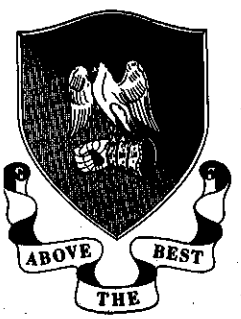
ROTARY WING TACTICAL FLIGHT MANEUVERS GUIDE



APRIL 1969

DEPARTMENT OF TACTICS

UNITED STATES ARMY AVIATION SCHOOL

FORT RUCKER, ALABAMA

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UNITED STATES ARMY AVIATION SCHOOL
FORT RUCKER, ALABAMA 36360

PREFACE

The information contained in this publication is to be used as a guide. The procedures and maneuvers explained are standard. All material is a recapitualtion of academic instruction. It is intended in this publication to outline the major considerations and to orient the maneuvers to a tactical situation. The student must apply all knowledge attained in a specific area during the conduct of any maneuver in order to make his own decisions. Initiative is a key to learning, therefore guidance rather than absolute statements is used in the presentation of a given maneuver. Student application of the basic fundamentals of flying previously learned and guidance in performance of tactical maneuvers will produce an accomplished, competent aviator. The manuevers and procedures outlined herein are intended as an aid in accomplishing this goal.

TABLE OF CONTENTS

I

CREW DUTIES - PILOT AND COPILOT RESPONSIBILITIES

1. General. These crew duties prescribe the procedures to be followed by the student pilot and copilot in preparing and executing all flight training during the Rotary Wing Tactics Training Phase. Specific crew duties are designed to insure the teamwork necessary to safely and expeditiously execute a tactical flight. The sharing of duties in no way relieves the pilot of his overall responsibility for the actions and safety of his aircraft.

2. Pilot duties.

a. Preflight.

(1) The pilot plans the mission together with the copilot.

(2) The pilot is solely responsible for the conduct of a thorough and complete preflight of the aircraft.

(3) The pilot may direct the copilot to accomplish part of the preflight.

(4) The preflight checklist will be used.

b. Start and runup.

(1) Perform the cockpit and starting procedures as prescribed in the current UH-1A, B, C, D and H normal and emergency procedures checklist. These procedures will be read by the copilot (IP will act as copilot while student copilot is performing fireguard duties).

(2) The copilot will read off all items from the checklist and the pilot will call out all checks.

(3) Sets and checks searchlight and landing light prior to night flight.

c. Inflight.

(1) The pilot will fly the aircraft. He will maintain his attention and vision on the items outside the aircraft that influence the mission, i.e., other aircraft, obstacles, terrain clearance, formation position, etc.

(2) Perform the pre-takeoff and landing checks prior to all takeoffs and approaches except when flying a position in formation other than lead.

(3) Aids the copilot in navigation and reconnaissance by providing a verbal commentary of the terrain features and man-made objects that he observes on the route being flown.

(4) Hold headings, altitude and airspeed prescribed by copilot.

(5) Makes all radio transmissions.

d. Shutdown and postflight.

(1) The pilot will perform the shutdown procedure as called off by the copilot.

(2) Insure that the log book is filled out properly to include discrepancies on the -13 and notifying maintenance.

(3) Conduct a post flight of the aircraft assisted by the copilot.

(4) Insure that aircraft is refueled.

(5) After last flight of the day post aircraft time in operations.

3. Copilot duties.

a. Preflight.

(1) Assists pilot in preplanning of mission.

(2) Assist in preflight of aircraft as directed by the pilot.

(3) List on 2408-12 all names of personnel to fly in the aircraft.

(4) Untie main rotor blade and place it 90° to fuselage.

(5) Insure that all cargo is secure and safety belts are installed for each passenger.

b. Start and runup.

(1) Secure all doors.

(2) Stand fireguard to left rear of aircraft with rotor tie-down in one hand and fire extinguisher in the other hand.

(3) Read cockpit, starting and runup checklist for the pilot.

NOTE: The IP will act as copilot until the student co-pilot (fireguard) is in a position to assume the copilot duties. Solo the copilot prior to acting as fireguard will read the checklist up to the time for pulling the starter trigger to include all emergency procedures for engine hot start. After assuming fireguard duties and engine is started he will proceed with copilot duties.

(4) Cages copilot attitude indicator, places inverter switch in "Spare", checks engine and transmission oil pressure rising and states "in the green" when the instruments are within normal operating limits.

(5) Turn radios "ON" and tune to desired frequencies.

(6) Checks boost pumps and makes AC and DC voltage checks. Turns rotating beacon "ON" when cleared for takeoff.

(7) Make changes in navigation lights and rotating beacon as per SOP and/or student briefing prior to night flying.

c. Inflight.

(1) Navigate and verbally directs the flight path of the aircraft.

(2) Advise pilot of all obstacles.

(3) Monitor engine and flight instruments and advise pilot as required.

(4) Record data as required by the mission.

(5) Insure that passengers have their seat belts fastened. Alert passengers for landing.

(6) Advise ground commander aboard the aircraft of any changes to the original mission.

(7) Advise troops aboard the aircraft as to direction of attack in the LZ.

(8) Tunes radios to desired frequencies.

(9) Adjust copilot altimeter to current altimeter setting with "K factor" when available and advises the pilot of the change.

(10) Rotating beacon, navigation lights, landing and search light - set as prescribed in Combat Avn Bn SOP.

(11) Perform any additional cockpit procedures as directed by pilot, i.e., arming cargo release switch, turning force trim "ON" or "OFF" as directed.

(12) Perform pre-takeoff and landing checks when flying formation.

d. Shutdown.

(1) Read shutdown checklist for pilot.

(2) Complete flight log book.

(3) Tie main rotor blades down.

(4) As directed, assist pilot in post flight of aircraft.

4. Summary.

A thorough understanding of these duties and their proper execution will facilitate a safe, efficient flight. This list of crew duties is designed to compliment the syllabus and methods of tactics training in the Tactical Training Division, Department of Tactics. Units in the field will have similar lists of crew duties designed for their particular mission and aircraft requirements.

NOTE: a. After aborting a start in the UH-1, no solo student will attempt a restart.

b. Emergency start procedures will not be performed by students. Students will only be briefed by the instructor pilot on these procedures and their possible combat use.

II

FORMATION FLIGHT

1. Day formation.

a. Definition. Formation flight is the grouping of aircraft in a flight pattern for a specific purpose. Two or more aircraft holding position relative to each other and under the command of a designated aviator constitutes a formation.

b. Purpose. The primary purpose of formation flight is control. In addition, formation flight facilities discipline, maneuverability, flexibility, reaction time to contingencies, and provides for the rapid development of a situation, either offensive or defensive.

c. Formation types. For the purpose of tactical training, six of the numerous formations will be practiced. These formations are the "V", the echelon (left and right), the trail and staggered trail (left and right), the diamond, the tactical heavy (left and right), and free cruise.

(1) V formation. The positions of a V of three are a wingman in left echelon and a wingman in right echelon on the leader. The wingmen hold a position 45° astern of the leader both right and left with an interval between helicopters of 2 rotor disc diameters measured between tip path planes. A vertical "stepped-up" separation of 3 feet is maintained by the wingmen. Determining and maintaining a 45° angle can best be done by positioning your aircraft so that the pilot visually aligns the far front crosstube and the nearest rear crosstube at the point where the crosstube joins the skid, on the aircraft on which he is holding formation. (Fig II-1). The 3-feet vertical separation can be maintained by positioning your aircraft so that the swashplate assembly of the aircraft you are holding position on is aligned with the horizon. Figure II-2. The numbering and spacing is as shown in Figure II-3.

VIEW OF UH-1 CROSSTUBES

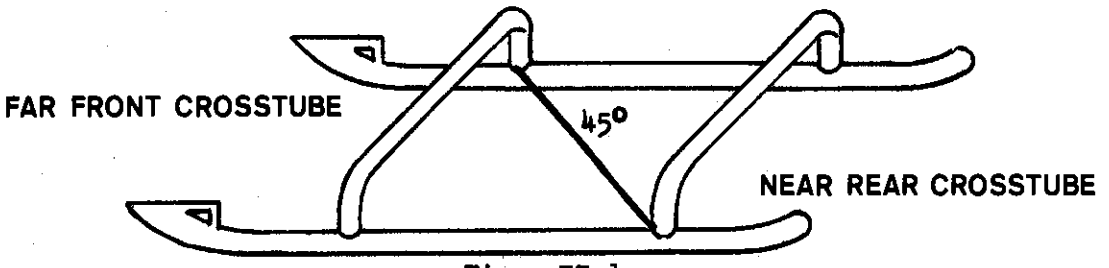


Fig. II-1

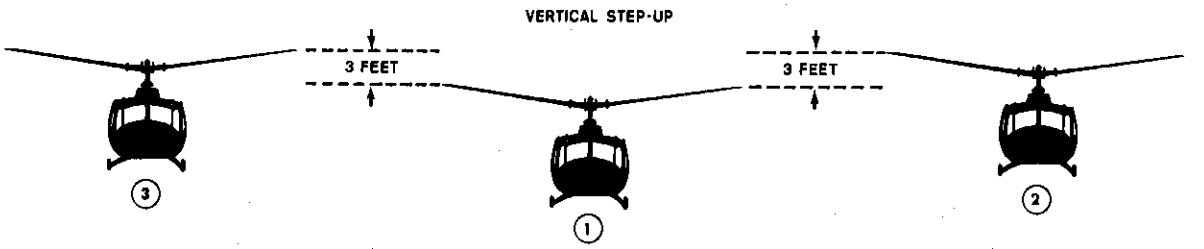


Fig. II-2

THREE HELICOPTER V-FORMATION

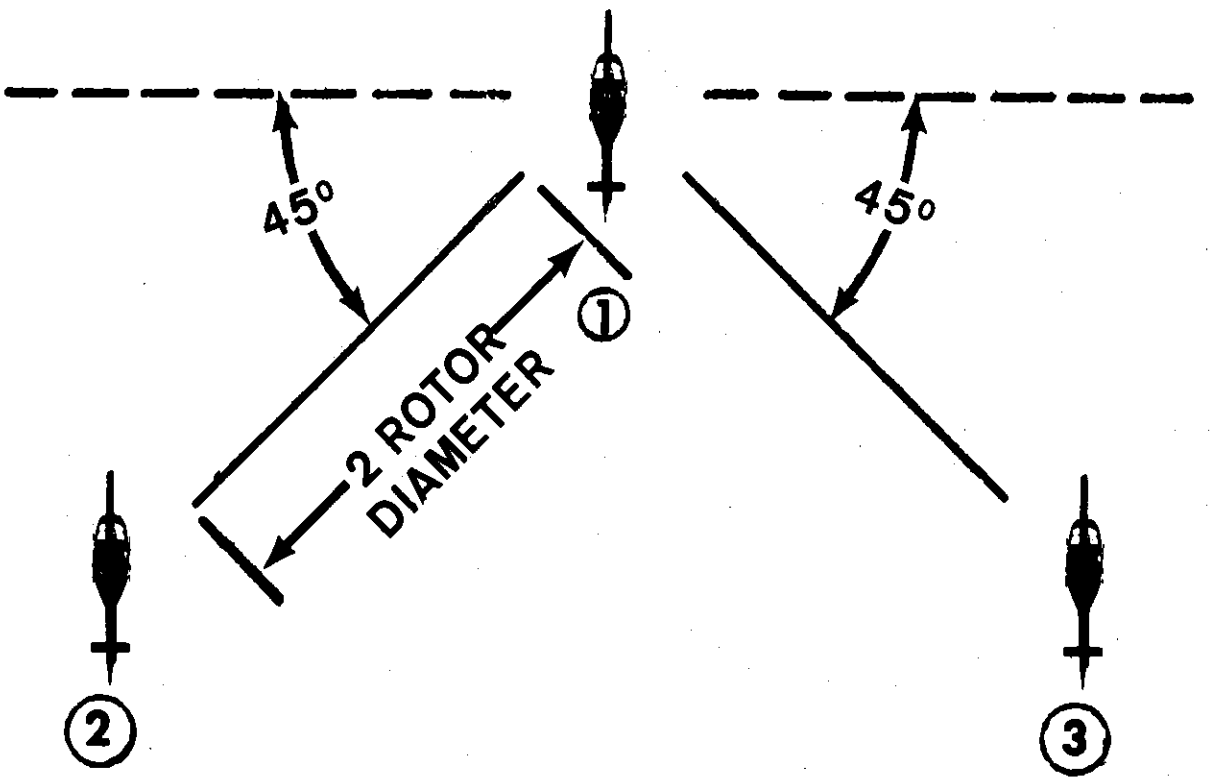
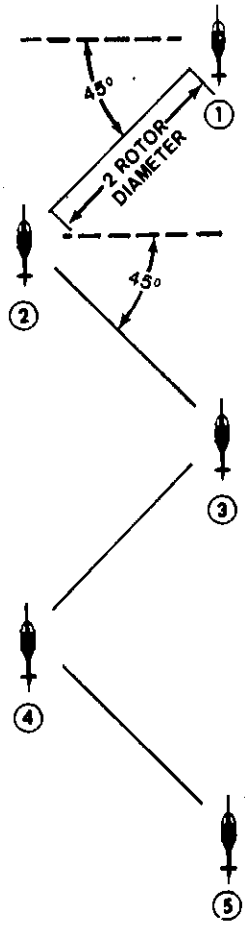


Fig. II-3

(2) Staggered trail. The positions of a staggered trail are each aircraft of the formation holding a position 45° astern on the aircraft to its front alternating left and right echelon. Each succeeding aircraft maintains 3 foot vertical separation on its "lead". This formation is not limited to any p ribed number of aircraft; its size is dictated by the mission re ent. A diagram of positions and numbering is shown in Figure II-4.

STAGGERED TRAIL LEFT OF FIVE A/C



STAGGERED TRAIL RIGHT OF FIVE A/C

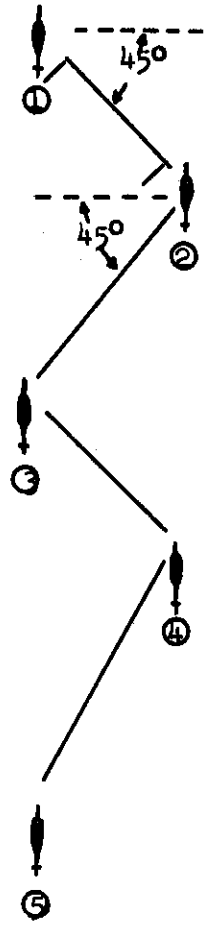


Fig. II-4

(3) Trail formation. In the trail formation the number 2 helicopter takes a position of two aircraft lengths directly behind the lead aircraft, with a three foot vertical step-up. Each trailing helicopter holds the same relative position on the aircraft immediately to its front. This formation is not limited to a prescribed number

of aircraft. Helicopters are numbered and spaced as shown in Figure II-5.

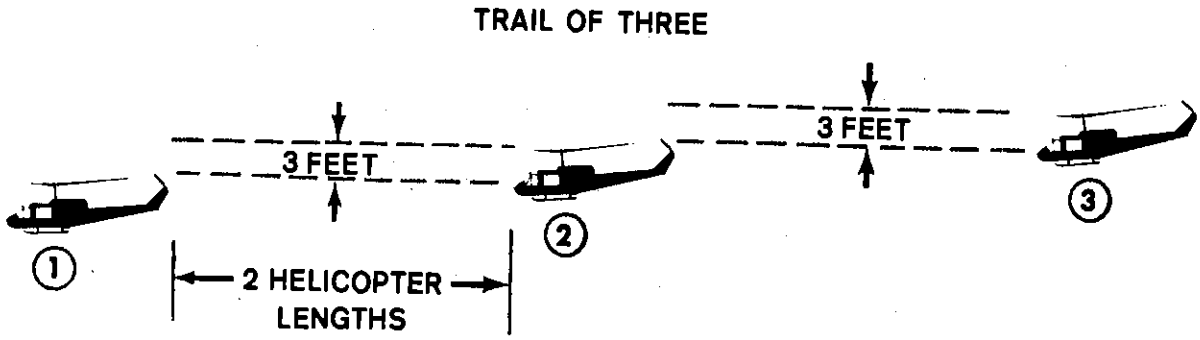


Fig. II-5

(4) Right and left echelon. The position of echelon right or left is each aircraft holding a position 45° astern on the aircraft to its front on the side (right or left) directed by the formation leader. Each succeeding aircraft maintains a two rotor disc diameter separation and a 3 feet vertical step-up. A diagram of positions and numbering is shown in Figure II-6.

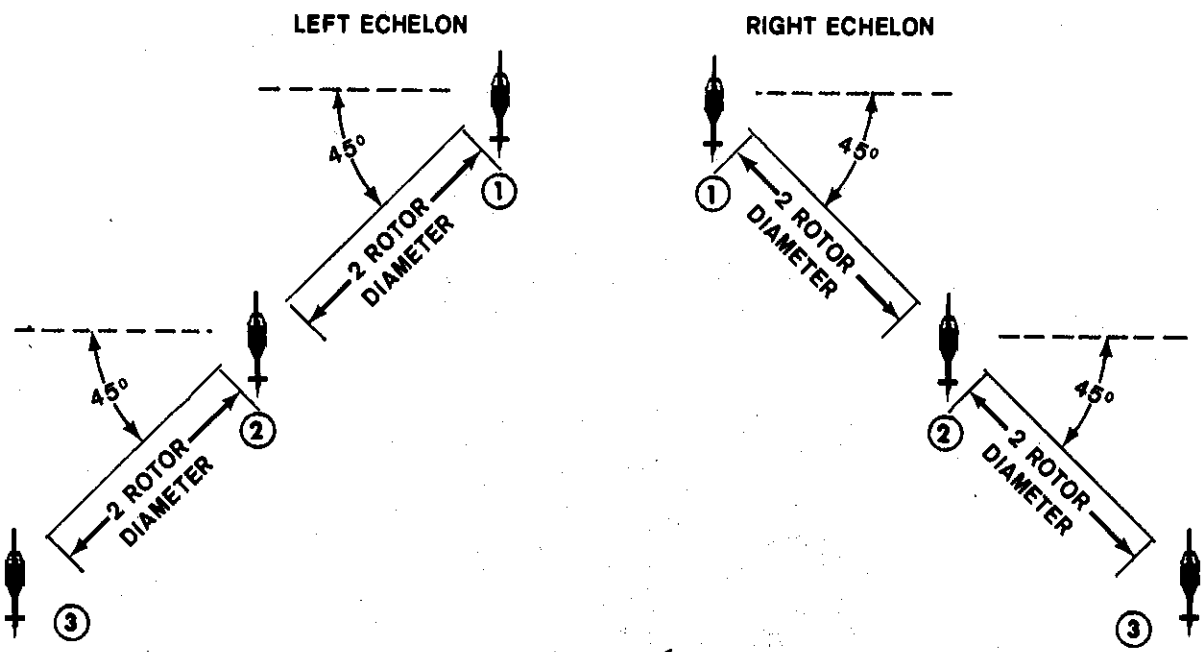


Fig. II-6

(5) Diamond formation. In the diamond formation aircraft number 1 through 3 fly the standard "V" described in paragraph 1c(1). The number 4 aircraft flies a position called the "slot". In the "slot", number 4 flies directly behind the lead aircraft, and 45° astern of both wingmen, with a three foot vertical step-up on number 3. Helicopters are numbered and spaced as shown in Figure II-7.

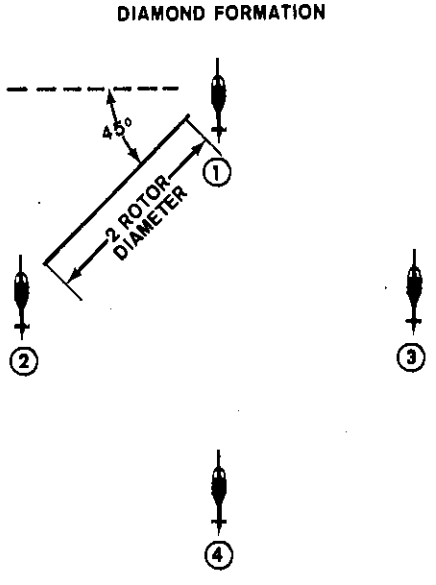


Fig. II-7

(6) Tactical heavy (left and right) formation. The tactical heavy formation is composed of two (2) helicopter sections. In this formation, the leader of the second section flies 45° astern of the flight leader, 3 feet above the flight leader, and opposite the side of the wingman of the flight leader. Spacing between sections must be sufficient to permit the wingman of the flight leader to move from or to either echelon position. Figure II-8 shows the flight with the second section on the right (heavy right). Figure II-9, shows the second section on the left (heavy left).

TACTICAL HEAVY RIGHT FORMATION

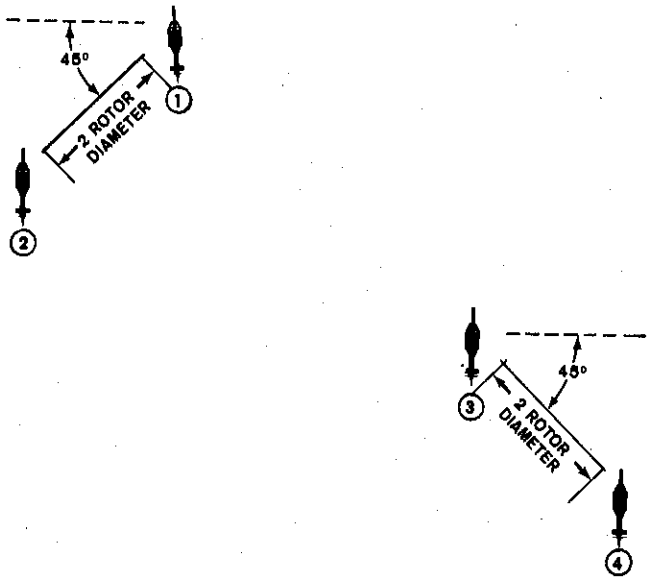


Fig. II-8

TACTICAL HEAVY LEFT FORMATION

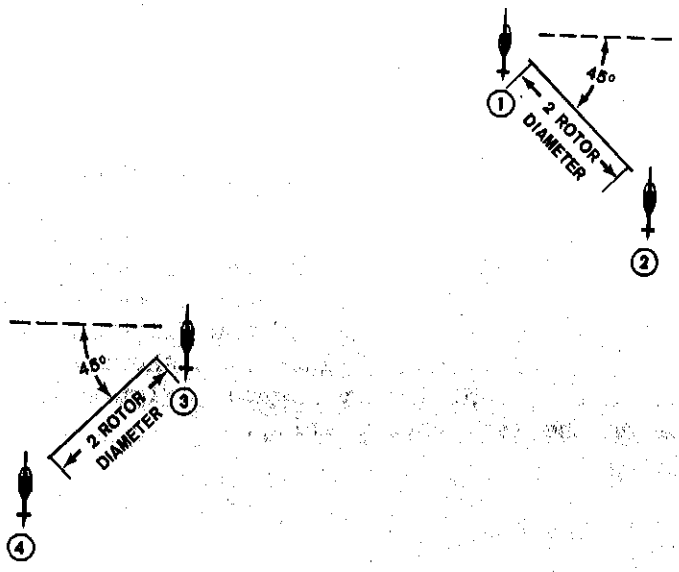


Fig. II-9

(7) Free cruise. The position of free cruise is not rigidly fixed as in other formations; therefore it is normally used when only two aircraft are flying formation. The wingman has the prerogative to move quickly and freely from 45° astern on one side of the lead aircraft to a position 45° astern on the other side. Although the wingman has the prerogative of changing sides he should keep the lead aircraft advised, by radio, as to what side he is flying. This formation is used to reduce pilot fatigue.

d. Elements. Many formations are made up of a number of smaller formations. This is particularly true for airmobile operations where a section of aircraft fly as part of a platoon formation, as part of company. In instances where this is practiced, an interval (fore and aft) of 2 helicopter lengths should be maintained between elements (measured from rear of lead element to first aircraft of second and subsequent elements).

e. Formation selection. Of primary importance to formation flight techniques is the selection of the best formation for the mission.

(1) Important factors in determining the best formation are:

(a) Objective of the mission.

(b) Simplicity to permit easy control, facilitate discipline, and afford reconnaissance efficiency.

(c) Flexibility to meet different situations and ability to quickly close up to fill vacancies.

(d) Mutual support and maximum protection.

(e) Maneuverability for evasive tactics.

(f) Provisions for rapid development of either offensive or defensive power.

(2) After selection of the most desirable formation, a great deal of planning and preparation must be completed before the mission takes place. Prior to a formation flight a detailed briefing must be conducted (ref. AR 95-2). This briefing will include, but is not limited to the following:

(a) Weather.

(b) Route.

(c) Mission.

(d) Interval.

(e) Airspeed.

(f) Radio frequencies and call signs.

(g) Formation.

(h) Emergency procedures.

(i) Terrain conditions.

(j) Altitude.

(k) Maps and charts.

(l) Communication check procedure.

(m) Communication failure procedure.

f. Formation leaders are responsible for maintaining smooth level flight and correct formation positions at all times. To insure accomplishing the mission of "lead" helicopter, the complete pre-mission briefing is necessary and should include all coordination instructions available.

g. Principles of formation flying.

(1) An aircraft flies only on one other aircraft in the formation. The constant vigilance required to detect any change in altitude, airspeed or heading of the lead aircraft precludes watching other aircraft. If all aircraft guide correctly to their lead, all aircraft have adequate distance and altitude separation for safe operation. In those formations requiring a relative position to more than one aircraft, i.e., staggered trail, number 4 position in the diamond formation, etc., the aviator must utilize his peripheral vision to the maximum while concentrating on his "lead" aircraft.

(2) All turns made by the lead helicopter should be constant rate and should not exceed standard rate turn. The reduced degree of bank requires a larger turning radius and must be considered in planning, particularly in the landing pattern. Should it be necessary to exceed standard rate turn, this can best be accomplished by slowly continuing to increase the degree of bank until the desired turn is established. By slowly increasing the bank the lead ship will allow the wingmen time to react. (When flying with inexperienced aviators, it is also a good practice to make a radio call to the flight before making turns, approaches, climbs, landings, etc.)

(3) Regardless of the altitude, it is the responsibility of the formation leader to provide obstruction clearance for all helicopters in the formation. This rule of safety applies during all portions of the flight from takeoff to termination.

(4) During a turn the inside wingman will have to decelerate slightly, while the outside wingman will be required to accelerate slightly to maintain their relative positions in the formation.

(5) Formation takeoff.

(a) Definition: A formation takeoff is two or more aircraft leaving the ground at the same time and then maintaining a predesignated relative position within that formation.

(b) Description of maneuver:

1. All helicopters should break ground simultaneously at a prearranged signal from the formation leader. Most formation takeoffs are from the ground.

2. During a formation takeoff the leading elements must accelerate slightly faster than a normal takeoff which will allow the following elements to gain translational lift. Obstructions permitting, an airspeed over altitude takeoff should be made until the flight has established a definite airspeed and rate of climb.

(6) Formation landing.

(a) Definition: A landing during which all elements of a formation touchdown at the same time while maintaining their relative position within the formation.

(b) Description of maneuver:

1. Most formation landings are made to the ground where the terrain and obstacles permit, to avoid added hovering turbulence and resulting dust conditions.

2. Every effort must be made to avoid "S" turns on final approach, as the increases and decreases in airspeed required to maintain relative positions in the formation are critical at that time, perhaps necessitating a go-round if the aircraft are heavily loaded.

3. During the formation landing, consideration must be given to insure that sufficient obstacle clearance, landing, and takeoff space is provided for all aircraft in that formation.

This is the responsibility of the formation leader. It is mandatory that the lead element hold straight and level flight into the objective area until the correct approach angle is intercepted, avoiding an excessively steep or shallow approach by the rear elements.

(7) Formation changes en route.

(a) Definition: A change in the formation pattern accomplished while airborne.

NOTE: For training all formation changes will be made through trail formation.

(b) Performance of maneuver.

1. Change from V-formation to echelon. The wingman opposite the side on which the echelon is to form decreases airspeed until the leader and other wingman have moved ahead a helicopter length. He then moves laterally to his echelon position (Fig. II-10). The reverse of this procedure is used to reform a "V" from an echelon.

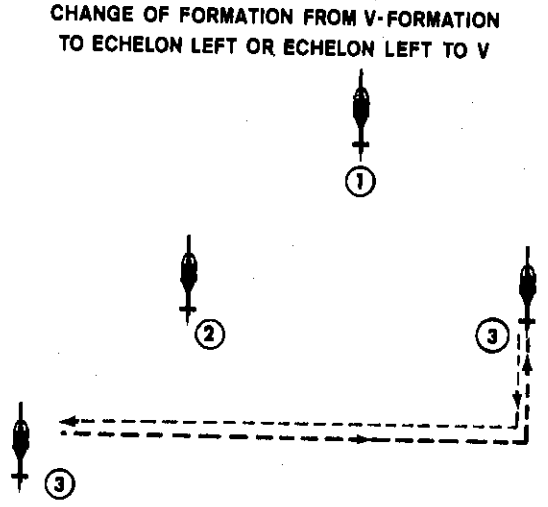


Fig. II-10

2. Change from V-formation to trail. The number two and three wingman reduce airspeed until the leader has moved ahead of the number two wingman by three aircraft lengths and ahead of the number three wingman by six aircraft lengths. The number two wingman then moves laterally to assume a position two aircraft lengths behind and 3 feet above the leader. Number three wingman moves laterally two aircraft lengths behind number two with 3 feet vertical separation. During this maneuver only one aircraft is to be moving laterally at one time, number two moves first then number three (Fig. II-10). To

change to a "V" formation from trail, the reverse of this procedure is followed.

CHANGE FORMATION FROM V-FORMATION TO TRAIL

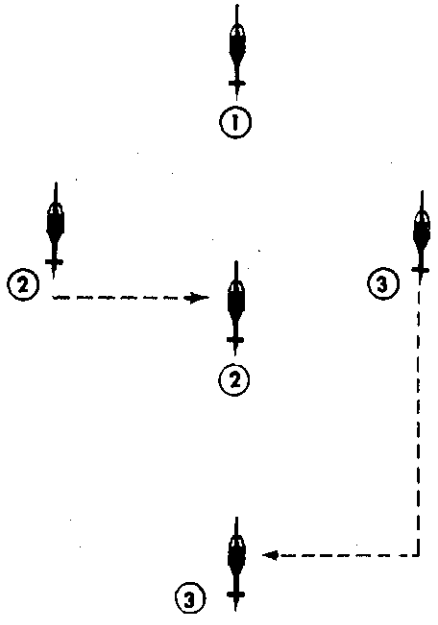


Fig. II-11

3. Change from V-formation to a staggered trail. The number three wingman reduces airspeed until wingman number two has moved ahead by three aircraft lengths; number three then moves laterally behind number one and at a 45° position astern of wingman number two (Fig. II-12). The V is reformed by reversing this procedure.

CHANGE OF FORMATION FROM
V-FORMATION TO STAGGERED TRAIL LEFT

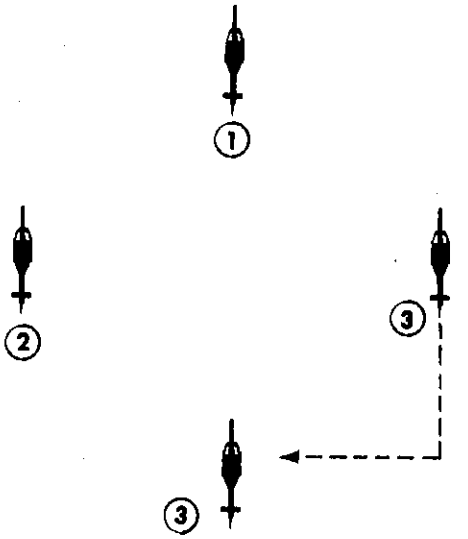


Fig. II-12

4. Change from trail to staggered trail. The number two aircraft moves laterally to the left to a position 45° astern of number one; number three then closes on number one to a 45° astern position on number two (Fig. II-13). To reform a trail, the reverse is followed. Caution must be exercised in that number three must extend his interval before number two can laterally move into the trail position.

CHANGE OF FORMATION FROM TRAIL TO STAGGERED TRAIL LEFT

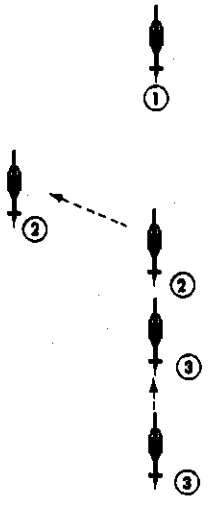


Fig. II-13

5. Change from tactical heavy left to tactical heavy right. Number 2 moves to the left, 45° astern of the flight leader number 1. Number 3 moves right to a position 45° astern and to the right of the flight leader number 1, leaving sufficient spacing between sections to permit the wingman of the flight leader, number 2, to move from or to either echelon position. Number 4 moves with number 3 and takes a position 45° to the right of number 3 (Fig II-14). To change from a tactical heavy right to a tactical heavy left the above procedure would be reversed.

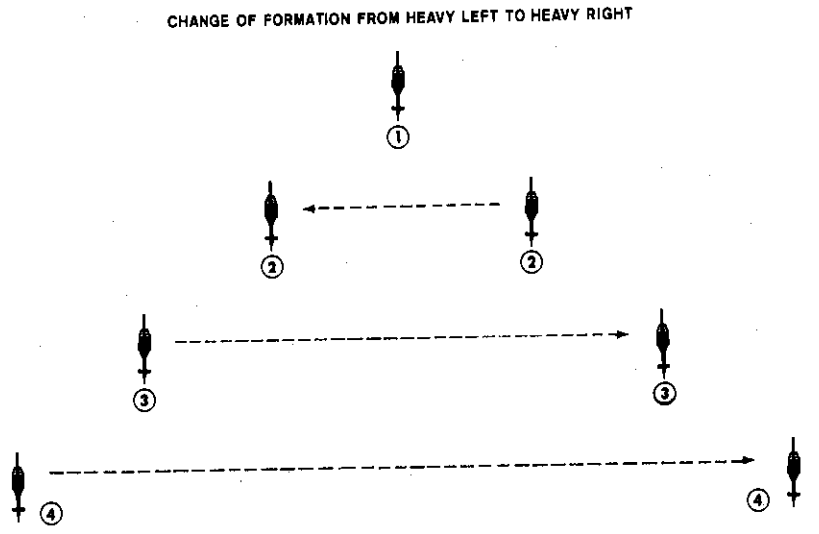


Fig. II-14

6. Change from tactical heavy right to staggered trail. Aircraft number 1 and 2 maintain their position. Aircraft number 3 slows and moves to the left until he is in a position directly behind number 1 and 45° astern of number 2. Number 4 slows and moves left to a position directly behind number 2 and 45° astern of number 3 (Fig. II-15).

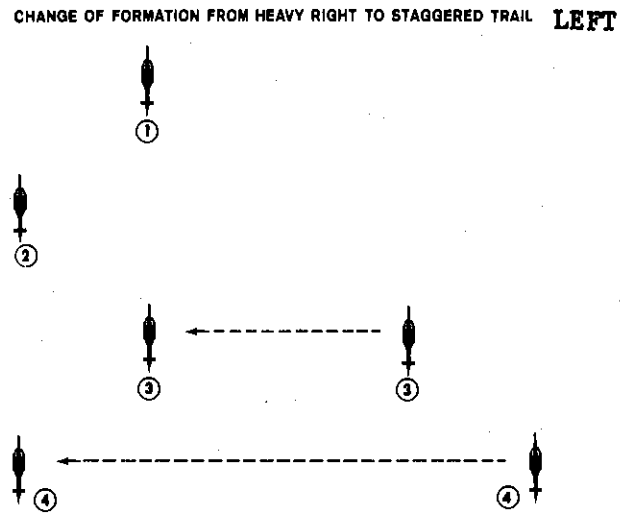


Fig. II-15

7. Change from tactical heavy left to staggered trail. Aircraft number 2 moves to the left 45° astern of number 1. Aircraft numbers 3 and 4 slow and move to the right until number 3 is directly behind number 1 and number 4 is directly behind number 2 at positions 45° astern. (Fig. II-16).

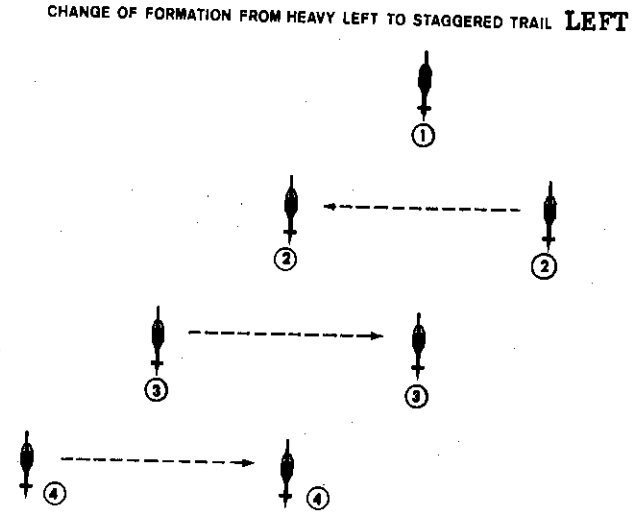


Fig. II-16

(8) Tactical formation break up:

(a) Break up of formation into single aircraft: The flight leader directs an echelon formation initially for this maneuver. After the formation has closed into an echelon the flight leader will designate the number of seconds (normally 10 sec) between breaks. Upon the command "execute" the lead aircraft will turn 90° away from his wingman. After a delay of the designated time the number two aircraft will break in the same direction and state "(Callsign) breaking right (left)". This procedure will continue until the formation breakup is complete.

(b) Break up of formation into two aircraft elements: The flight leader directs a staggered trail formation initially for this maneuver. After the formation has closed into a staggered trail the flight leader will announce the time interval between elements and receive an acknowledgement. On the command "execute" the first two aircraft will continue on course and if load and flight condition permit will increase airspeed by 10 knots. The remainder of the aircraft will slow by pairs (3 and 4, 5 and 6, etc) until desired separation is attained.

An exception to the above procedure must be used with large formations to avoid stacking up of the last aircraft. This exception is at the command, "execute" the lead aircraft will enter a standard rate (right or left, as designated) 180° turn. Each subsequent two aircraft element will fly his designated separation interval and then enter a standard rate 180° turn in the same direction as the lead element. As the turn is complete the flight has proper separation and can continue in the desired direction for mission accomplishment.

(9) Rendezvous and join up: The flight leader will approach the rendezvous point at the preplanned time and altitude. Upon reaching the rendezvous point he will enter an orbit in the preplanned direction using a standard rate turn and an airspeed of 60 knots. Joining members of the flight will approach the lead aircraft by crossing his orbit at 70 to 80 knots and at the same altitude. As final join up is completed airspeed will be reduced and heading varied so as to close into position at 60 knots and 45° to the lead aircraft. Planning and judgement must be exercised at all times to insure a safe rate of closure is maintained and that the common error of overrunning is avoided.

2. Night formation flight.

a. Procedures for night formation flight are basically the same as day formation flight. The primary difference being aircraft

spacing. During night flight the interval between helicopters is increased to 3 to 5 rotor disc diameters. During night flight pilot depth perception is greatly reduced. For this reason changes in formation must be kept to the minimum.

b. Aviators executing a joinup, formation change or adjusting position must take care that their rate of closure is slow enough to be stopped quickly, and that they do not overrun the helicopter immediately ahead. The silhouette of a helicopter cannot be seen except at a close distance; the best point of reference is the position lights.

c. Another problem encountered during night formation flight is fixation. Fixation occurs when the aviator looks or stares too long and hard at a point. When experiencing fixation the pilot is unaware of the movement of his aircraft or the aircraft he is flying formation on. To avoid this fixation the aviator must look around, moving his eyes from one position to another on his leader.

d. Communication considerations.

(1) Definition: Communication procedures required during formation flight training for reasons of safety and positive control.

(2) Performance of maneuver:

(a) A communications check on the FM Command/Operation Net is required prior to departure on a formation flight. Current regulations require that all aircraft of a formation have operational radio communications and that communications are established between all aircraft of the formation.

(b) Prior to initiating an enroute formation change, rendezvous and join up or formation breakup, positive communications must be established with all elements of the flight. An acknowledgement of the transmission directing the maneuver is required to insure completed understanding of the maneuver and to avoid misinterpretation of an aircraft's movement. These maneuvers should not be attempted if communications are lost.

(c) During the tactics training an aircraft that loses all communication capability while enroute will remain with the formation to its next landing site. At the landing site, the crew members will give the visual signal of "thumbs down". As the formation leader cannot see this signal, it should be part of the premission briefing to designate an aircrew responsible for notifying the leader, normally the last aircraft of the formation. After insuring that the lead aircraft has been informed of the lost

communications, the aircraft will break formation and return to base airfield. Should the formation leader determine that he has lost all communications capability he will land at the next landing site, give a visual signal of "thumbs down" to the number two aircraft, at this time number two will assume the lead, and the leader will return to base airfield.

(d) All formation changes and frequency changes are directed by the formation leader, using a preparatory command and a command execution.

SITUATION EXAMPLES:

Commo check

"Basin 30, this is Basin 31, FM Commo Check, over."

Reply: "Basin 32 is up." "Basin 33 is up." "Basin 34 is up," etc., in numerical sequence.

Basin 31 "Roger Out"

Formation of flight

"Basin 30 flight, this is Basin 31, Tail Number _____, Form on _____ in _____(Type of formation), acknowledge."

Reply: "Basin 32, Roger." "Basin 33, Roger," etc.

"Basin 30, this is Basin 31, execute formation line up."

Reply: "Basin Lead, This is Basin 36 your flight is formed in _____ (Type of formation).

NOTE: If covered in briefing, not necessary

Formation takeoff

"Basin 30 Flight, This is Basin 31, pitch pull in 10 seconds."

"Basin 31, this is Basin 34, your flight is off"

"This is Basin 31, Roger."

After Flight Joined - Reply: "Basin 31, this is Basin 34, Your flight is joined _____ (Type of formation)."

"Basin 34, this is Basin 31, Roger, going 80"

Frequency change

"Basin 30 flight, this is Basin 31, the next UHF frequency will be command UHF, acknowledge."

Reply: "Basin 32, Roger," "Basin 33, Roger," etc.

"Basin 30, this is Basin 31, execute command UHF."

Formation change in flight

"Basin 30 flight, this is Basin 31, the next formation will be _____, acknowledged."

Reply: "Basin 32, Roger," "Basin 33, Roger," etc.

"Basin 30 flight, this is Basin 31, execute _____ (Type of formation)."

Reply after proper formation change: "Basin 31, this is Basin 34, your formation is joined _____ (Whatever is desired formation)."

Formation break

"Basin 30 flight, this is Basin 31, prepare to break left at five second intervals, (give rendezvous instructions) call the break, acknowledge."

Reply: "Basin 32, Roger." "Basin 33, Roger, " etc.

"Basin 30 Flight, this is Basin 31, breaking now."

5 seconds later - "Basin 32, breaking this time"

5 seconds later - "Basin 33, breaking this time"

When all aircraft have landed - "Basin 31, this is Basin 34, your flight is down with _____ (No. of aircraft)"

"Basin 31, Roger."

3. Inadvertant instrument conditions.

a. Definition: situations requiring immediate action.

b. Performance of maneuver:

(1) Inadvertent instrument conditions ("V" of 3).

(2) If visual contact can be maintained, a 180° turn is accomplished.

(3) If visual contact cannot be maintained, the following procedure is followed (Fig. II-17):

(a) The flight leader continues straight ahead, announces "Execute Inadvertent IFR Procedure", and reports his magnetic heading and altitude.

(b) The formation acknowledges and the number two wingman executes a 30° turn to the left and climbs 100 feet.

(c) The number three wingman executes a 30° turn to the right and climbs 200 feet.

(d) After all helicopters have completed the initial break away and climbed to the assigned altitude they fly a straight course for 30 seconds. The leader will then direct helicopters numbers 2 and 3 to complete the 180° turn (150° additional). Ten seconds later the leader makes his reverse of course.

(e) When the helicopter at the lowest altitude reports VFR, the aircraft at the next higher altitude begins a descent to VFR. This sequence is followed until all aircraft are VFR and have reported so to the leader.

(f) This procedure may not conform to those procedures prescribed by unit SOP's; however, this procedure is used as a training maneuver.

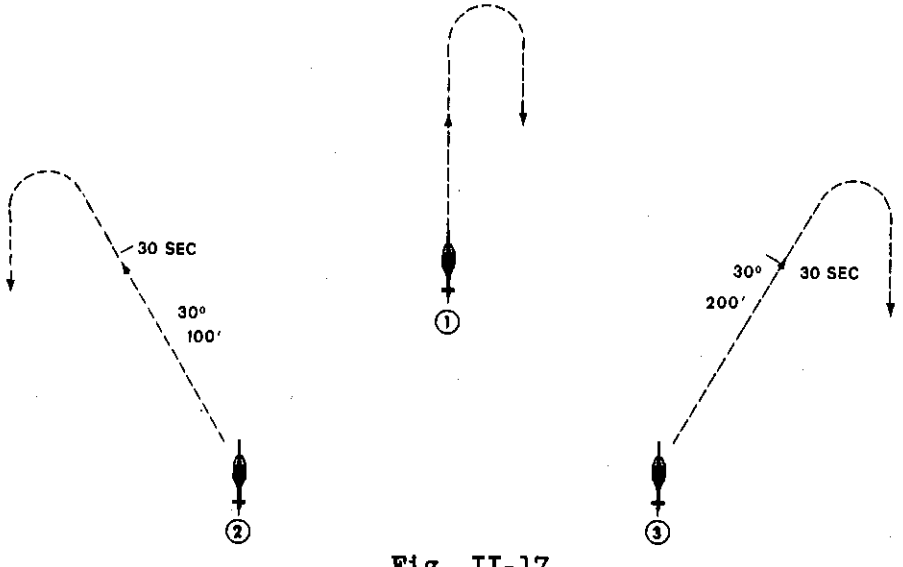


Fig. II-17

III

RADIO AIDS TO NAVIGATION

1. FM Homing with the AN/ARC-44.

a. Definition. The use of the AN/ARC-44 FM radio in conjunction with the ARA-31 homing antenna to home to any FM transmitter transmitting on a frequency within 24.0 to 51.9 MHZ.

b. Performance of maneuver.

(1) Tune to frequency of homer station. After tuning, place the COMM/HOME switch in the HOME (UP) position, and receive homing signal. To home on a station, it is necessary to establish voice contact with the station and request the operator to transmit for approximately 15 seconds with 10-second pauses to monitor or send voice transmissions. (COMM/HOME switch must be in the COMM (DOWN) position to transmit voice communications.) If the signal reaches the aircraft's left antenna first, the aviator will hear the Morse Letter D (-..). This indicates the station is to the left. If the signal reaches the right antenna first, the aviator will hear the Morse Letter U (..-). This indicates the station is to the right. If the signal reaches both antennas at the same time, the aviator will hear the on-course, solid tone. This indicates the station is directly in front of or behind the aircraft. See Fig III-1

(2) If the on-course signal is heard initially (solid tone), the aircraft must be turned (either right or left) until the U or D signal is heard. Then the aircraft must be turned in the direction the signal indicates until the on-course signal is heard again. The station will now be directly in front of the aircraft.

(3) If the letter D is heard, the aircraft must be turned left until the on-course signal is heard. The station will now be directly in front of the aircraft.

(4) If the letter U is heard, the aircraft must be turned right until the on-course signal is heard. The station will now be directly in front of the aircraft.

(5) For successful homing and station passage, the pilot should, while homing on the station, make a 10^{o} to 15^{o} turn frequently (always in the same direction) to identify the signal. Then the aircraft is turned back on course, in the direction the signal indicates.

(6) When a reversal of the signal is heard, the aircraft has passed the station and the aviator should continue the turn and start

looking for the station or verify his position over that point. The most apparent indication of station passage will be a turn in excess of 90° required to reestablish the on course signal.

(7) There are times when a signal will become unreliable due to beacon malfunction or aircraft receiver malfunction. These signals may give erroneous indications and will normally contain large errors that are readily apparent, i.e., turns in excess of 90°, reversal of signals or course signals of wrong azimuth. When a determination has been made that the set is unreliable, normal map navigation should be resumed and another homing attempt made when in closer to the beacon.

c. Common errors.

(1) Failure to receive the FM homing signal. This is caused by the aviator forgetting to turn the COMM/HOME switch up to the HOME position.

(2) Turning in wrong direction. Student must learn to recognize Morse D (-..) and Morse U (..-) and to turn the correct direction to them.

(3) Failure to turn off course in same direction when homing to station. Opposite signals may be mistaken for station passage.

(4) Disorientation from reliance on FM homer and failure to maintain map/ground orientation.

NOTE: FOR TRAINING PURPOSES ONLY. During the tactics phase of training normally, students will be assigned one FM frequency to use for homing and another FM frequency to use for voice communications.

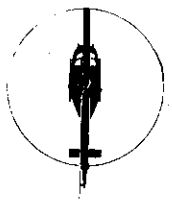
This applies to both the AN/ARC-44 and AN/ARC-54.

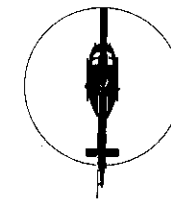
HOMING PROCEDURES

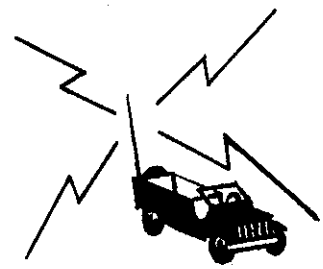
AN/ARC-44

..- ..- ..-
U! I turn to the right to head toward the station.

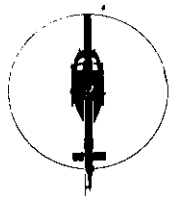
-.. -.. -..
D! I turn to the left to head toward the station.

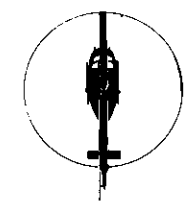






Always turn in direction indicated until steady tone is heard. This means that the a/c is heading toward the station.





..- ..- ..-
U! I turn to the right to head toward the station.

-.. -.. -..
D! I turn to the left to head toward the station.

NOTE: Freq range of AN/ARC-44 when used for homing purposes is 24.0 to 51.9 MHZ.

Fig. III-1

2. FM Homing with the AN/ARC-54.

a. Definition. The use of the AN/ARC-54 FM radio in conjunction with the Omni Indicator to home to any FM transmitter transmitting on a frequency within 30.00 - 69-95 MHZ.

b. Performance of maneuver.

(1) Tune to frequency of homer station and identify station through normal operating voice procedures of the AN/ARC-54. After tuning, place the mode selector in the HOME position and if the homing station is receiving sufficient signal strength, both Flag Alarms on the Omni Indicator should disappear. The horizontal needle will indicate signal strength on the Omni Indicator and will also indicate station passage. The vertical needle will indicate that you are on course, right or left of course, and can also indicate station passage.

(a) If the aircraft is flying towards the station and is to the right of course, the vertical needle will deflect to the left thus indicating that a left turn is required to return to the course line (Fig. III-2).

(b) If the aircraft is flying towards the station and is to the left of course, the vertical needle will deflect to the right thus indicating that a right turn is required to return to the course line (Fig. III-2).

(c) If the aircraft is on course, the vertical needle will be centered. A centered needle will indicate that the station is directly in front of, or behind the aircraft.

(d) To determine if the aircraft is flying away from the station, attempt to center the vertical needle by turning the aircraft.

1. If the aircraft is to the left of the station, the right homing antenna will be closest to the station and the vertical needle will indicate a right turn. As the aircraft turns right, the right antenna will continue to be closest to the station and the vertical needle will deflect further right, indicating a continuing right turn to return to the station.

2. The converse is true if the aircraft is to the right of the station, the left homing antenna will be closest to the station and the vertical needle will indicate a left turn. As the aircraft turns left, the left homing antenna will continue to be closest to the station and the vertical needle will move further to the left indicating a continuing left turn to return to the station.

3. The horizontal needle may also be used to indicate if the aircraft is flying away from or towards the station.

a. If the aircraft is flying towards the station, the horizontal pointer will slowly move towards the center position as the aircraft moves toward the station and the intensity of the station signal increases (Fig. III-2).

b. If the aircraft is flying away from the station, the horizontal needle will slowly move downward as the aircraft moves away from the station and the intensity of the station signal decreases (See Fig. III-2).

(2) Once the aircraft is flying towards the station and is on course, the aircraft must be turned (either right or left) until there is a definite deflection on the vertical needle. Then the aircraft must be turned in the direction the vertical needle indicates until the needle is again centered. The station will now be directly in front of the aircraft.

(a) If the vertical needle deflects to the left, the aircraft must be turned left until the needle is again centered.

(b) If the vertical needle deflects to the right, the aircraft must be turned right until the needle is again centered.

(c) For successful homing and station passage, the pilot should, while homing on the centered needle, make a 10° or 15° turn frequently, (always in the same direction) to identify the signal. While homing to the station, the vertical needle will reflect the necessary turn to return to course, i.e., if the aircraft is turned to the right the vertical needle will indicate a left turn. During this portion of the homing, the horizontal needle will move upward towards the horizontal position as the station signal increases.

(d) When the aviator turns to the right (left) and the vertical indicator indicates a continued right (left) turn, the aircraft has passed the station and the aviator should continue the turn and attempt visual identification of the station or verify his position over the point. After station passage the horizontal needle will slowly start moving downward away from the horizontal position.

c. Common errors.

(1) Failure to establish station identification and to insure that the alarm flags on the Omni Indicator have disappeared. This is caused by the aviator forgetting to turn the mode selector switch to the homing position.

(2) Failure to turn off course in the same direction when homing to station. Opposite indications may be mistaken for station passage.

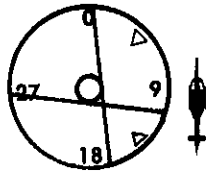
(3) Failure to solve for station ambiguity after tuning station.

(4) Disorientation from reliance on FM homer and failure to maintain map/ground orientation.

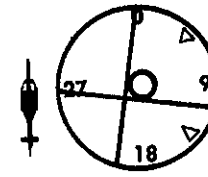
HOMING PROCEDURES

AN/ARC-54

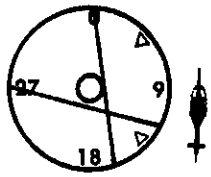
The ARC-54 uses the OMNI indicator to give a visual display for homing. The vertical pointer indicates whether or not you are on course to the station. The horizontal pointer indicates station passage by rising to the center position as the relative strength of the signal increases. Station passage can be determined by either or both pointers.



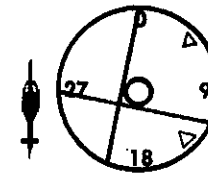
The vertical pointer indicates turn to the right. As I turn, however, the pointer moves further to the right. The horizontal pointer is slowly descending. I am going away from the station and must turn 180° to return.



The vertical pointer indicates turn to the left. As I turn, however, the pointer moves further to the left. The horizontal pointer is slowly descending. I am going away from the station and must turn 180° to return.



The vertical pointer indicates turn to the right. As I turn to the right the pointer moves toward the center. The horizontal pointer is slowly moving up to center position. I am to the left going toward the station.



The vertical pointer indicates turn to the left. As I turn to the left, the pointer moves toward the center. The horizontal pointer is slowly moving to center position. I am to the right going toward the station.

Fig. III-2