) The route designation may consist of a name (e.g., Highway 84, Jones Road), a trace of the route or coordinates along the route.

(2) Limits of the route may be indicated by coordinates or any other definite ground reference such as road junctions, towns, bridges, etc.

b. Information that should be provided the aviator/observer team, if available, is the time the route will be used; the type and number of units or vehicles that will be using the route. Any specific information required by the unit commander should be passed on to the aviator/observer team.

(1) The time a route will be used may change the desirability of using a route. At night curves and narrow roads are more critical

than during daylight hours. If a route is being reconnoitered in early fall for use during winter months, snow and frost would be more important considerations.

(2) The type and number of units or vehicles to use the route is another important factor in determining if a route is usable. Route requirements for infantry, armor, artillery, or truck units will be different. A few tanks may ruin the surface of a route, although many truck units could pass without difficulty.

c. Reconnaissance of ground routes. In reconnaissance of ground routes many features must be checked. They are, roads, bridges, tunnels, underpasses, and cross-country segments if required.

(1) Road classification takes into consideration many factors:

(2) Type surface - concrete, bituminous, sand, etc.

(3) Width - estimated and expressed in number of lanes (i.e., two lanes for 2½ ton truck traffic, one lane for M60 tanks).

(4) Drainage - of primary consideration to dirt, clay or sand roads. Observe water standing on road and in ditches during rainy periods.

(5) Surface condition - continually watch for: combat damage, cuts, craters, dirt slides, ruts, cracks or excessive erosion.

(6) Grades and curves - very steep grades or sharp curves will reduce the usage of a road.

(7) Drive off capabilities - shoulder condition, width and slope will determine capability to park vehicles off the roadway. Trees which overhand the shoulders will offer limited concealment to parked vehicles.

d. Bridges, tunnels and underpasses from an aerial observation classification are very difficult. The aviator/observer team must consider many factors in making this observation.

(1) Bridges are reconnoitered for location, type, condition, dimensions (length, width, and clearance) and by-pass capabilities.

(2) Tunnels and underpasses are reconnoitered for location, dimensions and by-pass capabilities.

(3) Type of construction and condition - steel, concrete, wood or brick, if the bridge has received combat damage, will it need

repair before use, etc.

(4) Length and width - estimate length of one span and multiply by number of spans. The width is estimated and expressed in number of lanes (i.e., two lanes, 2 1/2 ton truck traffic). The observer may use map distance for estimating tunnel length.

(5) Clearance - clearance of tunnels and underpasses is measured from the road surface to the lowest overhead obstruction.

(6) Location - check the accuracy of the map location of bridges, tunnels and underpass.

(7) Bypassing - always look for a bypass regardless of the condition of the bridge, tunnel or underpass. There are three bypass conditions.

(a) Bypass easy. This is a local detour by means of road or cross-country movement to an alternate crossing site which can be made by all types of traffic in a time that represents not more than 15 minutes or 4 miles (6.5 km) increase on the time for the direct route. This type of bypass requires minor improvements.

(b) Bypass difficult. This type of bypass differs from bypass easy only in that more work would be required with appropriate engineer equipment, to improve or construct it. Still within a 15 minute or 4 mile radius.

(c) Bypass impossible. This situation exists when: no alternate bridge is available within an acceptable distance; the terrain prohibits off-road movement or temporary road construction; characteristics of the stream to be crossed prohibits fording or construction of temporary crossing means; depth or slope of obstacle prohibits construction of approaches to the crossing site.

e. Cross-country segments - a careful reconnaissance of critical terrain (i.e., high ground-passes) must be made and any conditions that would slow traffic must be reported.

f. Ground route classification. A ground route is classified by width, type, and road carrying capacity. A route, like a chain, is only as good as its weakest link. If a large portion of the route is 4 lane expressway, but a small segment is two lane gravel the overall route classification would be 2 lane, limited all-weather medium. The method of expressing ground route classification is:

(1) Width - expressed in number of lanes of the narrowest road comprising the route.

(2) Type - the least desirable type road surface encountered along the route.

(a) All-weather. Any road which, with reasonable maintenance, is passable throughout the year to a volume of traffice never appreciably less than its maximum good-weather capacity. This type road has a waterproof surface and is only slightly affected by rain, frost, thaw, or heat. At no time is it closed to traffic due to weather effects, other than snow blockage. The following are examples of this category: concrete, bituminous, brick, or stone.

(b) Limited all-weather. Any road which, with reasonable maintenance, can be kept open in bad weather to a volume of traffic which is considerably less than its normal good-weather capacity. This road does not have a waterproof surface and is considerably affected by rain, frost and thaw. The following are examples of this category: crushed rock or water bound macadam, gravel, or lightly metaled surface.

(c) Fair weather. A road which becomes quickly impassable in bad weather, and which cannot be kept open by normal maintenance. This type of road is seriously affected by rain, frost, or thaw. The following are examples of this type: natural or stabilized soil, sand or clay, shell, cinder.

(3) Load carrying capacity - determined by the classification (light, medium or heavy) of the heaviest class vehicle which can use the entire route in convoy. This will normally be governed by the classification of the weakest bridge on the route. Otherwise, it is the load-bearing capacity of the surface of the road. These classification are:

(a) Light - 5 ton truck or less.

(b) Medium - Tractor trailer up to 30 tons.

(c) Heavy - Over 30 tons.

3. Reconnaissance of air routes. The principles of a reconnaissance of an air route are the same as for a ground route; however, the areas of interest are different. The movement by air is concerned primarily with the location of enemy forces, hazards to flight (i.e., antiaircraft areas, over water flight, mountainous areas), ease of navigation, landing sites and zones.

4. Selection of landing zones.

a. Definition. Procedures used in selecting sites and zones to be used as pickup areas, landing zones and tactical heliports or airfields.

b. Considerations. These elements fall into three basic categories: tactical, technical and meteorological.

(1) Tactical.

(a) Mission. The most important consideration when selecting a landing zone is the ability to accomplish the mission from or to that location.

(b) Location. Any landing zone selected should be close to the unit or objective it is intended to support.

(c) Security. Although security requirements vary depending on the general location and purpose, aviation units must depend to a great extent on the supported unit for its active security. Landing zones are usually unsecured.

(2) Technical. Technical considerations increase in significance as the landing zone becomes more complex. Some of the considerations are: (See Fig. IV-2)

(a) Location and orientation (coordinates, magnetic headings, sketch, etc.).

(b) Desirable approach and departure headings (into and out of the area).

(c) Size (length-width or number of aircraft area will accommodate in a type formation.

(d) Surface and condition.

(e) Other. Hazards to flight safety, available alternates and likely enemy positions.

(3) Prevailing meteorological conditions must be evaluated.

c. Performance of the reconnaissance. Once all the above elements have been considered, actual reconnaissance should begin. In the selection of landing zones, three types of reconnaissance are used - map, aerial photograph, and visual observation.

(1) Maps and aerial photographs. A study of maps and available aerial photographs is sometimes the only possible method of selecting a landing area, as when entering an area where access has been previously denied. Ideally, the map reconnaissance is the first type of reconnaissance used. The map shows locations of favorable areas, proximity to the supported unit, types of terrain and possible routes. Aerial

photographs will show any changes since the map was published. Aerial photographs also portray the terrain in greater detail than maps.

(2) Visual observation.

(a) From the map reconnaissance, a detailed visual reconnaissance can be planned. Make notes from the map reconnaissance to determine exactly what further facts are needed about the proposed landing area. Aerial reconnaissance alone may be used in a fast moving situation, when time is limited.

(b) No matter what the situation, it is imperative that the aviator know what information is needed before taking off on a reconnaissance. The reconnaissance may be performed at almost any distance, airspeed or altitude, depending on the tactical situation. Under a situation where the enemy has sophisticated anti-aircraft weapons a low-level reconnaissance would be used. When the enemy has limited air defense capability a higher altitude would be used. However, the requirement for surprise or detailed reconnaissance may dictate use of low altitude.

5. Night reconnaissance.

a. Definition. Techniques to be used when performing reconnaissance during the hours of darkness.

NOTE: Reread sections on route reconnaissance.

b. Performance of maneuver. Night reconnaissance depends upon three factors. These are:

(1) Weather. When the light is good, it is easy to see many details from a high altitude. With little or no light, it becomes necessary to fly lower to pick up detail. Low ceiling or poor visibility will impose limiting factors.

(2) Enemy situation.

(3) Information required. If you are looking for lights that give away enemy positions, a high altitude is utilized. For detail, the altitude must be lower. Airspeed must be taken into consideration. When flying at lower altitude, it is better to reduce airspeed to increase observation and reaction time in the event of a barrier. The individual aviator must make a sound decision based upon the information available and the job to be done and then fly the mission in the safest possible manner. Flares, flood lights or spot lights may be used.

6. Reconnaissance recording.

There are many acceptable methods for recording route reconnaissance information. The method should be relatively simple, but must contain all pertinent information concerning the route. An acceptable method is to number all important feature along your route as it is drawn on the map. Using a self-made form, write all pertinent information down corresponding to the same terrain feature on the map. This method gives a legible account of the route and does not clutter up the map which may have to used again for another mission. A simple, abbreviated shorthand can be worked out by each individual.

a. Reconnaissance worksheet (Fig. IV-1). A good worksheet will prove to be very valuable when making a route reconnaissance. A suggested format (Fig. IV-1) is divided into two sections, one for bridges, one for roads. Under the section of bridge there are 5 columns to consider, bridge number (in sequence), construction, length, width, capacity, a bypass. Under the road section there are 4 columns, road section number, construction (surface), width, shoulders, drive off capabilities and obstructions.

b. Landing zone worksheet. A landing zone reconnaissance should be recorded on a worksheet which provides the commander with a graphic illustration in addition to the tabulated information (Fig. IV-2).

ROUTE RECON WORKSHEET

BRIDGE	CONSTRUCTION	LENGTH	WIDTH	ESTIMATED TONNAGE	BYPASS	ROAD SECTION	CONSTRUCTION (SURFACE)	WIDTH	SHOULDERS	OBSTRUCTIONS
1						1				
2						2				
3						3				
4						4				
5						5				
6						6				
7						7				
8						8				
9						9				
10						10				
11						11				
12						12				

USAAVNC (TAC) Form 767, 7 May 1968

Fig. IV-1

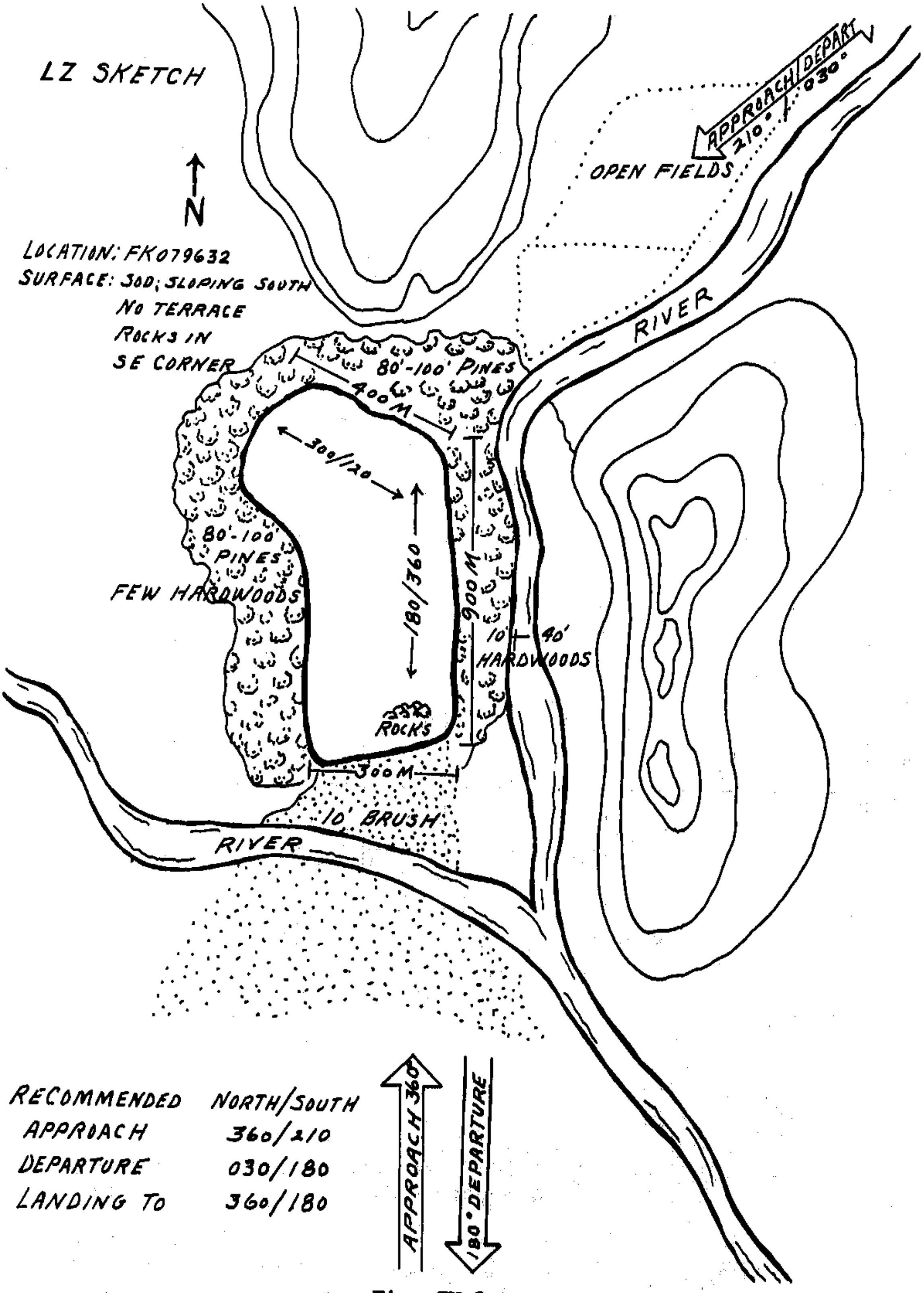

LZ SKETCH
N
LOCATION: FK079632
SURFACE: SOD; SLOPING SOUTH
NO TERRACE
ROCKS IN
SE CORNER
80'-100' PINES
400M
300/120
180/360
900M
80'-100
PINES
FEW HARDWOODS
10' 40'
HARDWOODS
ROCKS
300M
10' BRUSH
RIVER
RIVER
OPEN FIELDS
APPROACH 210°
DEPART 030°
RECOMMENDED NORTH/SOUTH
APPROACH 360/210
DEPARTURE 030/180
LANDING TO 360/180
APPROACH 360°
180° DEPARTURE

Fig. IV-2

7. Operational area reconnaissance.

a. This procedure allows the student to compare the local area check-out, orientation, and map updating, that he received at Fort Rucker; with the requirements of reconnaissance in a new tactical area of operations within a combat zone.

b. Definition: Operational area reconnaissance is a general survey of the supported units Tactical Area of Responsibility by air, to determine and preplan for special aviation problems which may exist or occur.

c. To conduct an operational area reconnaissance certain information must be provided the aviator/observer team. The minimum necessary information would be:

(1) Map coverage, and grid or check point system.

(2) Unit or units to be supported; with boundries, CP locations, and logistical base locations.

(3) Intelligence briefing to include possible AW positions or past anti-aircraft activity.

(4) Frequencies and call sign of all units in the TAOR.

(5) Aviation support activities, to include fuel and maintenance.

(6) Artillery fire base locations, with frequencies for fire information.

(7) Special areas, such as no fire areas and restricted flying areas.

d. Other information which, if possible, should be provided.

(1) Expected length of operation within new TAOR.

(2) Expected meteorological conditions which will normally exist for the time of year.

e. Performance.

(1) <u>Preflight Planning</u>: Given information consolidated, maps plotted, general map reconnaissance performed, and routes to be flown selected.

(2) <u>Inflight</u>. A general survey at or above 1500 feet absolute would be made to confirm dominate terrain features, night and low

visibility routes and navigational check points, man made features which may not appear on the map and the likely number of acceptable PZ's and LZ's. It must be remembered that other types of reconnaissance, cover the special missions such as routes, LZ's or area and that details in all these areas cannot be gained during this general survey.

> <u>NOTE</u>: Due to the limited airspace, in the Fort Rucker Area, mission altitude will be used to conduct an aerial reconnaissance.

(3) Debriefing. Information gained must be consolidated and disseminated to the unit operations as well as to the operational aviators within the unit.

V

LOW LEVEL FLIGHT TECHNIQUES

1. Definition. Techniques used to navigate from point to point at an altitude of 50 to 200 feet above the terrain using pilotage, dead reckoning or radio aids.

a. Performance of maneuver.

(1) Map selection.

(a) The most current tactical map available should be used as this will contain a military grid reference system and a more accurate display of man-made features. Suitability of a map for low level navigation is largely dependent upon its age and scale.

(b) Scale selection is based on the detail required, airspeed of aircraft and the distance to be flown.

1. For the planning phase, a large scale (1:25,000 or 1:50,000) map is best as it provides more detail for a thorough map study.

2. For inflight use a smaller scale (1:250,000) map may be used because of the reduced size of map to manipulate inside the cockpit.

3. Larger scale map coverage of the route from RP (release point) to the objective area may prove helpful for accurate selection in areas of similar terrain.

(2) Route selection. This is the most important aspect of premission planning. Route selection is based foremost on the mission, with consideration given to the terrain, weather and location of enemy forces and antiaircraft weapons. Two means are used to aid in route following.

(a) Air control points (ACP). Air control points define the flight route and are indicated along the course line at turning points or critical points of each leg; therefore, it must be either a readily identifiable topographic feature or operative radio aid. Visual ACP's should be significant terrain features or be unique to the area. ACP selection and designation is made prior to a flight, to be used as a standard means for control and coordination and should be identified to all air and ground elements involved in the operation.

(b) Check points. Frequent check points selected along or adjacent to the flight route assist in constant position orientation and serve to minimize navigational difficulties. Distant check points, both natural and man-made which stand out above the horizon, will assist in keeping the aviator oriented and offer a general course to follow. Check points are selected not greater than two minutes apart.

(c) A detailed map study is necessary to determine the type terrain along a route. An important part of low level navigation is to use the terrain shown on the map by contour lines as means of maintaining orientation. Ridge lines, cuts, hills or mountains and valleys or gorges may well be the only check points along a route in isolated areas. Terrain features that have length such as a valley if crossed perpendicular will not give an accurate navigational check but do give a very accurate time check. A terrain feature if used as a check point must be unique to the area. A review of basic map reading in the area of interpreting contour lines, interval and design is recommended prior to low level flight. Continuous correlation of the terrain features shown on the map by contour lines to the actual terrain can prevent your becoming lost.

(3) Map preparation. Data which must appear on the face of the map to assist the aviator in maintaining positive position orientation along the flight route includes:

(a) Flight route and course lines. A flight route denotes the path of flight within a one-half mile horizontal distance either side of the course line. Course lines should be indicated as sharp, clear lines shown in a dark color reflecting the ground track to be followed. Course lines drawn in red will not be visible at night when using the red lens on the map light.

(b) Headings. Magnetic headings are indicated along the course lines for each leg. Crosswind effect is compensated for along the route using standard techniques.

(c) ACP's and check points. ACP's and check points should be clearly marked using natural terrain features when possible since they are not normally subject to change. Visual points are more desirable than radio aids as radio aids are subject to malfunction and frequency compromise.

(d) Times and timing. Tick marks are indicated along the course line, equidistant apart at uniform time intervals, normally two minutes for the UH-1. These tick marks assist the aviator to determine distance between ACP's and check points at a glance and to make airspeed adjustments by correlating the position of the aircraft to tick marks and related topographic features on the ground.

(4) Flight log preparation. A flight log provides the copilot a quick reference to all pertinent flight data extracted from the map, so that hasty computations can be made with a minimum of activity in the cockpit. Items which may be helpful on a flight log include identification of course legs, magnetic headings for the flight, radio aids or position reports, mileages and times for separate legs and the entire flight, ETA's, altitudes to be flown, airspeeds, and fuel requirements.

(5) Pilot/copilot relationship. During low level flight, the pilot/copilot relationship is extremely important. It must be thoroughly understood by each what their duties are. Unless the pilot briefs the copilot on his duties, safe conduct of a low level flight and proper navigation is not possible. It must never be assumed that individual duties are understood. (See Chapter XV)

b. Common errors.

(1) Failure to use time tick marks, distance checks, and headings on charts.

(2) Failure to recognize improvements and changes in terrain.

(3) Failure to maintain proper altitude and headings.

(4) Failure to apply proper wind correction.

2. Low Level Observation Techniques.

a. During missions involving direct observation, the aviator/observer is primarily concerned with detection, identification, location, and reporting. Since the observer may be hampered by maneuvers used to reduce aircraft vulnerability (evasive maneuvers), he must devote maximum ability and effort to visually observe the terrain in the time available. Observation techniques will vary with the mission and the physical environment.

(1) Detection. Detection requires determination that an object or activity exists. Factors influencing the detection capability are terrain, light, altitude, airspeed (length of time the target is viewed), and visibility, as well as the deception practiced by the enemy.

(2) Identification. Major factors in identifying a target are description, strength, and disposition. The aviator/observer must be able to classify targets as either friendly or enemy and to discriminate among the types of targets observed.

(3) Location. The exact location of detected and identified targets is the ultimate objective of aerial observation missions. Depending upon the nature of the target, the aviator/observer may locate the center of mass and/or the boundaries of the entire area encompassed.

(4) Reporting. To provide the commanders and staffs with critical information during the conduct of the observation mission the aviator/observer team must be able to make spot reports. The means of spot reporting will be indicated by the requesting agency, normally G-2/S-2. The observer team must constantly evaluate observed information and report that which may be of value. It must be remembered that the aviator/observer team may not know the value of information so they should report everything. In addition to actual enemy sightings, the absence of enemy activity commonly called negative information is of value. No information should be omitted because it seems irrelevant.

b. Detection techniques.

(1) The capability to detect targets or locate activities of interest is dependent on several factors, the most important of which are:

(a) Altitude.

(b) Speed.

(c) Terrain.

(d) Light conditions to include weather.

(e) Limitations of the human eye

(2) The distance that can be seen from an aircraft increases as altitude increases; however, the ability to locate targets does not necessarily increase due to the inability of the eye to distinguish distant objects and the increased slant range to the target.

(3) At the speed flown during the tactics training a strip of terrain approximately 30 meters wide by 1000 meters long may be scanned each second.

(4) Jungle and heavily vegetated terrain limits the area of observation generally to the area directly adjacent to the flight path. This is a major consideration in a route reconnaissance through heavy forest or jungle. When the terrain is mountainous, hilly or covered with moderate vegetation, the area of observation is reduced to about 500 meters. During mission planning, these rules of thumb must be considered in planning the flight route for complete coverage.

(5) The area of coverage of the human eye is 250 meters x 40 meters at 500 meter slant range; therefore, no difficulty should be experienced in inspecting an area 30 meters wide.

(6) The technique recommended for low level visual search is to search from only one side of the aircraft at a time. Mentally define a sector encompassing 90° from the line of flight. This area is further divided into a 45° search sector and a 45° orientation sector (Fig. V-1). The search sector is the rear portion of the 90° arc. Within the search sector a systematic scan pattern is employed (Fig. V-2).

(a) Look out toward the horizon approximately 1000 meters and search in toward the aircraft. The rapidity with which this is repeated depends upon the aircraft speed and terrain being searched.

(b) As often as necessary for orientation, the observer must look forward into the orientation sector. Peripheral vision is the primary means of maintaining orientation. A complete map study and detailed route analysis are mandatory prior to attempting a reconnaissance or search mission to preclude spending excessive time in orientation (navigation) and not accomplishing the stated mission.

LOW LEVEL VISUAL SEARCH TECHNIQUE

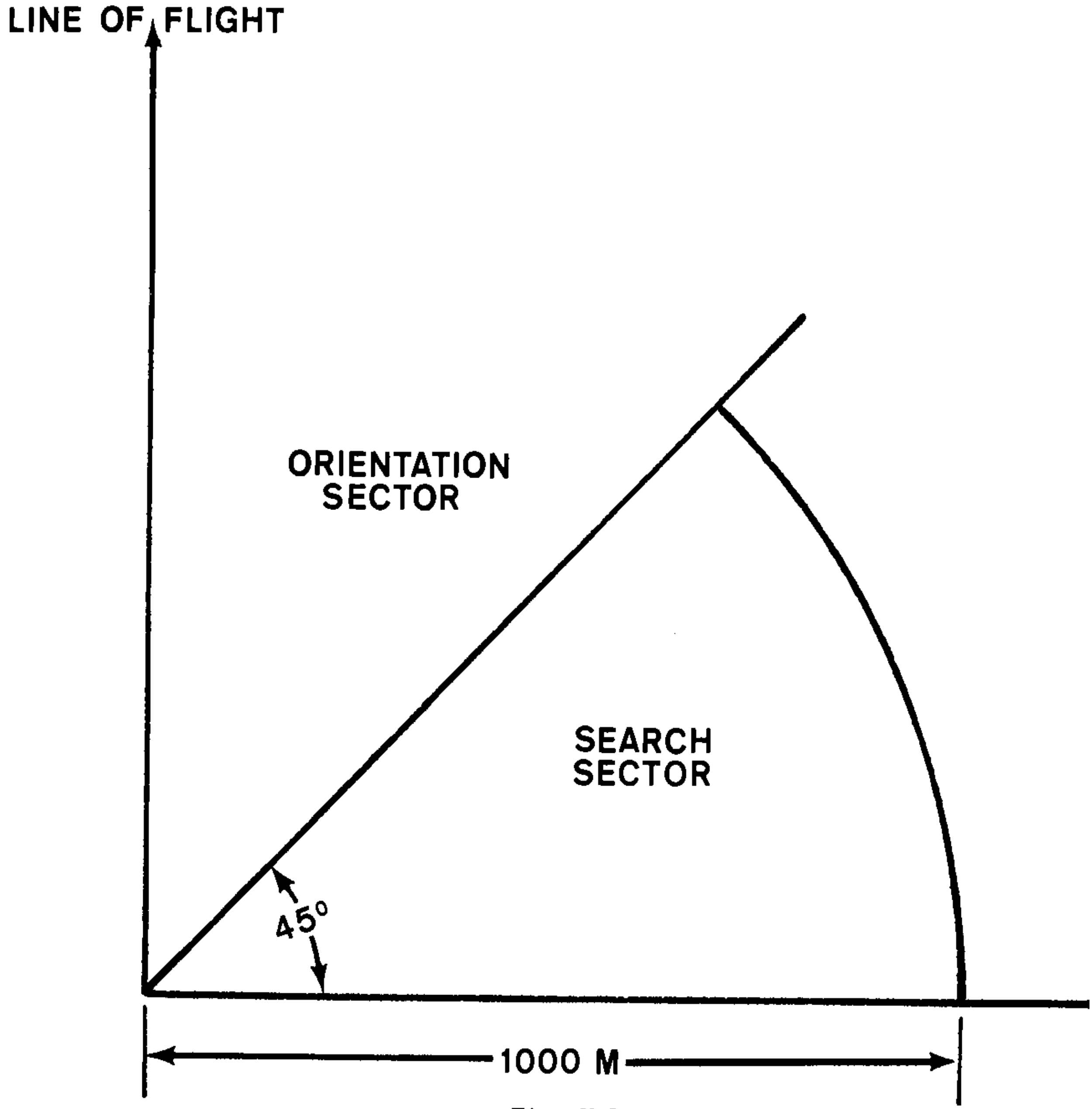


Fig. V-1

SYSTEMATIC SCAN PATTERN WITHIN SEARCH SECTOR

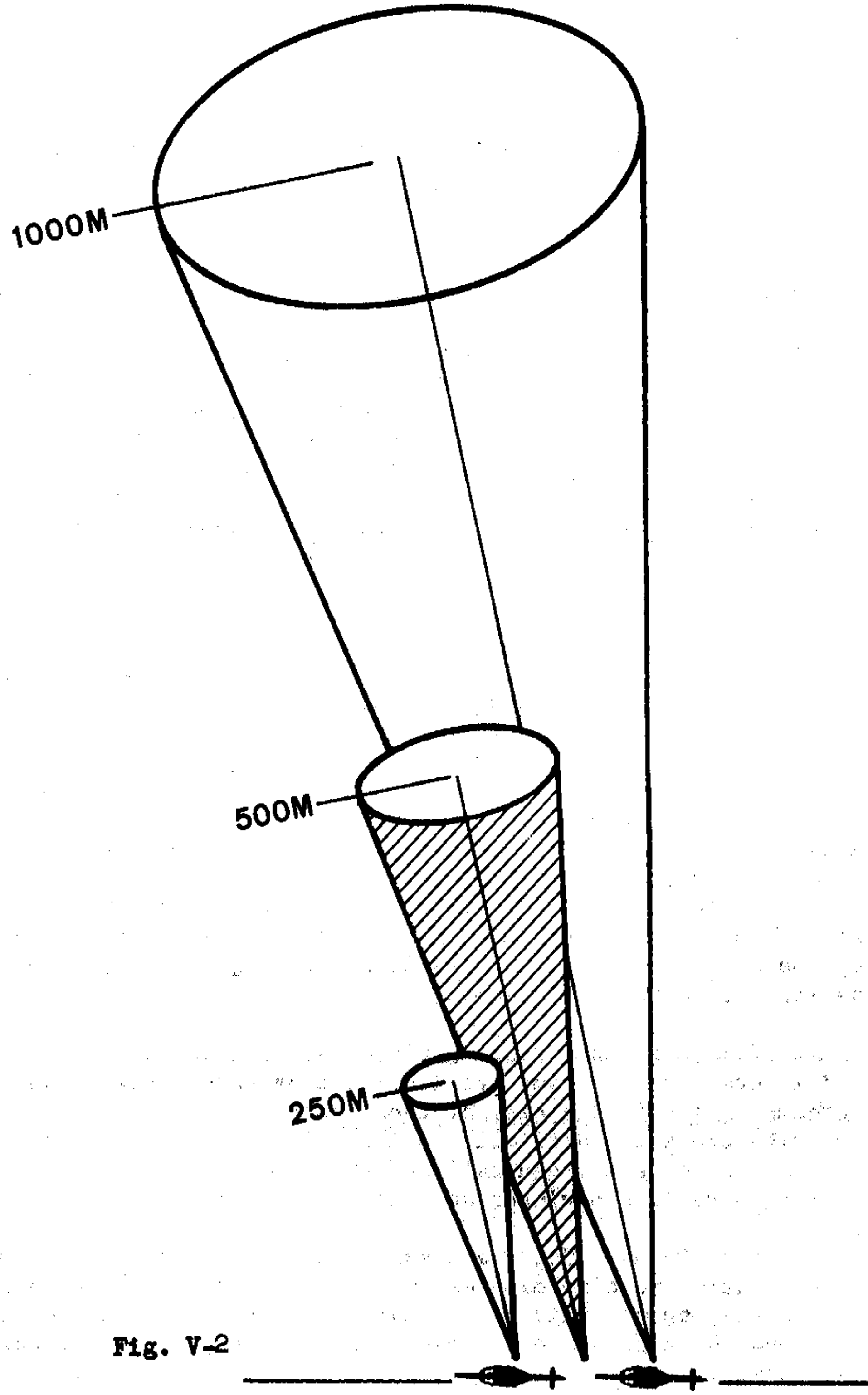


Fig. V-2

3. Low Level Navigation Techniques.

a. Definition.

Low Level navigation is a combination of dead reckoning and pilotage.

b. Preparation for the maneuver.

Preparation for low level flight consists of map and mission research and map plotting. The map which is commonly used during the course of instruction with the Department of Tactics is a 1:50,000 topographic map. This map is essentially up to date and does give accurate information. In isolated situations a 1:250,000 map may be utilized and consideration must be given to contour interval, roads, rivers, streams, ponds, and man made features all of which are shown in detail on a map of 1:50,000 scale. Although these features differ with the scale of the map. the techniques of low level navigation are applicable to all maps regardless of their scale.

(1) Map study (Fig. V-3)

(a) Contour lines. The contour lines on the map vary with the scale of the map. Study the various lines on the map and identify hill tops, ridges and valleys.

(b) Roads. Roads are detailed on the 1:50,000 map; however, on the 1:250,000 scale numerous roads are indicated by thin light gray lines on the map. Many of these roads have been paved since the map was last up dated. The red lines represent paved roads. There are newly constructed trails and dirt roads that do not appear on this map. There are also bridges on this map that are not indicated; however, you should look for bridges or culverts at any point which one of these lines intersect a stream.

(c) Streams. Running rivers are indicated by solid blue lines and intermittent streams are indicated by three dots, a line, etc. These streams except in the case of the larger rivers are generally overgrown with trees and difficult to identify. Look for valleys filled with thick stands of trees generally of the large leafed variety. These trees will be bare in the winter and easy to distinguish.

(d) Ponds. There are many small lakes and ponds indicated on the map. There are also many man made lakes and ponds that are not indicated on the map and this often leads to confusion. Some of the indicated ponds have become overgrown with foliage and are now nothing more than swamps.

(e) Small townships, churches and schools. Small dots with a name on the map create confusion in that it leads one to believe that there is a village there. These places are often only one house or a store at a specific place. Church indicators may well show a church that is actually there but often the church is gone and only a graveyard is left. There are also many new churches not shown on the map. The same holds true for school indicators.

(f) Other man-made features. Other features such as towers, power lines, railroad spurs, etc., tend to lead to confusion because they are often missing and there are many new power lines and towers, etc., that are not shown on the map.

(g) After reading the above, it is obvious that in studying your map, attention should be primarily focused on large and permanent man-made features as well as significant terrain features. The other features mentioned may be considered as possible check points.

(2) Mission study. The mission or operation order is the blueprint for the mission that you have been ordered to fly. Carefully read through this order and become familiar with it. Then, go through it again and extract all of the significant information which can be transferred to the map such as coordinates and routes. Extract for easy reference the names and call signs of the units involved and look up the proper frequencies. Once this has been accomplished the map is ready to be plotted.

(3) Map plotting (Fig. V-3).

(a) It is suggested that the following material be used to plot a mission on the map.

1. A plotter.

2. A sharp grease pencil or a felt tipped pen.

3. A time distance scale.

4. A coordinate scale.

(b) Plot the map using the following steps:

1. Locate all of the coordinates needed to fly the mission on the map and label each of these points with the proper identifier. Do not write the name, such as ACP Alpha, next to the point but instead, write the name away from the general area in which the mission will be flown and draw a small arrow from the name to the point.

2. Connect the points of the route with a thin line. On each of these lines draw a small arrow to indicate which way a specific leg will be flown. Plot the azimuth of each of the legs and write it to the side of the route again remembering not to write it on top of the area over which the mission will be flown. In addition, write the figure for the azimuth so that it can be read when the map is oriented in the direction of the course to be flown and toward the point to which you are flying. Add the time tick marks on each of the legs again keeping these very light and small.

3. When all of the information for the actual route is plotted then over to one side of the map add the frequencies and call signs for ready references.

(4) Now it is time to fly the route on the map. Once the map is plotted and the mission thoroughly studied, take a pencil or a pointer and fly or trace along each of the routes carefully studying the route and making mental notes of all of the significant terrain features. It is beneficial to add the airspeed and altitude for each leg on the map. It might be wise to put an indicator or hint on the routes to remind you to make specific radio transmissions. Once all of this has been accomplished, it is then time to make a final map study and locate limiting points or barriers for each leg. These are simply obvious or significant terrain features which are off to one side of the route or beyond the end of a specific leg. If any of these points are reached, it is then clear that a specified leg has been overflown and/or drifted away from. These barriers could be, for example, a river or a well known paved highway parallel to a course leg. The same could apply to a river or road running perpendicular to a leg beyond the end of the leg. Do not limit barriers to just these things. A barrier could also be a village, large hill top, observation tower or even a power line.

c. Flying the mission.

(1) Before the mission is actually flown, the pilot and navigator must thoroughly review the mission. Each man has specific responsibilities. There will not be sufficient time to discuss the mission once the aircraft has left the ground. When the aircraft leaves the ground, the navigator will tell the pilot the heading, altitude, airspeed, and estimated time of arrival to the first point.

(2) As the route is flown, the navigator should move his finger along the course leg at the same speed with which the helicopter is flying over the ground. Tell the pilot what to expect ahead such as roads, hills or streams and when he should expect it. Constantly monitor the heading the pilot is holding and correct it if he starts to drift off course. If the navigator sees a specific point which the

aircraft should be over, he should make an immediate correction to intercept the desired ground track. Before arriving at an ACP or a turning point, the navigator should warn the pilot and tell him which way to turn, giving **heading**, altitude, and airspeed.

(3) The pilot must assist the navigator by flying the heading, airspeed and altitude prescribed. He must also help the navigator by pointing out significant terrain or man-made features and never assume that the navigator has seen them. The pilot must take the wind into consideration and fly a heading to maintain the desired ground track.

(4) Cooperation between pilot and navigator is the teamwork that is essential for successful mission accomplishment.

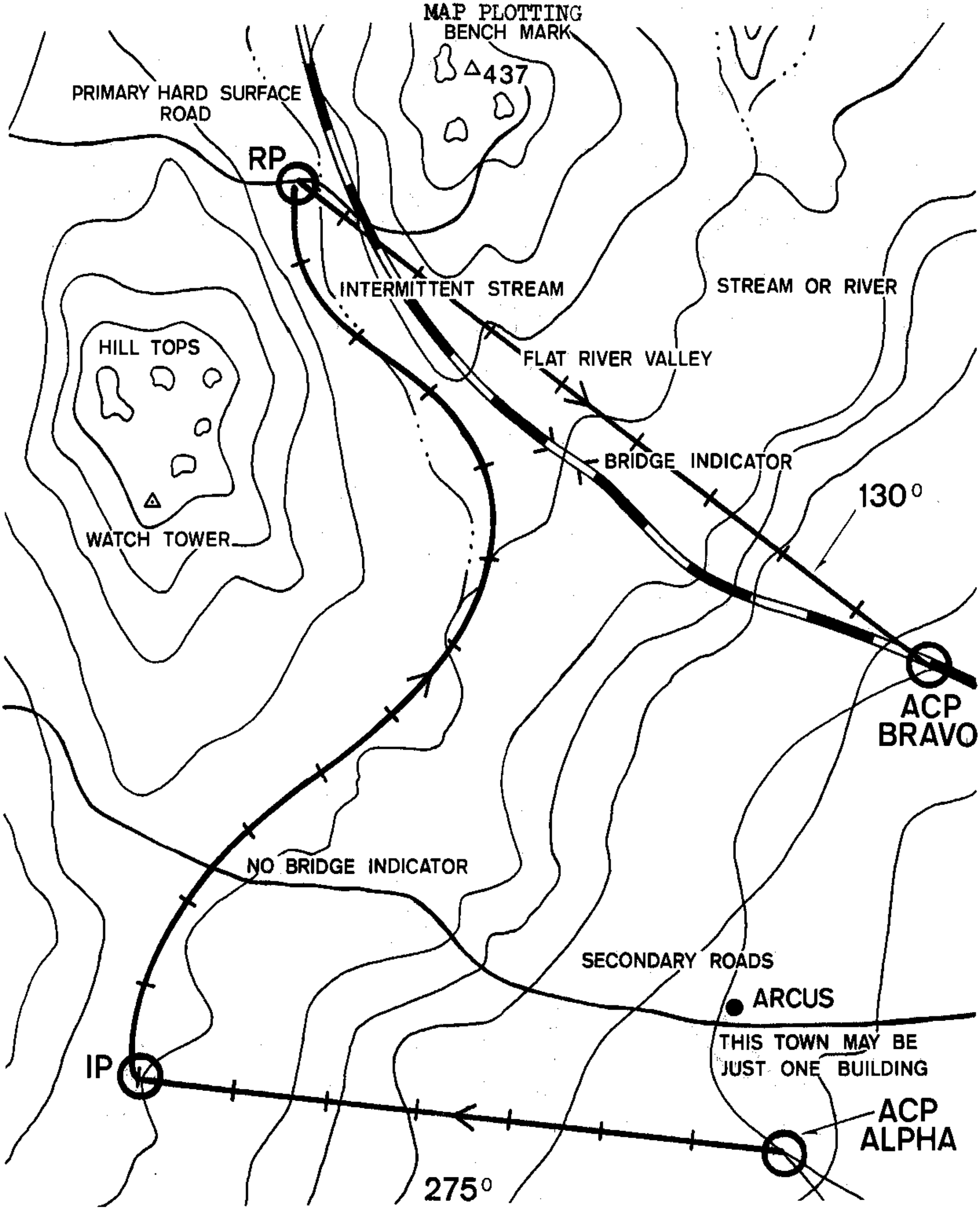

MAP PLOTTING
BENCH MARK
437
PRIMARY HARD SURFACE
ROAD
RP
INTERMITTENT STREAM
STREAM OR RIVER
HILL TOPS
FLAT RIVER VALLEY
BRIDGE INDICATOR
130°
WATCH TOWER
ACP
BRAVO
NO BRIDGE INDICATOR
SECONDARY ROADS
ARCUS
THIS TOWN MAY BE
JUST ONE BUILDING
IP
ACP
ALPHA
275°

Fig. V-3

4. Low Level Approach.

a. Definition: A descent to a landing or hover from a low altitude flight path.

b. Purpose of maneuver: The low level approach to landing permits the pilot to utilize the cover and concealment of low level flight technique to enter landing areas of varying size with minimum exposure.

c. Performance of maneuver: Contact ground party to determine as many of the following requirements as possible, enemy situation, condition of LZ, size of LZ, and wind direction. Approach on a low level flight path. (50 **to 100 feet)** Initiate a deceleration from cruise airspeed (80 knots) to approach speed (60 knots) when within $\frac{1}{2}$ to $\frac{1}{4}$ mile from LZ. Continue low level flight path at (60 knots) approach speed until desired point of touchdown is sighted. Plan to intercept a descent angle of 8° to 15° from flight path to touchdown site and lead the angle of descent by further deceleration of the aircraft. Upon intercepting the descent angle (8° to 15°) continue deceleration and descent so as to arrive at point of touchdown with **zero ground speed.**

d. Special characteristics of maneuver:

(1) The low level approach differs from normal and steep approaches in that the angle of descent starts from a low level (50 to 100 feet) rather than a higher level (300 to 500 feet).

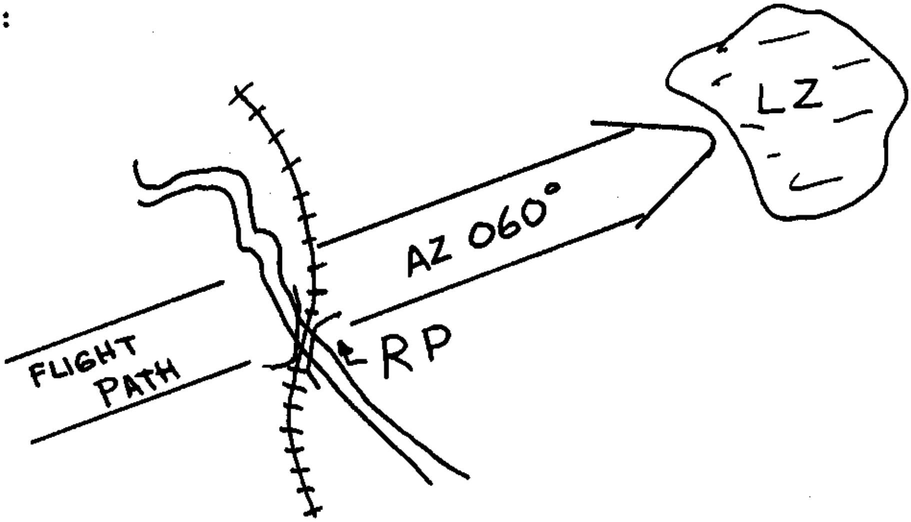
(2) The angle of descent to the desired point of touchdown will be no steeper than a steep approach angle (12° to 15°) and no shallower than a normal approach angle (8° to 10°). This angle of interception seems to occur more rapidly due to the low height of the aircraft above the ground and the pilot should **anticipate the angle in order to intercept the angle. Once established on the angle of approach (100 meters** to 300 meters from touchdown) the pilot applies collective and cyclic forces as necessary to reduce airspeed and maintain his angle of descent to the touchdown point.

e. Techniques of low level approaches. At low level in dense woods, it is not always possible to see the touchdown area until the last moment. At speeds of eighty knots or more, it could cause overshooting a small area. Several techniques to prevent this overshooting or missing the LZ are:

(1) Use of another aircraft at a higher altitude directing the low level aircraft by vectors and information of distances to the LZ.

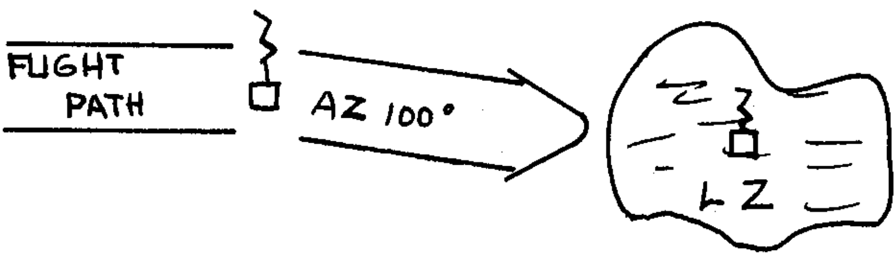
(2) Preplanned missions that have an excellent terrain feature easily identified that can serve as a release point in close proximity to the LZ.

EXAMPLE:



(3) Navigational aids set up in close proximity to the LZ or on the LZ.

EXAMPLE:

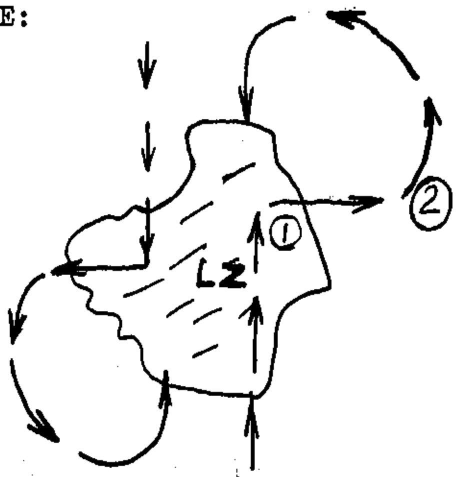


(4) Any other means of identifying flight path and distance to desired touchdown area, such as the use of friendly units, pilotage, radar information, directions from troops on the ground, flares fired by the ground troops on command of the pilot, and/or numerous other means, left only to the imaginative aviator.

(5) In heavy forests, similar terrain, and areas of high jungle canopies, the first approach of the pilot may result in overflying or passing left or right of the LZ. The pilot can salvage his approach in several ways:

(a) The 90° - 270° approach.

EXAMPLE:



(1) A/C overflies LZ at 60 kts.
(2) A/C at 60 kts turns left or right 90° from flight path.
(3) A/C immediately turns 270° in opposite direction. Returns to LZ.
*All turns with consistent angle of bank.

If wind is a factor - overfly LZ the second time and repeat 90° - 270° turns.

(b) Rectangular pattern approach.

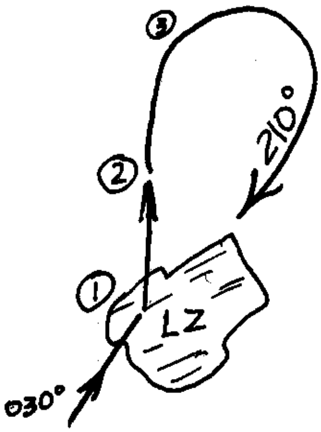
EXAMPLE:

(1) A/C passes left of LZ - Determines LZ AZ - 30°
(2) A/C turns to opposite side of LZ standard turn 180°, to LZ's long axis.
(3) A/C flies on heading 1 minute.
(4) A/C turns to LZ AZ - 030° and proceeds to landing.
(5) If LZ is missed **repeat** procedures.

Winds at low level are usually not so strong that the LZ will be missed completely due to wind drift.

(c) Tear drop approach.

EXAMPLE:



(1) A/C passes LZ and notes LZ AZ - 030°
(2) A/C turns to 360° (-30°) to left. Flies out 40 seconds.
(3) A/C turns to LZ AZ-210° and proceeds to landing.

f. Common errors.

(1) Excessive airspeed on short final causing the aircraft to overshoot desired touchdown.

(2) Gaining altitude on final, go-around, or while circling in order to keep the LZ in sight.

(3) Attempting to stop forward speed with steep flare rather than a uniform deceleration.

(4) Slowing down too soon, too far out from touchdown.

(5) Steep turns close to the ground in attempt to remain in close to the LZ.

(6) Flying too shallow on approach angle when obstacles are cleared.

5. Contour Flight.

a. Definition. Flight at minimum safe altitude to take maximum advantage of terrain, vegetation, and other cover to avoid detection and gain the element of surprise. NOTE: Contour (Nap-of-the-Earth) flight differs from low level flight in that it follows all contours of the terrain and is conducted along a wider axis allowing aircraft to zig-zag for maximum coverage of available terrain and vegetation. Altitude is determined by the contours of the earth and height of obstacles. Normally flight would be conducted at the height of the vegetation.

b. Performance of maneuver. Contour flight is performed in much the same manner as low level flight except that, in general, at much lower absolute altitudes. These altitudes usually vary from 10 to 40 feet obstacle clearance, depending on wind conditions, terrain, visibility, and the aviator's general knowledge of the area to be flown over. Routes to be followed will conform more to terrain and vegetation cover and will generally cover a broader path than low level flight. Low level navigation techniques should be used, and good preflight planning is essential because of the additional attention that must be devoted to actually flying the aircraft. The aviator must be alert for the same hazards as in low level flight plus additional hazards such as power lines, tall trees, abrupt terrain changes, etc. In addition, caution must be used in all turns, and especially steep turns at low altitudes to insure clearance between the aircraft and all existing obstructions to flight. A downwind flight path during gusty surface wind conditions should be avoided when possible. These conditions produce settling, which the aviator may not be able to overcome.

c. Aviators should make all changes in flight path and attitude gradually and should not make rapid or abrupt changes in power or attitude. Whenever possible, obstacles will be cleared by gradually increasing altitude by use of collective or by making a gradual change in flight to go around obstacles.

d. Common errors.

(1) Failure to maintain aircraft control and outside observation at low altitude. Aviator should divide attention between flying the aircraft and observing outside features.

(2) Failure to recognize checkpoints at low altitude. Aviator should observe differences in sight picture at high and low altitude.

(3) Failure to take advantage of natural cover.

VI

HIGH ALTITUDE APPROACH

1. <u>Definition</u>. A descent to landing from altitude while maintaining the aircraft in the vicinity of a relatively secure area resulting in minimum pattern and exposure (within radius of effective friendly fire).

2. <u>Performance of maneuver</u>. Lower the collective pitch to effect a rate of descent not to exceed 1500 fpm. Maintain an 80 knot attitude with cyclic. Trim with antitorque pedals. Planning and judgment should be exercised to insure angle of bank does not exceed allowable limits or turning radius does not get excessively large. Final approach should be into the wind and/or the direction of traffic. At 200 feet above the ground the approach should be continued as a normal or steep approach.

a. Entry - Mission altitude. (1000 feet AGL if possible), aligned with landing direction, reduce power to 10 - 15 psi torque initially.

b. Entry airspeed - 80 knots.

c. Rate of descent - Maintain a constant rate of descent not to exceed 1,500 fpm.

d. Rotor rpm - Maintain within limits.

e. Coordinated turn - maintain in descent not to exceed 45° angle of bank or 30° angle of bank in a loaded aircraft.

f. Final approach - entry 60 knots into the wind or direction of traffic.

g. Approach angle - normal to steep (8° - 15°)

3. Common errors.

a. Beginning approach too late and requiring large turning radius.

b. Rate of descent too high requiring early recovery or causing approach to be short of landing zone.

c. Airspeed too high.

d. Failure to align aircraft properly on final approach.

e. Failure to keep aircraft in trim, resulting in excessive rate of descent.

f. Large and rapid power application during termination of approach.

g. Failure to reduce airspeed to 60 knots prior to intercepting final approach angle.

h. Failure to maintain a close proximity to the area so as to take advantage of existing security.