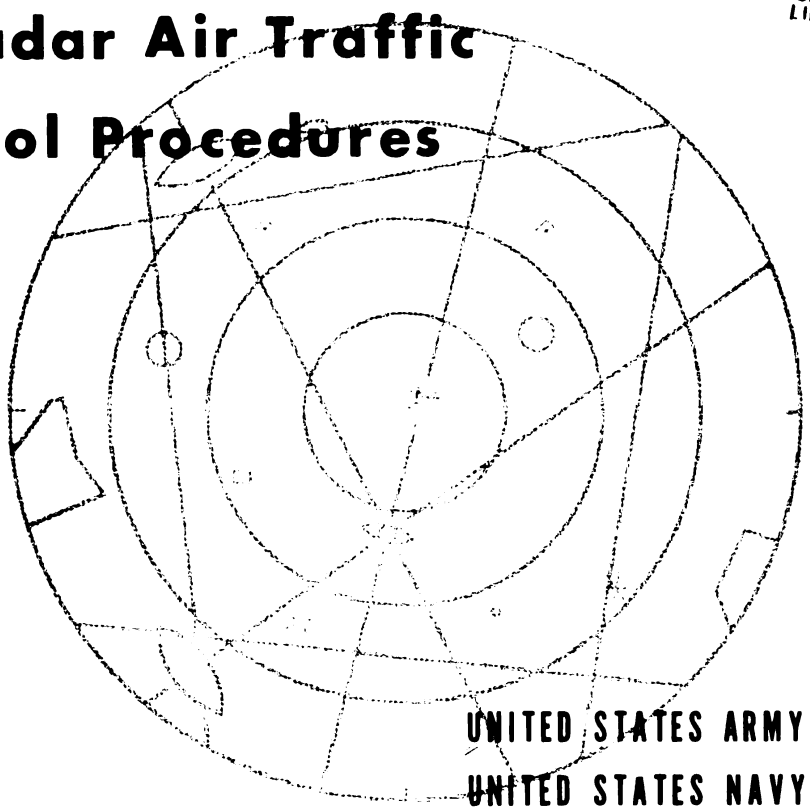
Army.....TM 11-2557-28
Navy.....OPNAV INST. 3722.17A
Air Force.....AFM 55-10
Coast Guard..CG 321

United States Standard Manual of Radar Air Traffic Control Procedures



UNITED STATES ARMY
UNITED STATES NAVY
UNITED STATES AIR FORCE
UNITED STATES COAST GUARD
CIVIL AERONAUTICS ADMINISTRATION

EVISED FIRST EDITION

EFFECTIVE MAY 1, 1958

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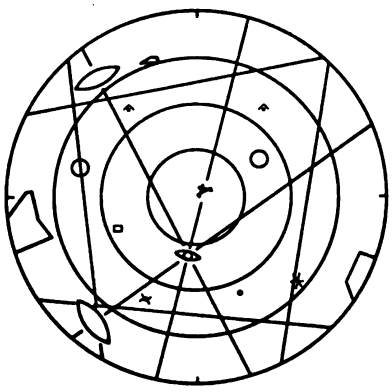

DEPT. OF THE
UNITED STATES ARMY
UNITED STATES NAVY
UNITED STATES AIR FORCE
UNITED STATES COAST GUARD
CIVIL AERONAUTICS ADMINISTRATION

Foreword

*This Manual of Radar Procedures has been officially adopted by the U. S. Army, U. S. Navy, U. S. Air Force, U. S. Coast Guard, and the Civil Aeronautics Administration to standardize the operation of the radar traffic control services.

These procedures are to be observed by air traffic control personnel of the Army, Navy, Air Force, Coast Guard, and Civil Aeronautics Administration. However, instances will arise where air traffic can be controlled more efficiently and safely by deviation from these standards. In such cases, controllers on duty are expected to use their best judgment.

The material in this manual will be incorporated later in the ANC manual titled "Procedures for the Control of Air Traffic." The time factor makes presentation in this form feasible, pending complete revision of the ANC/PCAT manual.

Any recommendations concerning procedures in this manual should be forwarded to one of the following:

Chief of Staff, U. S. Army, Washington 25, D. C.
Chief of Naval Operations, U. S. Navy, Washington 25, D. C.
Chief of Staff, U. S. Air Force, Washington 25, D. C.
Commandant (O), U. S. Coast Guard, 1300 Pennsylvania Avenue, N. W., Washington 25, D. C.
Office of Air Traffic Control, Civil Aeronautics Administration, Washington 25, D. C.

Recommendations received by each agency will be coordinated with the other agencies concerned through joint meetings.

An asterisk (*) has been placed to the left of each new or revised paragraph.

This manual of Air Traffic Control Procedures has been officially approved by the Chief of Staff, U. S. Army; the Chief of Naval Operations; the Chief of Staff, U. S. Air Force; Commandant, U. S. Coast Guard; and the Administrator of Civil Aeronautics as a standard for use by their respective services.

BY ORDER OF THE SECRETARIES OF THE ARMY, NAVY, AIR FORCE, TREASURY AND COMMERCE:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

OFFICIAL:
HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

ARLEIGH BURKE,
Admiral, United States Navy,
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G. L. RUSSELL,
Vice Admiral, United States Navy,
Deputy Chief of Naval Operations
(*Administration*).

THOMAS D. WHITE,
Chief of Staff,
United States Air Force.

OFFICIAL:
J. L. TARR,
Colonel, United States Air Force,
Director of Administrative Services.

A. C. RICHMOND,
Vice Admiral, United States Coast Guard,
Commandant.

OFFICIAL:
F. T. KENNER,
Rear Admiral, United States Coast Guard,
Chief, Office of Operations.

JAMES T. PYLE,
Administrator,
Civil Aeronautics Administration.

OFFICIAL:
D. D. THOMAS,
Director, Office of Air Traffic Control,
Civil Aeronautics Administration.

AIR FORCE DISTRIBUTION:
F; X:
Special distribution to AACS Units.
Commanders may requisition additional copies of this manual for issue to AACS Units.

Table of Contents

United States Standard Manual Of Radar Air Traffic Control Procedures

1 Introduction

1.1 General.

*Standard procedures and phraseologies for all radar traffic control operations are prescribed in this manual. These standards cannot, of course, cover every situation that may arise. In all cases, however, they require that clearances and information be transmitted clearly and concisely.

1.2 Utilization.

Radar equipment may be used to:

(1) Maintain surveillance of en route and terminal air traffic to provide the controllers concerned with supplementary and more complete position information.

(2) Provide radar navigation to, or between, established fixes and to provide radar separation as required.

(3) Vector inbound aircraft to provide separation and radar navigation from established fixes in the terminal area to all runways (includes feeding into ILS/precision radar, etc.).

(4) Vector departing aircraft to provide separation and radar navigation for the purpose of safely expediting aircraft departures from the airport.

(5) Conduct precision or surveillance approaches:

(a) When requested by pilots, traffic permitting;

(b) When suggested by the controller and acceptable to the pilot.

*(6) Provide assistance to pilots of aircraft in distress.

(7) Provide pilots with information on storm and precipitation areas observed on the radar scopes and, insofar as practicable, vector aircraft around such areas as necessary or when requested by the pilot.

(8) Monitor approaches made on standard letdown facilities and advise pilots of deviations from normal approach paths.

1.3 Separation Standards.

*A minimum of three miles separation shall be maintained between aircraft being controlled in accordance with the procedures authorized in this manual and between such radar-controlled aircraft and other traffic being controlled in accordance with the Instrument Flight Rules unless standard nonradar separation is provided. When radar separation is utilized more than 40 miles from the radar site, a minimum of five miles separation shall be maintained. The above separation standards are the minima except as provided in paragraphs 1.3.1 and 1.3.2. Air traffic control is not responsible for deviation from these standards which result from the failure of the pilot to respond to the measures taken to control them.

1.3.1 At the discretion of the controller, a takeoff may be authorized with respect to an arriving aircraft when the arrival is not less than two miles from the end of the runway provided:

(1) The arrival is in radar contact and positively identified; and,

(2) The course of the departing aircraft will not conflict with the missed approach course to be followed by the arriving aircraft, when the possibility of a missed approach exists.

***1.3.2** When it is apparent that speed variations of the aircraft, wind conditions, runway acceptance rate, or other factors require such action, additional separation shall be provided to maintain standard separation as aircraft proceed through the system. The provisions of paragraph 3.2.8 of this manual shall also be observed where applicable.

1.4 Additional Services.

*Subject to the provisions of paragraph 1.4.4 of this manual, the controller will provide aircraft operating on IFR flight plans with traffic information on all observed targets except when the pilot advises he does not wish the service. The traffic information shall be issued in accordance with the following examples:

"(*Ident.*) Westbound traffic ten o'clock, five miles on converging course, altitude unknown," or

"(*Ident.*) Numerous targets vicinity (*name*) Airport, altitude unknown."

***1.4.1** The controller may initiate a call to the pilot to determine if flight conditions no longer require this service or such information may be volunteered by the pilot. Traffic information, as used herein, is defined as any aircraft target observed on the radar scope which, in the judgment of the controller, appears to constitute a hazard to the operation of the aircraft concerned.

***1.4.2 If the pilot—upon receipt of traffic information—requests radar separation, the request shall be complied with subject to the provisions of paragraph 1.4.4 of this manual.

*1.4.3 Aircraft not operating on IFR flight plans may request traffic information. Controllers will supply such information subject to the provisions of paragraph 1.4.4 of this manual.

*1.4.4 It should be noted that many factors (such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion) may prevent the controller from proyiding the additional services described above. The controller possesses complete discretion for determining whether he is able to provide or to continue to provide these additional services in a specific case. His reason against providing or continuing to provide the services in a particular case, is not subject to question and need not be communicated to the aircraft. In other words, the provision of the additional services is entirely dependent upon whether the controller believes he is in a position to provide them.

1.4.5 In those areas where aircraft are being positioned and spaced to establish an approach interval which requires the issuance of precise navigational guidance, it is not considered practicable to attempt to provide the additional services outlined above if, in so doing, the primary function of separating IFR aircraft would be compromised. However, if it becomes known that an aircraft not under radar-control is at an altitude and in the same general area as a radar-controlled aircraft, action shall be taken to separate the aircraft being controlled from the nonradar-controlled traffic. For example, if an unidentified aircraft target is observed on the precision scope at the same altitude of an aircraft on approach, the controller shall immediately take emergency action to provide separation.

1.5 Radar Identification.

Identification of aircraft on radar must be recognized as one of the most important phases of radar air traffic control. Therefore, emphasis shall be placed on:

(1) The importance of establishing positive identification.

(2) The pilot shall be notified and reidentification accomplished immediately or nonradar separation established, whenever positive identification is lost.

***1.5.1** Prior to separation of two or more aircraft, solely by radar, the radar controller must establish and maintain identification of each aircraft in accordance with the procedures prescribed in this manual. Exceptions will be permitted only under the conditions outlined in paragraphs 1.5.4 and 1.4.2.

1.5.2 Aircraft may be considered to be identified when:

(1) A departing aircraft is observed on radar within one mile of the end of the runway.

(2) A direct radio report is received from an aircraft of a position based on VOR/DME/TACAN or over a visual or radio fix which is displayed on the radar scope or radar map coupled with a heading consistent with the observed radar track. However, when more than one aircraft target is observed in such proximity to each other as to cause any doubt as to identification, additional means of identification shall be utilized.

(3) Identifying turn(s) is observed of sufficient magnitude as to identify the aircraft from all other observed targets, provided that the aircraft is known to be within the area covered by radar, and provided further that only one aircraft target is observed to make a similar turn at the same time.

(4) An aircraft target is being observed along a line of position utilizing UHF/VHF/DF coupled with the reported heading consistent with the observed track provided that the aircraft is known to be within the area covered by radar, and provided further that not more than one unidentified aircraft target is observed on the line of position displayed by the UHF/VHF/DF following the reported heading.

*1.5.3 It is emphasized that at least one of the above methods of establishing positive identification is considered to be the absolute minimum, and also that additional identification must be accomplished whenever the controller has any doubt about the aircraft's identity.

1.5.4 In lieu of the provisions of paragraph 1.5.1, a radar controller may apply radar separation between an identified aircraft under his control and any other unidentified aircraft target appearing on the radar scope, provided that:

(1) The controller is assured that his workload and/or the number of targets being observed on the radar scope will permit him to accomplish the required separation, and

(2) Radar separation is maintained from all observed targets until such time as appropriate nonradar separation is established from other IFR flights, and

(3) The area in which such operation is accomplished is not less than three miles or five miles, as appropriate, from the perimeter of the scope, and

(4) The other IFR (but unidentified) traffic is of a type which has consistently given an adequate target return in the areas in which radar separation will be utilized, and

(5) The controller is personally satisfied with the quality and adequacy of the radar performance at the time (specific consideration must be given to the radar coverage limitations as determined by flight check; blind spots; any observed interference to the radar picture such as precipitation, ground clutter, electronic interference; or any other factors which the controller may deem detrimental to proper system performance), and

(6) A controller shall limit application of the procedures contained herein to his assigned airspace, except when an operations letter specifically delineates additional airspace in which such techniques may be applied, and any special local conditions under which they may be applied. Provision shall also be made in the operations letter to preclude simultaneous use of these procedures by more than one controller or facility in the same airspace.

*NOTE: When subparagraph (2) is applicable, the radar controller may not know which of the observed targets are IFR flights and which are VFR flights. Separation from all observed targets must be provided if the controller is to make certain that the necessary separation is maintained between IFR flights. Subparagraph (2) is solely for the purpose of achieving this separation and is not to be construed as placing a responsibility on a radar controller for providing separation between an IFR flight and a VFR flight.

***1.5.5 Transferring Identity and Control From One Radar Controller to Another.** Where the identity of an aircraft target is being transferred from one radar scope to another, the controller who has the aircraft identified shall specify the distance and bearing from a known fix which appears on the radar or radar map, together with the observed track of the target being transferred. The receiving controller may consider identification positive if the target observed on his scope agrees with the above and if no other targets are observed in such vicinity as to cause any doubt as to identity. The receiving controller shall acknowledge. This indicates that the target is identified and that control of the aircraft is accepted, provided the aircraft is cleared immediately to change to the appropriate control frequency (if frequency change is necessary). In case of doubt, additional identification shall be accomplished in accordance with paragraph 1.5.2 or by repetition of the procedures outlined in this paragraph, until no doubt exists. Identification may be transferred by pointing out an identified target to a controller on another scope, when the proximity of scopes permits.

*1.5.5.1 The transfer of control of aircraft from one facility to another shall be accomplished only after conflictions with other known IFR traffic, under the transferring facility's jurisdiction, have been eliminated.

1.5.5.2 The provisions of paragraph 1.5.4 may also be applied in the case of unreported aircraft in place of the 30-minute restriction of instrument operations as specified in paragraph 2.17 of the ANC/PCAT Manual.

1.6 Responsibility.

The operation of the radar units shall be under the supervision of the watch supervisor in charge of the tour of duty. He shall be responsible for assuring that the personnel assigned to the radar positions are fully competent.

1.6.1 The watch supervisor may designate one of the controllers assigned to a radar position to be directly responsible for radar operations during a tour of duty. The controller so designated shall be responsible for determining that the radar units are operating satisfactorily for the service to be provided and that radar operations are conducted in accordance with current operating procedures.

1.7 Inauguration of Radar Air Traffic Control.

A NOTAM shall be issued for each location, at least 30 days prior to implementing radar air traffic control procedures, containing the following items:

(1) Nature of service (departure and/or arrival).
(2) Effective date.
(3) Normal clearance limits.

2 Radar Monitoring Operation

2.1 General.

The radar controller shall keep the appropriate controllers advised of the position of all aircraft under their jurisdiction when IFR conditions prevail, or as requested during VFR conditions. In addition, position information shall be furnished on any other observed traffic which, in the judgment of the radar controller, will have an effect on the control being exercised.

2.2 Utilization of Information Obtained by Radar Monitoring.

*Apparent deviations from standard or normal flight paths or other flight information observed on the radar scope should be transmitted to the pilot to be used at his discretion. Examples:

"Air Force 1234 (*distance and direction*) of (*name*) fan marker."
"United 98, five miles left of course."

2.3 Radar Monitoring of Instrument Approaches.

*Instrument approaches on the ILS or other letdown facilities which are made within the coverage of the precision radar equipment shall be observed whenever the reported weather is below the basic VFR minimums.

***2.3.1** Radar advisories shall be provided to aircraft making instrument approaches whenever the ceiling and/or visibility is reported below the highest circling minimum for the airport concerned, provided that the approach can be observed by utilizing PAR equipment.

2.3.2 Prior to starting final approach, the pilot shall be advised of the frequency on which the advisories will be transmitted. This will normally be the ILS localizer voice channel. If radar advisories cannot be furnished for any reason, pilots shall be so advised. Examples:

"Radar advisories on localizer voice," or
"Radar advisories on (*frequency*)," or
"Radar advisories not available."

2.3.3 Radar advisories, when required (by paragraph 2.3.1), will be confined to the following (except for the provisions of paragraph 2.3.4).

(1) The pilot shall be advised when the aircraft is observed to pass the outer marker on final approach when on an ILS approach. Flights not making an ILS approach shall be advised when passing the range station, "H" facility, fan marker, or omni, as appropriate.

This advisory shall be transmitted regardless of safety zones and will consist of position information relative to the outer marker (or other aid). Example:

"(*Ident.*) Passing outer marker—500 feet right of course—200 feet above glide path," or "Passing range station on course—Altitude O.K."

(2) The following safety zones will be

established based on the ILS localizer course and glide path and will be indicated on the PAR scope:

Range	Azimuth	Elevation
Miles	*Ft. right or left*	*Ft. above or below*
6	1200	300
5	1000	250
4	800	200
3	600	150
2	400	100
1	200	50
½	100	50

Advisories will be transmitted to pilots of aircraft (which have passed the outer marker or other appropriate fix on final approach) observed continuing outside the safety zone. The advisory shall include only the observed distance above or below the glide path and/or the distance right or left of the localizer course. The advisory will be repeated only after the flight has had an ample opportunity to make correction, and then only if no correction or inadequate correction is observed.

(3) Pilots will be advised when passing major obstructions (tall buildings, stacks, towers, power lines, etc.) regardless of whether the aircraft is inside or outside the safety zone. (The determination of what constitutes a major obstruction shall be made locally after coordination with appropriate representatives of CAA offices, commanding officers, pilots, and operators.)

2.3.4 An advisory shall be transmitted immediately on the normal radar advisory frequency and on the control frequency whenever radar observation reveals a situation or an emergency which, in the opinion of the controller, could affect the safety of the flight.

2.3.5 Where an emergency is created because of continued flight outside the safety zone limit, the following phraseology shall be utilized to advise the pilot of this information:

"(*Ident.*) ( ) feet (*right or left*) of course and/or ( ) feet below glide path—If not contact advise you climb to (*altitude*)—Turn right/left heading ( )."

2.3.6 Advisories shall be terminated when the pilot reports contact or that he has the runway in sight.

***2.3.7** When approaches are being monitored by radar, the controller must constantly bear in mind that the radar serves only as a secondary aid and that the pilot has selected the ILS or other aid as the primary aid for the approach. Therefore, it is most important that good judgment be exercised by the radar controller in issuing advisory information to avoid superfluous transmissions which distract pilots from the proper conduct of the approach.

3 Radar Air Traffic Control

3.1 General.

Procedures may be established to utilize radar in controlling the flight paths of aircraft for the purpose of expediting the flow of traffic. In establishing a radar traffic control system at a location, the following principles shall be applied:

(1) The extent of the area wherein such a system should regularly utilize radar separation should be limited to that portion of the area wherein definite operational advantage will be gained. It should be kept in mind that the use of radar separation increases communications and controller workload. Additional concentration is also entailed in identifying aircraft, providing navigational guidance, etc. Because of this, standard nonradar separation should be maintained, to the point where it becomes necessary for transition to radar separation, in order to properly position and space aircraft to achieve an orderly and efficient traffic flow. Normally, this positioning and spacing will be accomplished between the outer fixes and the turn-on to final approach.

(2) To eliminate the effect that the rate-of-descent factor has on the approach interval, a minimum of two outer fixes is normally required to permit simultaneous holding of aircraft as follows:

(a) They must be sufficiently separated laterally to permit simultaneous holding at the same altitude when required.

(b) The outer fixes should be located within the area of radar coverage. The normal flight paths of aircraft en route from the outer fixes to the approach gate should be suf-

ficient to permit the aircraft to effect normal descent from the altitude over the outer fix to the final approach interception altitude.

(c) They should be so located as to most efficiently serve aircraft proceeding to the outer fixes as well as aircraft proceeding from the outer fixes to the approach gate.

(3) The number of aircraft which will be separated solely by radar should be kept to a minimum. By so doing, the controller workload is reduced and, in the event of a radar failure, the number of aircraft requiring emergency action will be such as to permit the radar controller to provide the aircraft with nonradar separation expeditiously.

(4) Insofar as practicable, routings directed by radar should overlie the navigational tracks established by conventional radio aids. This will provide a backup for the radar in the event of radar failure and reduce the amount of "radar navigation" required.

(5) Insofar as practicable, aircraft operating on IFR flight plans shall be handled in accordance with the established procedures as a standard practice so that pilots will become accustomed to the type of handling to be expected during IFR conditions and to maintain the proficiency of controller personnel.

*3.1.1 Standard nonradar separation shall be provided to any aircraft whenever requested by the pilot. Such requests should be made prior to the time transition to solely radar separation is accomplished. Notification of the pilot's desire for nonradar separation on departure should be made at the time the flight plan is filed, if possible. Arrival or departure clearance shall not be withheld because of a pilot's desire to not accept radar separation, provided the request was made prior to the time radar separation is being utilized.

3.1.2 Unless the provisions of paragraph 1.5.4 are applied, radar controlled aircraft shall be separated from the boundary of nonradar controlled airspace by a minimum of three miles or five miles, as appropriate. However, radar controlled aircraft, while in climb or descent, shall be considered to have adequate lateral separation from nonradar controlled airspace so long as the radar controlled aircraft is definitely outside such airspace. Radar controlled aircraft shall be provided a minimum lateral distance of one and one-half miles (two and one-half miles when more than forty miles from the radar site) from the boundary of adjoining radar controlled airspace.

3.2 Control Procedures.

3.2.1 Arriving Aircraft. Except when radar hand-offs are employed, the center shall clear arriving aircraft:

(1) To an outer fix appropriate to the route being flown; or

(2) If holding is anticipated, to hold at such outer fix until advised by approach control and furnish an expected approach clearance time. In the first instance, the aircraft shall normally be cleared to change to approach control frequency prior to reaching the fix for further clearance by approach control. The center shall not release arriving aircraft to approach control until possible conflict with other known IFR traffic has been eliminated. Approach control shall assume control of the aircraft at the outer fix, or earlier if specified by the center.

3.2.2 When the volume of arriving traffic is such that aircraft are being held at the outer fixes, coordination shall be effected between the center and approach control to insure that a sufficient number of aircraft will be released to approach control at or before each of the outer fixes being used. This is to permit their proper positioning and spacing by approach control prior to leaving the outer fixes en route to the final approach gate.

3.2.3 The number of aircraft which can be handled by approach control will vary, depending upon the weather, volume of traffic, the location of the outer fixes being used, and their distance from the final approach gate. Normally, there will be little or no advantage in the center's releasing more aircraft to approach control than can be conveniently handled without undue extension of the radar pattern or overloading communications channels.

3.2.4 Approach control will vector aircraft from outer fixes to the gate for interception of the final approach path over the most direct route consistent with other traffic, taking advantage of the radar in vectoring aircraft along such short-cut routes as have been authorized.

3.2.5 When aircraft at higher levels arrive at an outer fix in advance of aircraft at lower

levels, the approach sequence may be altered to allow a continuous flow of traffic and expected approach clearance times will be amended as required.

3.2.6 The approach gate will normally be located from five to six miles from the approach end of the runway to be used. However, to provide the flexibility required for air traffic control purposes, the controller may deviate from the pattern courses as required to provide separation between aircraft and to make allowance for wind conditions, speed of aircraft, direction of approach or other reasons which may require deviation therefrom, provided that the minimum obstruction clearances are strictly adhered to. (See paragraph 6.0242 of the United States Manual of Criteria for Standard Instrument Approach Procedures.)

***3.2.7** Altitude separation will not be required between successive aircraft departures from the same outer fix, provided that the aircraft are identified and radar separation is maintained. Aircraft may be descended to the minimum instrument altitude, provided that no known traffic confliction will result from such action.

3.2.8 When aircraft are being vectored on converging courses and their relative positions and speeds could result in less than standard radar separation in the event of loss of radio communications or radar contact, a minimum of 500 feet vertical separation should be provided as a safety factor until such time as the potential traffic confliction no longer exists. This eliminates the necessity for the issuance of detailed alternate instructions which otherwise would be required.

3.2.9 When radar is used to position aircraft on final approach to the ILS, or other final approach fix, the flight will be so vectored that it is established on the final approach course prior to reaching the approach fix.

3.2.10 The outer fixes will be used to feed the final approach path. Aircraft leaving these outer fixes under radar control will be considered on initial approach. Radar vectors and altitude levels assigned between the outer fixes and final approach will be issued as required for spacing and separating aircraft. Example:

"(*Ident.*) Depart (*fix*), heading ( ) maintain (*altitude*) for a radar vector to the (*ILS*, *ADF*, *VOR*, *etc.*) final approach course."

The altitude restriction shall be omitted when not required.

3.2.11 Aircraft shall be cleared for approach at the time the final heading for interception of the final approach course is issued, or after the aircraft is established on final approach course prior to passing the approach fix. Examples:

*"(*Ident.*) Cleared for (*ILS*, *VOR*, *ADF*, *etc.*) approach, turn (*left/right*) heading ( ) to intercept final approach course take over, complete approach," or

*"(*Ident.*) Cleared for (*ILS*, *VOR*, *ADF*, *etc.*) approach, take over, complete approach."

*3.3 Final Approach Fix Requirement.

Pilots shall be advised to change to the final approach frequency prior to the time the aircraft reaches the final approach fix or final approach.

3.4 Departing Aircraft.

*Standard departure routings and procedures shall be established, insofar as practicable, to reduce need for coordination between the tower and the center and between tower/center operating positions. Wherever practicable, channelized altitudes should be employed so that departing aircraft can be assigned altitudes which will not conflict with those in use by the center or by approach control.

***3.4.1** Aircraft shall normally be cleared out of the terminal area utilizing radio navigation facilities. Where this is not feasible, navigational guidance may be provided within controlled airspace by means of radar from the airport until established "on course" on the appropriate navigational facility.

3.4.2 When the departure is to be vectored by the controller in accordance with the foregoing, the departure clearance shall contain the initial heading to be flown so that the pilot will proceed in the desired direction after takeoff while radar contact is being established. Following takeoff, the pilot shall be advised to "Contact Departure Control (*frequency*)." This should normally be accomplished after the aircraft has passed the airport boundary.

***3.4.3** After an aircraft is airborne, if standard nonradar separation is not provided, the radar departure controller shall maintain radar separation between it and other known IFR traffic.

*3.4.4 Standard radar separation shall be maintained between departures being controlled by radar until standard nonradar separation can be effected. Transition from radar separation to standard nonradar separation will be accomplished in all cases as soon as practicable within the surveillance limits of the radar being utilized.

3.4.5 A departing aircraft which has been identified on radar may be cleared through the altitude of a preceding departure which has been tracked to the surveillance limit of the radar being utilized, provided the succeeding aircraft under radar control is not permitted closer than three or five miles, as appropriate, to the perimeter of the radar scope until standard nonradar separation has been established.

3.4.6 Standard radar separation may be utilized to expedite departing aircraft climbing to "on-top" within the limits of the radar coverage and where prior coordination has been effected with the center.

3.4.7 Short Range Clearance Procedures.

Whenever these procedures are utilized, the center's initial clearance will be to an appropriate fix for the route to be flown. This fix should be located so as to allow sufficient time for the aircraft, which are separated initially by radar, to obtain standard nonradar separation and thereafter to allow for the release of the aircraft to the center so that the pilot can obtain the center's long-range en route clearance prior to crossing the fix.

3.4.7.1 The tower will coordinate with the center and obtain clearance for the departing aircraft. When the routing (or any portion thereof) beyond the clearance limit differs from that filed in the original flight plan, the proposed routing beyond the clearance limit shall be included in the clearance for relay to the pilot prior to takeoff. Examples:

"American 60, expect further clearance via R–17 and A–7," or

"TWA 16, expect further clearance via Lock Raven-Lancaster-Philadelphia."

*3.4.7.2 Whenever an aircraft is cleared to a clearance limit other than the destination airport, the altitude of the aircraft at such clearance limit must be protected from other known aircraft. This is necessary even though holding instructions have not been issued, because the aircraft is expected to hold in a standard holding pattern on the course on which it approaches the fix if further clearance is not received by the time it reaches the fix.

*3.4.7.3 The center shall assume control of a departing aircraft at the fix to which it has been cleared, or earlier if specified by the tower. The center's long-range en route clearance shall be transmitted to the pilot prior to the time the aircraft reaches the clearance limit. This shall be accomplished by the center, except that if the tower cannot release the aircraft to the center prior to arrival at the clearance limit, the tower shall obtain and relay such clearance to the pilot.

3.4.8 Long-Range Clearance Procedures. Whenever practicable, the center's clearance shall be from point of departure to the airport of first intended landing.

3.4.8.1 The tower will coordinate with the center and obtain the long-range clearance for the departing aircraft.

*NOTE: Whenever the control of an aircraft passes from a radar to a nonradar facility, and the aircraft cannot attain cruising altitude within the limits of radar coverage, successive aircraft will be afforded standard nonradar separation prior to being transferred to the jurisdiction of a nonradar facility.

3.4.8.2 The control of a departing aircraft will be transferred from the tower to the center as the aircraft approaches the boundary between each facility's area of jurisdiction or as determined by coordination between the facilities concerned.

3.5 Missed Approach Procedures.

Standard nonradar separation shall be provided between:

(1) Successive missed approaches;

(2) Departures and aircraft executing missed approaches;

(3) Aircraft executing missed approaches and other arriving aircraft.

*3.5.1 Alternate missed approach procedures which will provide adequate lateral separation between successive missed approaches shall be established. Where such procedures are not feasible, alternate missed approach procedures which will provide adequate vertical separation shall be established. Unless otherwise advised, arriving aircraft are expected to follow the standard missed approach procedure and control of all aircraft shall be predicated on this basis. If an aircraft misses an approach, the succeeding aircraft shall be assigned an alternate missed approach procedure.

3.5.2 When aircraft executing missed approaches are reidentified and under radar control, standard radar separation may be utilized in lieu of standard nonradar separation.

3.6 Emergencies.

3.6.1 Loss of Communications. If two-way communication is lost after leaving the outer fix under radar control, the pilot of an arriving aircraft will proceed direct to the ILS outer marker/compass locator, or to an approach facility serving the airport, and execute an instrument approach. The required separation between such aircraft and other aircraft in the area will be provided on the basis that the aircraft which has experienced the radio failure will effect a landing as soon as possible and radar will be used to control other aircraft accordingly. If the instrument approach cannot be successfully completed for any reason (such as weather), the pilot will be expected to comply with any instructions issued previous to radio failure or execute a missed approach. Standard radio failure procedure shall apply in any case of two-way radio communications failure other than those outlined in this paragraph.

3.6.2 Radar Equipment Failure. In the event of radar equipment failure, immediate action shall be taken to provide standard nonradar separation between aircraft. Thereafter, nonradar control procedures shall be utilized.

***3.6.3 Emergency Radar Flight Patterns.** Radar facilities shall be on the alert for emergency radar flight patterns and shall give whatever assistance they can, on a first priority basis, to any aircraft so found in an emergency. A noncenter radar facility which observes an emergency pattern shall immediately advise the appropriate center. The center shall be responsible for coordinating the emergency and action taken with other facilities and agencies, as appropriate, and shall initiate search and rescue service. The emergency radar flight patterns and procedures are described in the USAF/NAVY RF Charts and CAA Flight Information Manual.

4 Radar Approaches

4.1 General.

***Radar approaches shall be conducted in accordance with the applicable provisions of this manual and the established radar instrument approach procedure. Prior to the start of any radar approach, the controller shall transmit to the pilot the current altimeter setting. Current weather shall be furnished to pilots whenever the reported ceiling and/or visibility is at or below the highest circling minimum for the airport concerned. A radar approach may be given to any pilot upon request, regardless of weather conditions, and may be offered to pilots of aircraft in distress, or to expedite traffic. Acceptance of a radar approach by a pilot does not waive the prescribed weather minimums for the airport or for the particular aircraft operator concerned. The pilot is responsible for determining whether the approach and landing are authorized under the existing weather minimums.

4.2 Types of Radar Approaches.

Any approach involving the use of precision radar equipment shall be known as a Precision Approach. An approach conducted entirely with reference to the surveillance radar scope shall be known as a Surveillance Approach.

4.2.1 If radar contact is lost during a radar approach, an alternate clearance shall be issued to aircraft as follows:

(1) If the aircraft has not started final approach, the pilot shall be advised to proceed to an appropriate letdown facility for an instrument approach. Standard nonradar separation shall be provided from other IFR traffic.

(2) If the aircraft has started final approach, an alternate clearance requiring immediate climb or a missed approach procedure shall be given the pilot unless the final approach can be continued by other means.

4.3 Surveillance Approaches.

A surveillance approach is one made on the basis of information relayed to the pilot by a radar controller interpreting the azimuth and range indications displayed on a surveillance radar indicator only. Since the azimuth presentation is not expanded in angle, its accuracy

is not comparable to that obtainable on a precision scope. Range information, however, is accurate. No altitude information is available and descent is made by use of the aircraft altimeter to establish an altitude above the terrain, as specified by the controller for each mile from the end of the runway.

4.3.1 Normally, a three-degree glide path is established for each runway. This means that the following heights above the airport elevation will be required for the distances from the end of the runway as indicated:

6 miles—1,800 feet
5 miles—1,500 feet
4 miles—1,200 feet
3 miles—900 feet
2 miles—600 feet
1 mile—300 feet

NOTE: The above elevations are tabulated in round figures rather than exact numbers.

4.3.2 Pilots shall be given the following:

(1) Prior to starting final approach:

"(*Ident.*) This will be a surveillance approach for runway ( ). Recommended mean sea level altitudes will be furnished each mile on final, control descent accordingly."

(2) Prior to start of final descent:

"(*Ident.*) Prepare to begin descent in ( ) seconds."

4.3.3 After a pilot has reached the point on final approach where descent will be commenced, descent information will be issued in the following manner:

"(*Ident.*) ( ) miles from runway, begin descent."

4.3.4 After descent has begun on final, the controller will advise the pilot of the distance from the end of the runway on each mile on final approach in the following manner:

"(*Ident.*) ( ) miles from runway, altitude should be ( ) feet."

4.3.5 Whenever a surveillance approach is being conducted during instrument weather conditions, the pilot should be requested to: "Report Runway In Sight," except in an emergency. Upon receipt of this report, surveillance approach information may be discontinued and the pilot issued a landing clearance or other appropriate clearance. (Except in an emergency, surveillance approach guidance will be discontinued at one mile from the end of the runway.)

"(*Ident.*) One mile from runway, if runway not in sight at landing minimum discontinue approach—Climb to (*altitude*)—Turn right/left heading ( )."

NOTE: When practice surveillance approaches are being conducted during VFR weather conditions, the above is not applicable since the pilot may have the runway in sight several miles from the airport. Therefore, practice approaches should normally be discontinued when the aircraft is one mile from the end of the runway.

4.4 Precision Approaches.

A precision approach is one in which the controller, by reference to the precision scopes, issues navigational guidance and altitude information to pilots to enable them to effect landings. If an aircraft exceeds the lower and/or lateral limits of the prescribed safety zone to a point where—in the judgment of the controller—safety of flight may become affected, the pilot shall be issued a specific clearance to climb to a specified altitude and alter course, if appropriate.

4.5 Phraseologies.

All phraseologies shall be in accordance with standard phraseology contained in the ANC Manual, Procedures for the Control of Air Traffic, unless exceptions for radar operations are authorized herein. The following phraseologies are to be used as appropriate and not necessarily in the order listed:

(1) In Sight Report. As soon as the aircraft is definitely located and identified, the pilot shall be advised, as follows:

"(*Ident.*) Radar contact (*position*)."

(2) Radio Failure. An alternate procedure must be given to the aircraft by the surveillance controller when radio communication is established to provide for loss of communication in the pattern:

"If no transmissions are received for a period of (*time*) (*alternate procedures*[1]).

[1] Procedures to be worked out locally.

(3) Read Back Information. To require the pilot to read back information given as a position check:

"(*Ident.*) Read back (altitude, heading, *etc.*)."

(4) Aircraft Transmitter Failure. In the event that no reply is received from an aircraft but the radar controller has reason to believe that the aircraft is receiving, the following transmissions shall be used:

"(*Ident.*) Reply not received—If you read turn left/right heading ( )."

(This is a turn for acknowledgment).

"(*Ident.*) Turn observed—Will continue radar direction."

(5) Landing Information. Landing information shall be given as follows:

"Runway (*number*) Wind (*value*) (*current weather as required*) Altimeter setting (*value*) (*field and runway conditions*)."

(6) Headings. Headings shall be given in groups of three digits such as:

"Heading Zero Zero Five" for 5°

"Heading Zero Three Zero" for 30°

"Heading Three Five Zero" for 350°

The word "Heading" will always precede these values; however, the word "degrees" will not be used. Heading Three Six Zero will be used instead of zero to indicate a north heading.

(7) Turn Information. Headings given shall be prefaced by the word "Turn" and the direction in which the turn should be made to the desired heading, if required, as follows:

"(*Ident.*) Turn left/right heading ( )."

(8) Avoiding Action. To inform a pilot that an immediate turn is necessary to avoid collision with an obstruction or other aircraft.

"(*Ident.*) Turn left/right immediately—Heading ( ) (*reason*)—Acknowledge."

(9) Radio Failure on Final Approach. Clearances providing for radio failure on final approach normally shall be issued prior to start of final descent as follows:

Precision Approach:

"(*Ident.*) If no transmissions are received for a period of five seconds on final (*missed approach procedure*)."

Surveillance Approach:

"(*Ident.*) If no transmissions are received for a period of thirty seconds on final (missed approach procedures)."

(10) Cockpit Check. While on downwind leg the pilot should be advised to perform cockpit check, allowing sufficient time for completion prior to turning onto base leg. When an incomplete pattern is used the pilot should be advised to perform cockpit check well in advance of being taken over by the final controller.

"(*Ident.*) Perform landing cockpit check."

(11) Position Reports. Each aircraft making a radar approach shall be advised of its position at least once prior to the start of the final approach, as follows:

"(*Ident.*) (*distance*) (*direction*) of airport."

Position reports over known fixes may be used whenever applicable, such as:

"(*Ident.*) Over (*name of range station, marker or landmark*)."

(12) Airspeeds. To request approach airspeeds of aircraft if desired by radar controllers:

"(*Ident.*) What will be your airspeed?"

For reduction to approach speed:

"(*Ident.*) Reduce to approach speed."

(13) Initial Contact by Final Controllers. To check communications:

"(*Ident.*) This is Washington radar final controller—Do you read?"

(14) No Replies Desired. To advise pilot not to reply to transmissions while on final approach:

"(*Ident.*) On final—Do not acknowledge further transmissions."

(15) Correct Course. When the aircraft is on course, advise the pilot as follows:

"(*Ident.*) On course."

449136 O - 58 - 2

(16) Approach to Glide Path. To inform pilot of his position relative to glide path while still in level flight:

"(*Ident.*) Approaching glide path."

(17) Initial Descent. Initial descent clearance shall be given as follows:

"(*Ident.*) Begin descent" or "Begin Descent ( ) feet per minute."

(18) Correct Glide Path. When the glide path is good, the pilot should be advised as follows:

"(*Ident.*) On glide path."

(19) Glide Path Deviations. Deviations from the glide path shall be indicated to the pilot as follows:

"(*Ident.*) (*distance in feet*) above/below glide path—Adjust rate of descent."

(20) Range. Range information shall be given as follows, at least once per mile on final approach:

"(*Ident.*) Miles from runway," or

"(*Ident.*) Miles from touchdown." (For precision approaches only.)

In addition, the pilot should be advised when over the approach lights and the end of the runway as follows:

"(*Ident.*) Over approach lights."

"(*Ident.*) Over end of runway."

(21) Tower Clearance. On final approach the pilot shall be advised of tower clearance to continue descent for landing or low approach over the field:

"(*Ident.*) Cleared to land" or "Cleared for low approach/touch and go landing."

If the tower clearance is not received or is cancelled, the following shall be used:

"(*Ident.*) Climb to (*new clearance*)."

(22) Final Position. When the aircraft is over the end of the runway, if off to one side, the pilot shall be advised as follows:

"(*Ident.*) Over end of runway (*distance in feet*) right/left of centerline. Take over visually."

(23) Discontinuing Approach. In the event an aircraft goes beyond the safe limits set for successful completion of a radar approach at any time, the following phraseology shall be used:

"(*Ident.*) Climb immediately to (*altitude*)—Turn right/left heading ( )." (*Give reason and further clearance if necessary.*)—"Acknowledge."

(Altitude and heading dependent on local conditions.)

(24) Change of Frequency. The following shall be used to advise the pilot to change frequency:

"(*Ident.*) Contact (*blank*) radar (*frequency*)," or "Contact (*blank*) radar on localizer voice, transmit (*frequency*)," or "Contact (*blank*) (*facility*) on (*frequency*)."

(The flight identification as listed in the above phraseologies may be omitted when there is no probability of misunderstanding.)

5 Information on Precipitation and Storm Areas

5.1 General

All electronic and radio aids, including radar, are sometimes affected by atmospheric conditions which reduce their effectiveness and restrict their use. Upon occasions, the amount of interference created on the radar scopes by precipitation is such that aircraft targets cannot be tracked through the resulting clutter. As in the case of "blind spots," the radar controller should recognize this equipment limitation and plan his control accordingly by vectoring aircraft around such areas or, where this is not possible, by providing other means of separation during the period that radar separation cannot be maintained.

5.1.1 Because precipitation interference sometimes is discernible on the radar scopes, the radar controller can locate storm areas such as thunderstorms, rain showers, snow squalls, etc., which may involve turbulence and reduced visibility conditions and thereby assist pilots by guiding them around such areas. Insofar as practicable, this service shall be provided when considered advisable by the controller (unless unacceptable to the pilot), or when requested by pilots.

6 VHF/UHF/DF Equipment

6.1 General.

VHF/UHF/DF equipment will be installed in all locations equipped with airport surveillance radar to assist the radar controller in:

(1) Locating and identifying aircraft.

(2) Obtaining an accurate bearing for the purpose of:

(a) Vectoring aircraft to an airport by the most direct route (when required).

(b) Locating lost aircraft or aircraft in distress who are within communications range but outside of the area of radar coverage. This information will furnish the controller with the proper heading required to bring aircraft within the antenna pattern of the surveillance radar equipment.

(c) Obtaining and coordinating cross bearings to establish a fix in localities where the VHF/UHF communications range of two or more VHF/UHF/DF installations overlap. Such use will materially assist in locating lost aircraft.

6.1.1 Bearing information is provided from the VHF/UHF/DF antenna site each time the aircraft transmits on the frequency to which the equipment is tuned. This information can be presented directly on the surveillance scope by strobe line indication and also appears on the VHF/UHF/DF mechanical azimuth indicator.

6.2 Location of Antenna Site.

Whenever possible, the VHF/UHF/DF antenna site is located on the airport. If a suitable site is not available on the airport proper, a site not more than two miles from the airport is used. When the antenna is remoted, however, the bearing information obtained therefrom is in relation to the antenna site rather than the airport. This fact must be recognized by the controller when VHF/UHF/DF bearings are used, particularly in connection with surveillance approaches.

6.2.1 At locations where the VHF/UHF/DF antenna is located at a different site than the surveillance radar antenna, the surveillance compass rose will not furnish an accurate VHF/UHF/DF bearing because the surveillance compass rose is centered on the surveillance antenna site (main bang) rather than on the VHF/UHF/DF antenna site. When assigning a heading to aircraft which have been identified through use of the VHF/UHF/DF equipment under such circumstances, the controller must make the proper allowances as required by the relative location of the two antenna sites.

6.3 Limitations of VHF/UHF/DF Equipment.

As in the case of any electronic equipment, the VHF/UHF/DF unit has certain limitations. To obtain maximum benefits from its use, therefore, the controller must understand these limitations and plan his control accordingly.

6.3.1 This equipment is designed to furnish bearing information from any transmitting station within communications range on the frequency selected. Therefore, any signal within range will affect the VHF/UHF/DF and when two or more aircraft are transmitting simultaneously, an inaccurate bearing indication will result.

6.3.2 Specifications for the equipment require a bearing accuracy of plus or minus four degrees on the azimuth indicator, which may be increased depending on the site selected, terrain, or other considerations. A small additional error is introduced when the strobe line indication is placed on the surveillance scope. Because of this, the possibility of improper identification exists when two or more aircraft appear within the same relative azimuth. It should be recognized that while VHF/UHF/DF equipment can be invaluable in assisting to identify aircraft by eliminating in many cases the need for identifying turns or the use of other time-consuming procedures, it cannot be considered a positive means of identification under all conditions. Recognition of the limitations of the equipment, therefore, is imperative.

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