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MATS

CHAPTER 16

SURVEILLANCE SERVICES

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CHAPTER 16

SURVEILLANCE SERVICES

16.1 RADADR SYSTEMS CAPABILITIES

16.1.1 ATS surveillance systems used in the provision of air traffic services shall have a very high level of reliability, availability and integrity. The possibility of system failures or significant system degradations which may cause complete or partial interruptions of service shall be very remote. Backup facilities shall be provided.

Note 1. An ATS surveillance system will normally consist of a number of integrated elements, including sensor(s), data transmission links, data-processing systems and situation displays.

Note 2. Guidance material pertaining to use of radar and to system performance is contained in the Manual on Testing of Radio Navigation Aids (Doc 8071), the Manual on the Secondary Surveillance Radar (SSR) Systems (Doc 9684) and the Air Traffic Services Planning Manual (Doc 9426).

Note 3. Guidance material pertaining to use of ADS-B and to system performance is contained in the Assessment of ADS-B to Support Air Traffic Services and Guidelines for Implementation (Circular 311).

16.1.2 ATS surveillance systems should have the capability to receive, process and display, in an integrated manner, data from all the connected sources.

16.1.3 ATS surveillance systems should be capable of integration with other automated systems used in the provision of ATS, and should provide for an appropriate level of automation with the objectives of improving the accuracy and timeliness of data displayed to the controller and reducing controller workload and the need for verbal coordination between adjacent control positions and ATC units.

16.1.4 ATS surveillance systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning, conflict prediction and unintentionally duplicated SSR codes and aircraft identification.

16.1.5 ATS surveillance systems, such as primary surveillance radar (PSR), secondary surveillance radar (SSR) and automatic dependent surveillance - broadcast (ADS-B) may be used either alone or in combination in the provision of air traffic services, including in the provision of separation between aircraft, provided:

a. reliable coverage exists in the area;
b. the probability of detection, the accuracy and the integrity of the ATS surveillance system(s) are satisfactory; and
c. in the case of ADS-B, the availability of data from participating aircraft is adequate.

16.1.6 PSR systems should be used in circumstances where SSR and/or ADS-B alone would not meet the air traffic services requirements.

16.1.7 SSR systems, especially those utilizing monopulse technique or having Mode S capability, may be used alone, including in the provision of separation between aircraft, provided:

a. the carriage of SSR transponders is mandatory within the area; and
b. identification is established and maintained.

Note. Monopulse technique is a radar technique in which azimuth information of an SSR transponder aircraft is derivable from each pulse detection by comparison of signals received simultaneously in two or more antenna beams. Monopulse SSR sensors provide for an improved azimuth resolution, fewer false reports from unsynchronized interrogator transmissions (fruit) and less garbling compared to conventional SSR sensors.

16.1.8 ADS-B shall only be used for the provision of air traffic control service provided the quality of the information contained in the ADS-B message exceeds the values specified by the appropriate ATS authority.

Note. An assessment of th e use of ADS-B for the application of 9.3 km (5.0 NM) separation minimum has been performed based on a comparison of the technical characteristics of ADS-B and a single monopulse SSR. This comparison, including performance values, is contained in the Assessment of ADS-B to Support Air Traffic Services and Guidelines for Implementation (Cir 311).

16.1.9 ADS-B may be used alone, including in the provision of separation between aircraft, provided:

a. identification of ADS-B-equipped aircraft is established and maintained;
b. the data integrity measure in the ADS-B message is adequate to support the separation minimum;
c. there is no requirement for detection of aircraft not transmitting ADS-B; and
d. there is no requirement for determination of aircraft position independent of the position-determining elements of the aircraft navigation system.

16.1.10 The provision of ATS surveillance services shall be limited to specified areas of coverage and shall be subject to such other limitations as have been specified by the appropriate ATS authority. Adequate information on the operating methods used shall be published in aeronautical information publications, as well as operating practices and/or equipment limitations having direct effects on the operation of the air traffic services.

Note. States will provide information on the area or areas where PSR, SSR and ADS-B are in use as well as ATS surveillance services and procedures in accordance with Annex 15, 4.1.1 and Appendix 1.

16.1.11 Where PSR and SSR are required to be used in combination, SSR alone may be used in the event of PSR failure to provide separation between identified transponder-equipped aircraft, provided the accuracy of the SSR position indications has been verified by monitor equipment or other means.

16.2 PRESENTATION OF SURVEILLANCE INFORMATION

16.2.1 Surveillance information available for display to the controller shall, as a minimum, include position indications, map information required to provide ATS surveillance services and, when available, information concerning the identity of the aircraft and the aircraft level.

16.2.2 Position indications may be displayed as:

a. individual position symbols, e.g. PSR, SSR and ADS-B symbols, or combined symbols;
b. PSR blips;
c. SSR responses.

16.2.3 Reserved SSR codes, including 7500, 7600 and 7700, operation of IDENT, ADS-B emergency and/or urgency modes, safety-related alerts and warnings as well as information related to automated coordination shall be presented in a clear and distinct manner, providing for ease of recognition.

16.2.4 Labels associated with displayed targets, should be used to provide, in alphanumeric form, relative information derived from the means of surveillance and, where necessary, the flight data processing system.

16.2.5 Labels shall, as a minimum, include information relating to the identity of the aircraft, e.g. SSR code or aircraft identification and, if available, pressure – altitude - derived level information. This information may be obtained from SSR Mode A, SSR Mode C, SSR Mode S and/or ADS-B.

16.2.6 Labels shall be associated with their position indications in a manner precluding erroneous identification by or confusion on the part of the controller. All label information shall be presented in a clear and concise manner.

16.3 COMMUNICATIONS

16.3.1 The level of reliability and availability of communications systems shall be such that the possibility of system failures or significant degradations is very remote. Adequate backup facilities shall be provided.

Note. Guidance material and information pertaining to system reliability and availability are contained in Annex 10, Volume I, and the Air Traffic Services Planning Manual (Doc 9426).

16.3.2 Direct pilot-controller communications shall be established prior to the provision of ATS Surveillance services, unless special circumstances such as emergencies dictate otherwise.

16.4 PROVISIONS OF ATS SURVEILLANCE SERVICES

16.4.1 Where suitable ATS surveillance systems and communication systems are available, information derived from ATS surveillance systems, including safety-related alerts and warnings such as conflict alert and minimum safe altitude warning, should be used to the extent possible in the provision of air traffic control service in order to improve capacity and efficiency as well as to enhance safety.

16.4.2 The number of aircraft simultaneously provided with ATS surveillance services shall not exceed that which can safely be handled under the prevailing circumstances, taking into account:-

a. the structural complexity of the control area or sector concerned;

b. the functions to be performed within the control area or sector concerned;

c. assessments of controller workloads, taking into account different aircraft capabilities, and sector capacity; and

d. the degree of technical reliability and availability of the main and backup communications, navigation and surveillance systems, both in the aircraft and on the ground.

e. the possibility of ATS surveillance equipment failure or other emergency that would eventually require reverting to back-up facilities and/or non surveillance separation; and

16.5 USE OF SSR TRANSPONDERS AND ADS-B TRANSMITTERS

16.5.1 General

To ensure the safe and efficient use of SSR and ADS-B, pilots and controllers shall strictly adhere to published operating procedures and standard radiotelephony phraseology shall be used. The correct setting of transponder codes and/or aircraft identification shall be ensured at all times.

16.5.2 Use of SSR Transponder

16.5.2.1 SSR Code Management

16.5.2.1.1 Codes 7700, 7600 and 7500 shall be reserved internationally for use by pilots encountering a state of emergency, radio communication failure or unlawful interference, respectively.

16.5.2.1.2 SSR codes are to be allocated and assigned in accordance with the following principles:

16.5.2.1.2.1 Codes should be allocated to States or areas in accordance with regional air navigation agreements, taking into account overlapping radar coverage over adjacent airspaces.

16.5.2.1.2.2 The appropriate ATS authority shall establish a plan and procedures for the allocation of codes to ATS units.

16.5.2.1.2.3 The plan and procedures should be compatible with those practiced in adjacent States.

16.5.2.1.2.4 The allocation of a code should preclude the use of this code for any other function within the area of coverage of the same SSR for a prescribed time period.

16.5.2.1.2.5 To reduce pilot and controller workload and the need for controller/pilot communications, the number of code changes required of the pilot should be kept to the minimum.

16.5.2.1.2.6 Codes shall be assigned to aircraft in accordance with the plan and procedures laid down by the appropriate ATS authority.

16.5.2.1.2.7 Where there is a need for individual aircraft identification, each aircraft shall be assigned a discrete code which should, whenever possible, be retained throughout the flight.

16.5.2.1.2.8 Except for aircraft in a state of emergency, or during communication failure or unlawful interference situations, and unless otherwise agreed by regional air navigation agreement or between a transferring and an accepting ATC unit, the transferring unit shall assign Code A2000 to a controlled flight prior to transfer of communications.

16.5.3 Operation Of SSR Transponder

Note. SSR transponder operating procedures are contained in Procedures for Air Navigation Services — Aircraft Operations *(PANS-OPS, Doc 8168), Volume I, Part VIII. Section 3.*

16.5.3.1 When, after a pilot has been directed to operate the aircraft's transponder on an assigned Mode A code, or to effect a code change, it is observed that the code shown on the radar display is different from that assigned to the aircraft, the pilot shall be requested to confirm the code selected and, if the situation warrants (e.g not being a case of unlawful interference), to reselect the assigned code.

16.5.3.2 If the discrepancy still persists, the pilot may be requested to stop the operation of the aircraft's transponder. The next control position and any other affected unit using SSR in the provision of ATS shall be informed accordingly.

16.5.3.3 Aircraft equipped with Mode S having an aircraft identification feature shall transmit the aircraft identification as specified in Item 7 of the ICAO flight plan or, when no flight plan has been filed, the aircraft registration.

Note. All Mode S-equipped aircraft engaged in international civil aviation are required to have an aircraft identification feature (Annex 10, Volume IV, Chapter 2, 2.1.5.2 refers).

16.5.3.4 Whenever it is observed on the radar display that the aircraft identification transmitted by a Mode S-equipped aircraft is different from that expected from the aircraft, the pilot shall be requested to reselect aircraft identification.

16.5.3.5 If, following confirmation by the pilot that the correct aircraft identification has been set on the Mode S identification feature, the discrepancy continues to exist, the following actions shall be taken by the controller:

a. inform the pilot of the persistent discrepancy;

b. where possible, rectify the radar label showing the aircraft identification on the radar display; and

c. notify the erroneous identification transmitted by the aircraft to the next control position and any other interested unit using Mode S for identification purposes.

16.5.3.6 Assignment of Codes

16.5.3.6.1 A controller shall only assign modes and codes in accordance with the published procedures or unit instructions. Whenever a code is assigned to an aircraft, the setting of this code shall be verified by the controller at the earliest opportunity.

16.5.4 Level information based on the use of Mode C

16.5.4.1 Verification of Accuracy of Mode C Derived Level Information

16.5.4.1.1 The tolerance value used to determine that Mode C - derived level information displayed to the controller is accurate shall be ± 200 ft in RVSM airspace. In other airspace, it shall be ± 300 ft.

16.5.4.1.2 Verification of the accuracy of Mode C derived level information displayed to the controller shall be effected at least once on initial contact with the aircraft concerned or, if this is not feasible, as soon as possible thereafter. The verification shall be effected by simultaneous comparison with altimeter derived level information received from the same aircraft by radiotelephony. The pilot of the aircraft whose Mode C derived level information is within the approved tolerance value need not be advised of such verification.

16.5.4.1.3 If the displayed level information is not within the approved tolerance value or when a discrepancy in excess of the approved tolerance value is detected subsequent to verification, the pilot shall be advised accordingly and requested to check his pressure setting and confirm his level.

Example :

IAW 012 CHECK ALTIMETER SETTING AND CONFIRM MAINTAING FL 150.

16.5.4.1.4 If, following confirmation of the correct pressure setting the discrepancy continues to exist, the following action should be taken according to circumstances:-

a. request the pilot to stop Mode C or ADS-B altitude data transmission, provided this does not cause the loss of position and identity information, and notify the next control positions or ATC unit concerned with the aircraft of the action taken; or

Example:

IAW012 STOP SQUAWK CHARLIE WRONG INDICATION.

b. inform the pilot of the discrepancy and request that the relevant operation continue in order to prevent loss of position and identity information of the aircraft and, when authorized by the appropriate ATS authority, override the label-displayed level information with the reported level. Notify the next control position or ATC unit concerned with the aircraft of the action taken.

16.5.4.2 Determination of Level Occupancy

16.5.4.2.1 The criterion which shall be used to determine that a specific level is occupied by an aircraft shall be ± 200 ft in RVSM airspace. In other airspace, it shall be ± 300 ft.

Note. For a brief explanation of the considerations underlying this value, see the Air Traffic Services Planning Manual (Doc 9426).

16.5.4.2.2*Aircraft maintaining a level:* An aircraft is considered to be maintaining its assigned level as long as the SSR Mode C derived level information indicates that it is within plus or minus 300 ft of the assigned level in non-RVSM airspace and within plus or minus 200 ft in RVSM airspace, as specified in 16.5.4.2.1 above.

16.5.4.2.3*Aircraft vacating a level:* An aircraft cleared to leave a level is considered to have commenced its manoeuvre and vacated the previously occupied level when the SSR Mode C derived level information indicates a change of more than 300 ft in the anticipated direction from its previously assigned level.

16.5.4.2.4*Aircraft passing a level in climb or descent:* An aircraft in climb or descent is considered to have crossed a level when the SSR Mode C derived level information indicates that it has passed this level in the required direction by more than 300 ft.

16.5.4.2.5*Aircraft reaching a level:* An aircraft is considered to have reached the level to which it has been cleared when three consecutive renewals of Mode C derived level information have indicated that it is within ± 200 ft in RVSM airspace and within ± 300 ft in other airspace of its assigned level.

Note. In automated ATS systems, the cycles of renewals of Mode C data may not be evident to controllers. In this case the following time intervals shall be used :

a. 15 seconds for TMA/Approach Radar, and

b. 30 seconds for Area Radar.

16.5.4.2.6 Intervention by a controller with the pilot of the aircraft whose Mode C derived level information is observed shall only be required if differences in level information between that displayed to the controller and that used for control purposes are in excess of the values stated above.

16.6 RADAR PROCEDURES

16.6.1 Performance Checks

16.6.1.1 The radar controller shall adjust the radar display(s) and carry out adequate checks on the accuracy thereof, in accordance with the technical instructions prescribed by the appropriate authority for the radar equipment concerned.

16.6.1.2 The radar controller shall be satisfied that the available functional capabilities of the radar system as well as the information presented on the radar display(s) is adequate for the functions to be performed.

16.6.1.3 The radar controller shall report, in accordance with local procedures, any fault in the equipment, or any incident requiring investigation, or any circumstances which make it difficult or impractical to provide radar services.

16.6.1.4 When necessary to record signal strength, Table 16 – 1 shall be used:-

STRENGTH	DESCRIPTION OF PSR BLIP *	USABILITY
0 - Nil	No visible PSR blip	None
1 - Poor	Barely visible PSR blip	Unreliable
2 - Acceptable	Discernible PSR blip. No Persistence	Usable
3 - Good	PSR blip discernible during complete revolution	Normal
4 - Good	Discernible PSR blip with positive trail	Normal

Table 16 – 1 Signal Strength

*** PSR blip:- Primary Surveillance Radar Blip.**

16.6.2 Radar Identification And Coordination Procedures

16.6.2.1 ESTABLISHMENT OF RADAR IDENTIFICATION

16.6.2.1.1 Before providing radar service to an aircraft, radar identification shall be established and the pilot informed. Thereafter, radar identification shall be maintained until termination of the radar service.

16.6.2.1.2 If radar identification is subsequently lost, the pilot shall be informed accordingly and, when applicable, appropriate instructions issued.

16.6.2.2 METHODS OF RADAR IDENTIFICATION

16.6.2.2.1 SSR IDENTIFICATION PROCEDURES

16.6.2.2.1.1 Where SSR is used, aircraft may be identified by one or more of the following procedures:

a. recognition of the aircraft identification in a radar label;

Note. The use of this procedure requires that the code/call sign correlation is achieved successfully, taking into account the Note following(b) below.

b. recognition of an assigned discrete code, the setting of which has been verified, in a radar label;

Note. The use of this procedure requires a system of code assignment which ensures that each aircraft in a given portion of airspace is assigned a discrete code.

c. direct recognition of the aircraft identification of a Mode "S" equipped aircraft in a radar label;

Note. The aircraft identification feature available in Mode " S " transponders provides the means to identify directly individual aircraft on radar displays and thus offers the potential to eliminate ultimately the recourse to Mode "A" discrete codes for individual identification. This elimination will only be achieved in a progressive manner depending on the state of deployment of suitable ground and airborne installations.

d. by transfer of radar identification (See Doc 4444 Item 8.6.3)

e. observation of compliance with an instruction to set a specific code;

f. observation of compliance with an instruction to squawk IDENT;

Note 1. In automated radar systems, the " IDENT " feature may be presented in different ways, e.g. as a flashing of all or part of the radar position and associated data block.

Note 2. Garbling of transponder replies may produce " IDENT "-type of indications. Nearly simultaneous " IDENT " transmissions within the same area may give rise to errors in identification.

16.6.2.2.1.2 When a discrete code has been assigned to an aircraft, a check shall be made at the earliest opportunity to ensure that the code set by the pilot is identical to that assigned for the flight. Only after this check has been made shall the discrete code be used as a basis for identification.

16.6.2.2.2 PSR IDENTIFICATION PROCEDURES

16.6.2.2.2.1 Where PSR is used for identification, aircraft may be identified by one or more of the following procedures::

a. POSITION REPORT METHOD: by correlating a particular radar position indication with an aircraft reporting its POSITION OVER , or as BEARING AND DISTANCE from, a point displayed on the radar map, and by ascertaining that the track of the particular radar position is consistent with the aircraft path or reported heading;

Note 1. When using this method the PSR blip shall be within 5 NM of the aircraft's reported position.

Note 2 . This method shall only be used on published ATS routes.

Note 3 . Bearing shall be a radial established from a VOR station and the distance shall be measured from a DME station collocated with that VOR.

b. DEPARTURE METHOD: by correlating an observed radar position indication with an aircraft which is known to have JUST DEPARTED, provided that the identification is established WITHIN 1 NM from the END of the runway used. Particular care should be taken to avoid confusion with aircraft HOLDING OVER or OVERFLYING the aerodrome, or with aircraft DEPARTING from or making a MISSED APPROACH over adjacent runways;

c. by transfer of radar identification (See Dc 4444 Item 8.6.3)

d. TURN METHOD: by ascertaining the aircraft heading, if circumstances require, and following a period of track observation:

i. instructing the pilot to execute ONE or MORE changes of heading of 30 degrees or more and correlating the movements of ONE particular radar position indication with the aircraft's acknowledged execution of the instructions given; or

ii. correlating the movements of a particular radar position indication with manoeuvres CURRENTLY executed by an aircraft having so reported.

iii. When using these methods, the radar controller shall:

1. **verify that the movements of NOT more than ONE radar position indication correspond with those of the aircraft; and**

2. **ensure that the manoeuvre(s) will NOT carry the aircraft outside the coverage of the radar or the radar display.**

Note 1. Caution must be exercised when employing these methods in areas where route changes normally take place.

Note 2. With reference to (2) above, see also Doc 4444 Item 8.6.5.1 regarding radar vectoring of controlled aircraft.

16.6.2.2.2.2 Use may be made of direction-finding bearings to ASSIST in radar identification of an aircraft. This method, however, shall NOT be used as the SOLE means of establishing radar identification.

16.6.2.2.2.3 When two or more radar position indications are observed in close proximity, or are observed to be making similar movements at the same time, or when doubt exists as to the identity of a radar position indication for any other reason, changes of heading should be prescribed or repeated as many times as necessary, or additional methods of identification should be employed, until all risk of error in identification is eliminated.

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16.6.3 TRANSFER OF RADAR IDENTIFICATION

16.6.3.1 Transfer of radar identification from one radar controller to another should only be attempted when it is considered that the aircraft is within the accepting controller's radar coverage.

16.6.3.2 Transfer of radar identification shall be effected by one of the following methods:

a. designation of the radar position indication by automated means, provided that only one radar position indication is thereby indicated and there is no possible doubt of correct identification;

b. notification of the aircraft's discrete SSR code of aircraft address;

Note1. The use of a discrete SSR code requires a system of code assignment which ensures that each aircraft in a given portion of airspace is assigned a discrete code (See Doc 4444 Item 8.5.2.2.7).

Note 2. Aircraft address would be expressed in the form of the alphanumerical code of six hexadecimal characters

c. notification that the aircraft is SSR Mode S-equipped with an aircraft identification feature when SSR Mode S coverage is available;

d. direct designation (pointing with the finger) of the radar position indication, if the two radar displays are adjacent, or if a common "conference" type of radar display is used;

Note. Attention must be given to any errors which might occur due to parallax effects.

e. designation of the radar position indication by reference to, or in terms of bearing and distance from, a geographical position or navigational facility accurately indicated on both radar displays, together with the track of the observed radar position indication if the route of the aircraft is not known to both controllers;

Note. Caution must be exercised before transferring radar identification using this method, particularly if other radar position indications are observed on similar headings and in close proximity to the aircraft under radar control. Inherent radar deficiencies, such as inaccuracies in bearing and distance of the radar position indications displayed on individual radar displays and parallax errors, may cause the indicated position of an aircraft in relation to the known point to differ between the two radar displays. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.:

i. a maximum distance from the common reference point used by the two controllers; and

ii. a maximum distance between the radar position indication as observed by the accepting controller and the one stated by the transferring controller.

f. instruction to the aircraft by the transferring controller to change code and the observation of the change by the accepting controller;

OR

g. instruction to the aircraft by the transferring controller to squawk IDENT and observation of this response by the accepting controller;

Note. Use of procedures f) and g) requires prior coordination between the controllers, since the indications to be observed by the accepting controller are of short duration.

16.6.4 POSITION INFORMATION

16.6.4.1 An aircraft provided with radar service should be informed of its position in the following circumstances:

a. upon identification, except when the identification is established:

i. based on the pilot's report of the aircraft position or within ONE nautical mile of the runway upon departure and the observation is consistent with the aircraft's time of departure; or

ii. by use of SSR Mode S aircraft identification or assigned discrete SSR codes and the location of the observed position indication is consistent with the current flight plan of the aircraft; or

iii. by transfer of radar identification;

b. when the pilot requests this information;

c. when a pilot's estimate differs significantly from the radar controller's estimate based on radar observation;

d. when the pilot is instructed to resume own navigation after radar vectoring if the current instructions had diverted the aircraft from a previously assigned route, (See 16.6.5.5);

e. immediately before termination of radar service, if the aircraft is observed to deviate from its intended route.

16.6.4.2 Position information shall be passed to aircraft in one of the following forms:

a. as a well-known geographical position;

b. magnetic track and distance to a significant point, an en-route navigation aid, or an approach aid;

c. direction (using points of the compass) and distance from a known position;

d. distance to touchdown, if the aircraft is on final approach; or

e. distance and direction from the centre line of an ATS route.

16.6.4.3 Whenever practicable, position information shall relate to positions or routes pertinent to the navigation of the aircraft concerned and displayed on the radar map.

16.6.4.4 When so informed, the pilot may omit position reports at compulsory reporting points or report only over those reporting points specified by the air traffic services unit concerned, including points at which air-reports are required for meteorological purposes. Pilots shall resume position reporting when so instructed and when advised that radar service is terminated or that radar identification is lost.

16.6.5 RADAR VECTORING

16.6.5.1 Radar vectoring shall be achieved by issuing to the pilot specific headings which will enable the aircraft to maintain the desired track. When vectoring an aircraft, a radar controller should comply with the following:

a. whenever practicable, the aircraft should be vectored along routes or tracks on which the pilot can monitor the aircraft position with reference to pilot-interpreted navigation aids (this will minimize the amount of radar navigational assistance required and alleviate the consequences resulting from a radar failure);

b. when an aircraft is given its initial vector diverting it from a previously assigned route, the pilot shall be informed what the vector is to accomplish, and the limit of the vector shall be specified (e.g. to ... position, for ... approach);

c. except when transfer of radar control is to be effected, aircraft shall not be vectored closer than 2.5 NM, or, where a radar separation minimum greater than 5 NM is prescribed, a distance equivalent to ONE - HALF of the prescribed separation minimum, from the limit of the airspace for which the radar controller is responsible, unless local arrangements have been made to ensure that separation will exist with radar-controlled aircraft operating in adjoining areas;

d. controlled flights shall not be vectored into uncontrolled airspace except in the case of emergency or in order to circumnavigate adverse meteorological conditions (in which case the pilot should be so informed), or at the specific request of the pilot; and

e. when an aircraft has reported unreliable directional instruments, the pilot should be requested, prior to the issuance of manoeuvring instructions, to make all turns at an agreed rate and to carry out the instructions immediately upon receipt.

16.6.5.2 When vectoring an IFR flight and when giving an IFR flight a direct routing which takes the aircraft off an ATS route, the radar controller shall issue clearances such that the prescribed obstacle clearance will exist at all times until the aircraft reaches the point where the pilot will resume own navigation. When necessary, the relevant minimum radar vectoring altitude shall include a correction for low temperature effect.

Note 1. When an IFR flight is being vectored, the pilot may be unable to determine the aircraft's exact position in respect to obstacles in this area and consequently the altitude which provides the required obstacle clearance. Detailed obstacle clearance criteria are contained in PANS-OPS (Doc 8168), Volume I Part VI, Chapter 3 (Altimeter Corrections) and Volume II, Part II, Departure Procedures, Part III, 24.2.2.3 (Procedures based on tactical vectoring), and Part VI (Obstacle Clearance Criteria for En-route).

Note 2. It is the responsibility of the ATS authority to provide the controller with minimum altitudes corrected for temperature effect.

16.6.5.3 Whenever possible, minimum vectoring altitudes should be sufficiently high to minimize activation of aircraft ground proximity warning systems.

Note. Activation of such systems will induce aircraft to pull up immediately and climb steeply to avoid hazardous terrain, possibly compromising separation between aircraft.

16.6.5.4 States shall encourage operators to report incidents involving activations of aircraft ground proximity warning systems so that their locations can be identified and altitude, routing and/or aircraft operating procedures can be altered to prevent recurrences.

16.6.5.5 In terminating radar vectoring of an aircraft, the radar controller shall instruct the pilot to resume own navigation, giving the pilot the aircraft's position and appropriate instructions, as necessary, in the form prescribed in 16.6.4.2 b), if the current instructions had diverted the aircraft from a previously assigned route.

16.6.6 NAVIGATION ASSISTANCE

16.6.6.1 An identified aircraft observed to deviate significantly from its intended route or designated holding pattern shall be advised accordingly. Appropriate action shall also be taken if, in the opinion of the controller, such deviation is likely to affect the service being provided.

16.6.6.2 The pilot of an aircraft requesting navigation assistance from an air traffic control unit providing ATS surveillance services shall state the reason (e.g. to avoid areas of adverse weather or unreliable navigational instruments) and shall give as much information as possible in the circumstances.

16.6.7 INTERRUPTION OR TERMINATION OF ATS SURVEILLANCE SERVICE

16.6.7.1 An aircraft which has been informed that it is provided with ATS surveillance service should be informed immediately when, for any reason, the service is interrupted or terminated.

Note. The transition of an aircraft across adjoining areas of radar and/or ADS-B coverage will not normally constitute an interruption or termination of the ATS surveillance service.

16.6.7.2 When the control of an identified aircraft is to be transferred to a control sector that will provide the aircraft with procedural separation, the transferring controller shall ensure that appropriate procedural separation is established between that aircraft and any other controlled aircraft before the transfer is effected.

16.6.8 MINIMUM LEVELS

16.6.8.1 The controller shall at all times be in possession of full and up-to-date information regarding:

a. established minimum flight altitudes within the area of responsibility;

b. the lowest usable flight level or levels determined in accordance with Chapters 5 and 11; and

c. established minimum altitudes applicable to procedures based on tactical vectoring.

16.6.8.2 Unless otherwise specified by the appropriate ATS authority, minimum altitudes for procedures based on tactical vectoring with any ATS surveillance system shall be determined using the criteria applicable to tactical radar vectoring.

Note. Criteria for the determination of minimum altitudes applicable to procedures based on tactical radar vectoring are contained in Procedures for Air Navigation Services — Aircraft Operations *(PANS-OPS, Doc 8168), Volume II.*

16.6.9 INFORMATION REGARDING ADVERSE WEATHER

16.6.9.1 Information that an aircraft appears likely to penetrate an area of adverse weather should be issued in sufficient time to permit the pilot to decide on an appropriate course of action, including that of requesting advice on how best to circumnavigate the adverse weather area, if so desired.

Note. Depending on the capabilities of the ATS surveillance system, areas of adverse weather may not be presented on the situation display. An aircraft's weather radar will normally provide better detection and definition of adverse weather than radar sensors in use by ATS.

16.6.9.2 In vectoring an aircraft for circumnavigating any area of adverse weather, the controller should ascertain that the aircraft can be returned to its intended or assigned flight path within the coverage of the ATS surveillance system and, if this does not appear possible, inform the pilot of the circumstances.

Note. Attention must be given to the fact that under certain circumstances the most active area of adverse weather may not be displayed.

16.6.10 REPORTING OF SIGNIFICANT METEOROLOCAL INFORMATION TO METEOROLOGICAL OFFICES

16.6.10.1 Although a controller is not required to keep a special watch for heavy precipitation, etc., information on the position, intensity, extent and movement of significant meteorological conditions (i.e. heavy showers or well-defined frontal surfaces) as observed on situation displays should, when practicable, be reported to the associated meteorological office.

16.7 USE OF ATS SURVEILLANCE SYSTEMS IN THE AIR TRAFFIC CONTROL SERVICE

Note. The procedures in this Section are general procedures applicable when an ATS surveillance system is used in the provision of area control service or approach control service. Additional procedures applicable in the provision of approach control service and aerodrome control service are detailed in sections 16.8 and 16.9 respectively.

16.7.1 Radar services provided to identified aircraft are as follows:-

a. Flights Within Controlled Airspace : Radar Control Service and Radar Flight Information Service;

b. Flights Outside Controlled Airspace: Radar Flight Information Service.

16.7.2 The information provided by ATS surveillance systems and presented on a situation display may be used to perform the following functions in the provision of air traffic control service:

a. provide ATS surveillance services as necessary in order to improve airspace utilization, reduce delays, provide for direct routings and more optimum flight profiles, as well as to enhance safety;

b. provide vectoring to departing aircraft for the purpose of facilitating an expeditious and efficient departure flow and expediting climb to cruising level;

c. provide vectoring to aircraft for the purpose of resolving potential conflicts;

d. provide vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence;

e. provide vectoring to assist pilots in their navigation, e.g. to or from a radio navigation aid, away from or around areas of adverse weather;

f. provide separation and maintain normal traffic flow when an aircraft experiences communication failure within the area of coverage;

g. maintain flight path monitoring of air traffic;

Note. Where tolerances regarding such matters as adherence to track, speed or time have been prescribed by the appropriate ATS authority, deviations are not considered significant until such tolerances are exceeded

h. when applicable, maintain a watch on the progress of air traffic, in order to provide a procedural controller with:

i. improved position information regarding aircraft under control;
ii. supplementary information regarding other traffic; and
iii. information regarding any significant deviations by aircraft from the terms of their respective air traffic control clearances, including their cleared routes as well as levels, when appropriate.

16.7.3 Separation Application

Note. Factors which the controller using an ATS surveillance system must take into account in determining the spacing to be applied in particular circumstances in order to ensure that the separation minimum is not infringed include aircraft relative headings and speeds, ATS surveillance system technical limitations, controller workload and any difficulties caused by communication congestion. Guidance material on this subject is contained in the Air Traffic Services Planning Manual (Doc 9426).

16.7.3.1 Except as provided for in 16.7.3.8, 16.7.3.9, the separation minima specified in 16.7.4 shall only be applied between identified aircraft when there is reasonable assurance that identification will be maintained.

16.7.3.2 When control of an identified aircraft is to be transferred to a control sector that will provide the aircraft with procedural separation, such separation shall be established by the transferring controller before the aircraft reaches the limits of the transferring controller's area of responsibility, or before the aircraft leaves the relevant area of surveillance coverage.

16.7.3.3 Separation based on the use of ADS-B, SSR and/or PSR position symbols and/or PSR blips shall be applied so that the distance between the centres of the position symbols and/or PSR blips, representing the positions of the aircraft concerned, is never less than a prescribed minimum.

16.7.3.4 **Separation based on the use of PSR blips and SSR responses shall be applied so that the distance between the centre of the PSR blip and the nearest edge of the SSR response is never less than a prescribed minimum.**

16.7.3.5 **Separation based on the use of ADS-B position symbols and SSR responses shall be applied so that the distance between the centre of the ADS-B position symbol and the nearest edge of the SSR response is never less than a prescribed minimum.**

16.7.3.6 **Separation based on the use of SSR responses shall be applied so that the distance between the closest edges of the SSR responses is never less than a prescribed minimum.**

16.7.3.7 **In no circumstances shall the edges of the position indications touch or overlap unless vertical separation is applied between the aircraft concerned, irrespective of the type of position indication displayed and separation minimum applied.**

16.7.3.8 **In the event that the controller has been notified of a controlled flight entering or about to enter the airspace within which the separation minima specified in 16.7.4 is applied, but has not identified the aircraft, the controller may, continue to provide an ATS surveillance service to identified aircraft provided that:**

- **a. reasonable assurance exists that the unidentified controlled flight will be identified using SSR or ADS-B or the flight is being operated by an aircraft of a type which may be expected to give an adequate return on primary radar in the airspace within which the separation is applied; and**
- **b. the separation is maintained between identified flights and any other observed ADS-B and/or radar position indications until either the unidentified controlled flight has been identified or procedural separation has been established.**

16.7.3.9 **The separation minima specified in 16.7.4 may be applied between an aircraft taking off and a preceding departing aircraft or other identified traffic provided there is reasonable assurance that the departing aircraft will be identified within 2 km (1 NM) from the end of the runway, and that, at the time, the required separation will exist.**

16.7.3.10 The separation minima specified in 16.7.4 shall not be applied between aircraft holding over the same holding fix.

16.7.3.11 Radar separation shall not be applied to aircraft when in close proximity to a radar antenna if loss of radar contact is expected.

16.7.4 Separation minima based on ATS surveillance Systems

16.7.4.1 The horizontal separation minimum based on radar and/or ADS-B shall be 5 NM.

16.7.4.2 The following distance-based wake turbulence separation minima shall be applied to aircraft being provided with an ATS surveillance service in the approach and departure phases of flight in the circumstances given in 16.7.4.2.1. (see table 16 – 2) and Fig. 16 – 1A and 16 – 1B

Aircraft Category		Distance Based Wake Turbulence Separation Minima
Preceding Aircraft	Succeeding Aircraft	
HEAVY	HEAVY	4 NM
	MEDIUM	5 NM
	LIGHT	6 NM
MEDIUM	LIGHT	5 NM

Table 16 – 2

16.7.4.2.1 The minima set out in 16.7.4.2 shall be applied when:

a. an aircraft is operating directly behind another aircraft at the same altitude or less than 300 m (1 000 ft) below; or

b. both aircraft are using the same runway, or parallel runways separated by less than 760 m (2 500 ft); or

c. an aircraft is crossing behind another aircraft, at the same altitude or less than 300 m (1 000 ft) below.

Note. See Figures 16-1A and 16-1B.

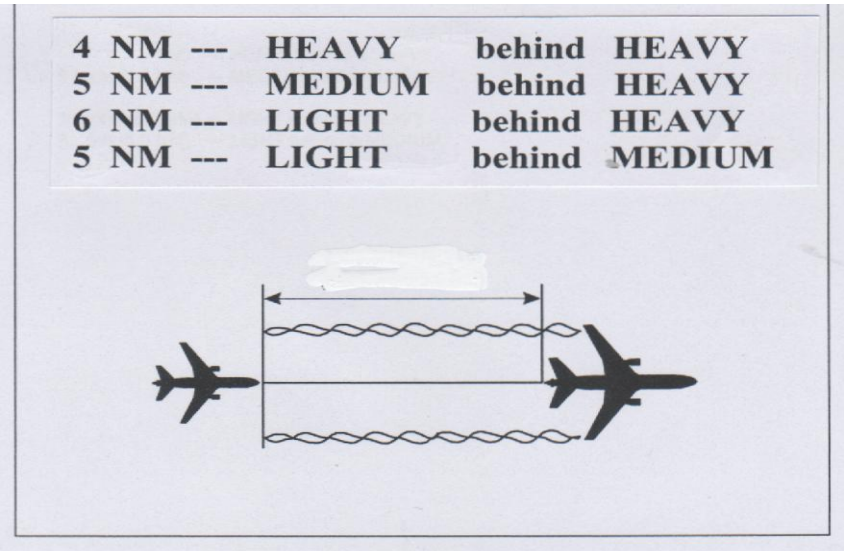

Fig. 16 – 1A
Operating directly behind (See 16.7.4.2 and 16.7.4.2.1)

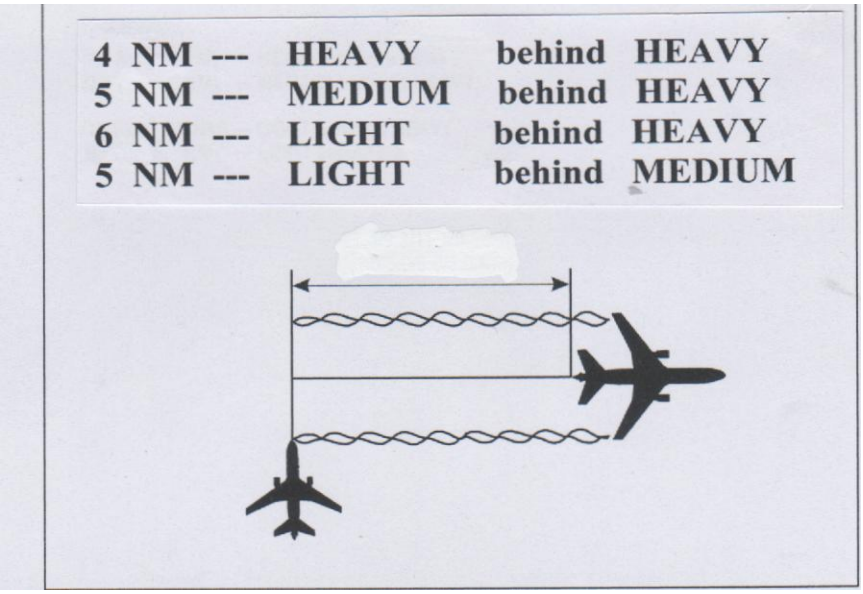

Fig. 16 – 1B
Crossing behind (See 16.7.4.2 and 16.7.4.2.1)

16.7.5 Transfer of control

16.7.5.1 Where an ATS surveillance service is being provided, transfer of control should be effected, whenever practicable, so as to enable the uninterrupted provision of the ATS surveillance service.

16.7.5.2 Where SSR and/or ADS-B is used and the display of position indications with associated labels is provided for, transfer of control of aircraft between adjacent control positions or between adjacent ATC units may be effected without prior coordination, provided that:

a. updated flight plan information on the aircraft about to be transferred, including the discrete assigned SSR code or, with respect to SSR Mode S and ADS-B, the aircraft identification, is provided to the accepting controller prior to transfer;

b. ADS-B or radar coverage provided to the accepting controller is such that the aircraft concerned is presented on the situation display before the transfer is effected and is identified on, but preferably before, receipt of the initial call;

c. when the controllers are not physically adjacent, two-way direct speech facilities, which permit communications to be established instantaneously, are available between them at all times;

Note. "Instantaneous" refers to communications which effectively provide for immediate access between controllers.

d. the transfer point or points and all other conditions of application, such as direction of flight, specified levels, transfer of communication points, and especially an agreed minimum separation between aircraft, including that applicable to succeeding aircraft on the same route, about to be transferred as observed on the situation display, have been made the subject of specific instructions (for intra-unit transfer) or of a specific letter of agreement between two adjacent ATC units;

e. the instructions or letter of agreement specify explicitly that the application of this type of transfer of control may be terminated at any time by the accepting controller, normally with an agreed advance notice;

f. the accepting controller is informed of any level, speed or vectoring instructions given to the aircraft prior to its transfer and which modify its anticipated flight progress at the point of transfer.

16.7.5.3 The minimum agreed separation between aircraft about to be transferred (16.7.5.2 d) refers) and the advance notice (16.7.5.2 e) refers) shall be determined taking into account all relevant technical, operational and other circumstances. If circumstances arise in which these agreed conditions can no longer be satisfied, controllers shall revert to the procedure in 16.7.5.4 until the situation is resolved.

16.7.5.4 Where primary radar is being used, and where SSR and/or ADS-B is employed but the provisions of 16.7.5.2 are not applied, the transfer of control of aircraft between adjacent control positions or between two adjacent ATS units may be effected, provided that:

a. identification has been transferred to or has been established directly by the accepting controller;

b. when the controllers are not physically adjacent, two-way direct-speech facilities between them are at all times available which permit communications to be established instantaneously;

c. separation from other controlled flights conforms to the minima authorized for use during transfer of control between the sectors or units concerned;

d. the accepting controller is informed of any level, speed or vectoring instructions applicable to the aircraft at the point of transfer;

e. radiocommunication with the aircraft is retained by the transferring controller until the accepting controller has agreed to assume responsibility for providing the ATS surveillance service to the aircraft. Thereafter, the aircraft should be instructed to change over to the appropriate channel and from that point is the responsibility of the accepting controller.

16.7.6 Speed control

16.7.6.1 Controller may, in order to facilitate sequencing or to reduce the need for vectoring, request aircraft to adjust their speed in a specified manner.

Note 1. Procedures for speed control instructions are contained in chapter 17 of this manual.

Note 2. Speed control phraseology is listed within Chapter 21 of this manual. Additional information and guidance on speed terminology, relationships, and speed control techniques, is contained in Appendix "O" of this manual

16.8 USE OF ATS SURVEILLANCE SYSTEMS IN THE APPROACH CONTROL SERVICE

16.8.1 General provisions

16.8.1.1 ATS surveillance systems used in the provision of approach control service shall be appropriate to the functions and level of service to be provided.

16.8.1.2 When vectoring to intercept the ILS localizer course or MLS final approach track, the final vector shall enable the aircraft to intercept the ILS localizer course or MLS final approach track at an angle not greater than 30 degrees and to provide at least 1 NM straight and level flight prior to ILS localizer course or MLS final approach track intercept. The vector shall also enable the aircraft to be established on the ILS localizer course or MLS final approach track in level flight for at least 2 NM) prior to intercepting the ILS glide path or specified MLS elevation angle.

16.8.1.3 A minimum of 1 000 ft vertical separation or, subject to radar system and situation display capabilities, a minimum of 5 NM radar separation shall be provided between aircraft on the same ILS localizer course or MLS final approach track unless increased longitudinal separation is required due to wake turbulence or for other reasons.

16.8.1.4 When assigning the final heading to intercept the ILS localizer course or MLS final approach track, the runway shall be confirmed, and the aircraft shall be advised of:

a. its position relative to a fix on the ILS localizer course or MLS final approach track;

b. the altitude to be maintained until established on the ILS localizer course or MLS final approach track to the ILS glide path or specified MLS elevation angle intercept point; and

c. if required, clearance for the appropriate ILS or MLS approach.

16.8.1.5 All approaches regardless of meteorological conditions shall be provided with flight path monitoring using radar. Control instructions and information necessary to ensure separation between aircraft shall be issued.

Note . The primary responsibility for navigation on the ILS localizer course and/or MLS final approach track rests with the pilot. Control instructions and information are therefore issued only to ensure separation between aircraft.

16.8.1.6 Flight path monitoring using radar shall not be terminated until:

a. visual separation is applied, provided procedures ensure that both controllers are advised whenever visual separation is applied;

b. the aircraft has landed, or in case of a missed approach, is at least 1.0 NM beyond the departure end of the runway and adequate separation with any other traffic is established.

Note. There is no requirement to advise the aircraft that flight path monitoring using radar is terminated

16.8.2 Functions

16.8.2.1 The position indications presented on a situation display may be used to perform the following additional functions in the provision of approach control service:

a. provide vectoring of arriving traffic on to pilot-interpreted final approach aids;

b. provide flight path monitoring of parallel ILS approaches and

c. provide vectoring of arriving traffic to a point from which a visual approach can be completed;

d. provide vectoring of arriving traffic to a point from which a precision radar approach or a surveillance radar approach can be made;

e. provide flight path monitoring of other pilot-interpreted approaches;

f. in accordance with prescribed procedures, conduct:

1. surveillance radar approaches;

2. precision radar (PAR) approaches; and

g. provide separation between:

1. succeeding departing aircraft;

2. succeeding arriving aircraft; and

3. a departing aircraft and a succeeding arriving aircraft.

16.8.3 General approach control procedures using ATS surveillance systems

16.8.3.1 The appropriate ATS authority shall establish procedures to ensure that the aerodrome controller is kept informed of the sequence of arriving aircraft, as well as any instructions and restrictions which have been issued to such aircraft in order to maintain separation after transfer of control to the aerodrome controller.

16.8.3.2 Prior to, or upon commencement of, vectoring for approach, the pilot shall be advised of the type of approach as well as the runway to be used.

16.8.3.3 The controller shall advise an aircraft being vectored for an instrument approach of its position at least once prior to commencement of final approach.

16.8.3.4 When giving distance information, the controller shall specify the point or navigation aid to which the information refers.

16.8.3.5 The initial and intermediate approach phases of an approach executed under the direction of a controller comprise those parts of the approach from the time vectoring is initiated for the purpose of positioning the aircraft for a final approach, until the aircraft is on final approach and:

a. established on the final approach path of a pilot-interpreted aid; or

b. reports that it is able to complete a visual approach; or

c. ready to commence a surveillance radar approach; or

d. transferred to the precision radar approach controller.

16.8.3.6 Aircraft vectored for final approach should be given a heading or a series of headings calculated to close with the final approach track. The final vector shall enable the aircraft to be established in level flight on the final approach track prior to intercepting the specified or nominal glide path if an MLS, ILS or radar approach is to be made, and should provide an intercept angle with the final approach track of 45 degrees or less.

16.8.3.7 Whenever an aircraft is assigned a vector which will take it through the final approach track, it should be advised accordingly, stating the reason for the vector.

16.8.4 Vectoring to pilot-interpreted final approach aid

16.8.4.1 An aircraft vectored to intercept a pilot-interpreted final approach aid shall be instructed to report when established on the final approach track. Clearance for the approach should be issued prior to when the aircraft reports established, unless circumstances preclude the issuance of the clearance at such time. Vectoring will normally terminate at the time the aircraft leaves the last assigned heading to intercept the final approach track.

16.8.4.2 The controller shall be responsible for maintaining separation specified in 16.7.3 between succeeding aircraft on the same final approach, except that the responsibility may be transferred to the aerodrome controller in accordance with procedures prescribed by the appropriate ATS authority and provided an ATS surveillance system is available to the aerodrome controller.

16.8.4.3 Transfer of control of succeeding aircraft on final approach to the aerodrome controller shall be effected in accordance with the following procedures:

a. Arriving aircraft vectored for ILS Approach can be transferred to Tower Controller when pilot reported fully established on the ILS.

b. Arriving aircraft vectored for Visual Approach can be transferred to Tower Controller when pilot reported visual Runway/Runway lights in sight.

c. Succeeding arriving aircraft shall note be transferred to Tower Controller until the time the preceding arriving aircraft has landed.

Note: Separation specified in 16.7.3 shall be maintained between preceding and succeeding arriving aircraft

16.8.4.4 Transfer of communications to the aerodrome controller should be effected at such a point or time that clearance to land or alternative instructions can be issued to the aircraft in a timely manner.

16.8.5 Vectoring for visual approach

16.8.5.1 The controller may initiate radar vectoring of an aircraft for Visual Approach provided :

a. the reported ceiling is above 2000 Meters (6500 Feet) (for Sulaymaniyah International Airport); and

b. meteorological conditions are such that, with reasonable assurance, a visual approach and landing can be completed.

16.8.6 USE OF ATS SURVEILLANCE SYSTEMS IN THE FLIGHT INFORMATION SERVICE

Note.The use of an ATS surveillance system in the provision of flight information service does not relieve the pilot-in-command of an aircraft of any responsibilities, including the final decision regarding any suggested alteration of the flight plan

16.8.6.1 The information presented on the radar display may be used to proved identified aircraft with :

a. Information regarding any aircraft observed to be on a conflicting path with the identified aircraft and suggestions or advice regarding avoiding action.

b. Information on the position of significant weather and, as practicable, advice to aircraft on how best to circumnavigate any such areas of adverse weather.

c. Information to assist the aircraft in its navigation.

16.8.7 Radar Approaches

16.8.7.1 GENERAL PROVISIONS

16.8.7.1.1 During the period that a controller is engaged in giving surveillance radar or precision radar approaches, he or she should not be responsible for any duties other than those directly connected with such approaches.

16.8.7.1.2 Controllers conducting radar approaches shall be in possession of information regarding the obstacle clearance altitudes/heights established for the types of approach to be conducted.

16.8.7.1.3 Prior to commencement of a radar approach, the aircraft shall be informed of:

a. the runway to be used;
b. the applicable obstacle clearance altitude/height;
c. the angle of the nominal glide path and, if so prescribed by the appropriate ATS authority or requested by the aircraft, the approximate rate of descent to be maintained;

Note. See the Air Traffic Services Planning Manual (Doc 9426) regarding calculation of approximate rates of descent.

d. the procedure to be followed in the event of radiocommunicatin failure, unless the procedure has been published in AIPs.

16.8.7.1.4 When a radar approach cannot be continued due to any circumstance, the aircraft should be immediately informed that a radar approach or continuation thereof is not possible. The approach should be continued if this is possible using non-radar facilities or if the pilot reports that the approach can be completed visually; otherwise an alternative clearance should be given.

16.8.7.1.5 Aircraft making a radar approach should be reminded, when on final approach, to check that the wheels are down and locked.

16.8.7.1.6 Unless otherwise prescribed by the appropriate ATS authority, the controller conducting the approach should notify the aerodrome controller or, when applicable, the procedural controller when an aircraft making a radar approach is approximately 15 km (8 NM) from touchdown. If landing clearance is not received at this time, a subsequent notification should be made at approximately 8 km (4 NM) from touchdown and landing clearance requested.

16.8.7.1.7 Clearance to land or any alternative clearance received from the aerodrome controller or, when applicable, the procedural controller should normally be passed to the aircraft before it reaches a distance of 4 km (2 NM) from touchdown.

16.8.7.1.8 An aircraft making a radar approach should:

a. be directed to execute a missed approach in the following circumstances:
- **i. when the aircraft appears to be dangerously positioned on final approach; or**
- **ii. for reasons involving traffic conflictions;**
- **iii. if no clearance to land has been received from the procedural controller by the time the aircraft reaches a distance of 4 km (2 NM) from touchdown or such other distance as has been agreed with the aerodrome control tower; or**
- **iv. on instructions by the aerodrome controller; or**

b. be advised to consider executing a missed approach in the following circumstances:

i. when the aircraft reaches a position from which it appears that a successful approach cannot be completed; or

ii. if the aircraft is not visible on the situation display for any significant interval during the last 4 km (2 NM) of the approach; or

iii. if the position or identification of the aircraft is in doubt during any portion of the final approach.

In all such cases, the reason for the instruction or the advice should be given to the pilot.

16.8.7.1.9 Unless otherwise required by exceptional circumstances, radar instructions concerning a missed approach should be in accordance with the prescribed missed approach procedure and should include the level to which the aircraft is to climb and heading instructions to keep the aircraft within the missed approach area during the missed approach procedure.

16.8.8 Final Approach Procedures

16.8.8.1 Surveillance Radar Approach

16.8.8.1.1 A final approach using solely surveillance radar should not be carried out if precision approach radar is available, unless meteorological conditions are such as to indicate with reasonable certainty that a surveillance radar approach can be completed successfully.

16.8.8.1.2 A surveillance radar approach shall only be performed with equipment suitably sited and a situation display specifically marked to provide information on position relative to the extended centre line of the runway to be used and distance from touchdown, and which is specifically approved for the purpose by the appropriate ATS authority.

16.8.8.1.3 When conducting a surveillance radar approach, the controller shall comply with the following:

a. at or before the commencement of the final approach, the aircraft shall be informed of the point at which the surveillance radar approach will be terminated;

b. the aircraft shall be informed when it is approaching the point at which it is computed that descent should begin, and just before reaching that point it shall be informed of the obstacle clearance altitude/height and instructed to descend and check the applicable minima;

c. azimuth instructions shall be given in accordance with the precision approach technique (see 16.8.8.2.4);

d. except as provided in 16.8.8.1.4, distance from touchdown shall normally be passed at every 2 km (each NM);

e. pre-computed levels through which the aircraft should be passing to maintain the glide path shall also be transmitted at every 2 km (each NM) at the same time as the distance;

f. the surveillance radar approach shall be terminated:

i. at a distance of 4 km (2 NM) from touchdown, except as provided in 16.8.8.1.4; or

ii. before the aircraft enters an area of continuous radar clutter; or

iii. when the pilot reports that a visual approach can be effected; whichever is the earliest.

16.8.8.1.4 When, as determined by the appropriate ATS authority, the accuracy of the radar equipment permits, surveillance radar approaches may be continued to the threshold of the runway, or to a prescribed point less than 4 km (2 NM) from touchdown, in which case:

a. distance and level information shall be given at each km (each half NM);

b. transmission should not be interrupted for intervals of more than five seconds while the aircraft is within a distance of 8 km (4 NM) from touchdown;

c. the controller should not be responsible for any duties other than those directly connected with a particular approach.

16.8.8.1.5 Levels through which the aircraft should pass to maintain the required glide path, and the associated distances from touchdown, shall be pre-computed and displayed in such a manner as to be readily available to the controller concerned.

Note. See the Air Traffic Services Planning Manual (Doc 9426) regarding pre-computation of levels.

16.8.8.2 Precision Radar Approach

16.8.8.2.1 DUTIES OF PRECISION APPROACH CONTROLLER

During the period the controller is engaged in giving a precision approach, the controller should not be responsible for any duties other than those directly connected with that particular approach.

16.8.8.2.2 TRANSFER OF CONTROL

Aircraft to be provided with a precision radar approach shall have been transferred to the controller in charge of the precision approach at a distance of not less than 2 km (1 NM) from the point of interception of the glide path, unless otherwise provided by the appropriate ATS authority.

16.8.8.2.3 COMMUNICATIONS

When control of the aircraft is assumed by the controller in charge of the precision approach, a communications check shall be made on the channel to be used during the precision approach and the pilot shall be advised that no further acknowledgement of transmission is required. Thereafter, transmission should not be interrupted for intervals of more than five seconds while the aircraft is on final approach.

16.8.8.2.4 AZIMUTH INFORMATION AND CORRECTIONS

16.8.8.2.4.1 The pilot shall be informed at regular intervals of the aircraft's position in relation to the extended centre line of the runway. Heading corrections shall be given as necessary to bring the aircraft back on to the extended centre line.

16.8.8.2.4.2 In the case of azimuth deviations, the pilot should not take corrective action unless specifically instructed to do so.

16.8.8.2.5 ELEVATION INFORMATION AND ADJUSTMENTS

16.8.8.2.5.1 The aircraft shall be informed when it is approaching the point of interception of the glide path and, just before intercepting the glide path, it shall be instructed to begin its descent and to check the applicable decision altitude/height. Thereafter, the aircraft shall be informed at regular intervals of its position in relation to the glide path. When no corrections are required, the aircraft should be informed at regular intervals that it is on the glide path. Deviations from the glide path shall be given to the aircraft, together with instructions to adjust the rate of descent if the corrective action taken by the aircraft does not appear to be sufficient. The aircraft shall be informed when it starts to regain the glide path, and immediately before it reaches the glide path.

16.8.8.2.5.2 In the case of deviations from the glide path, the pilot should take corrective action on the basis of the information given by the controller, even though not specifically instructed to do so.

16.8.8.2.5.3 Prior to the aircraft reaching a point 4 km (2 NM) from touchdown, or a greater distance as necessary for faster aircraft, a certain degree of tolerance should be allowed with regard to deviations from the glide path, and elevation information need not specify the actual number of metres (or feet) above or below the glide path unless it is required to emphasize the rate of change or the extent of the displacement.

Thereafter, any deviations from the glide path should be given to the aircraft, preferably in terms of specific distances (meters or feet) above or below the glide path. The use of emphasis in the manner in which the information is transmitted should normally be sufficient to expedite action by the pilot when necessary (e.g. "*STILL* 20 meters (60 feet) too low").

16.8.8.2.5.4 Should the elevation element fail during a precision radar approach, the controller shall inform the aircraft immediately. If possible, the controller shall change to a surveillance radar approach, informing the aircraft of the revised obstacle clearance altitude/height. Alternatively, instructions should be given for a missed approach.

16.8.8.2.6 DISTANCE INFORMATION

The distance from touchdown should be transmitted at intervals of 2 km (1 NM) until the aircraft reaches a distance of 8 km (4 NM) from touchdown. Thereafter distance information should be transmitted at more frequent intervals, priority being given, however, to the provision of azimuth and elevation information and guidance.

16.8.8.2.7 TERMINATION OF A PRECISION RADAR APPROACH

A precision radar approach is terminated when the aircraft reaches the point at which the glide path intercepts the obstacle clearance altitude/height. Nevertheless, information shall continue to be given until the aircraft is over the threshold, or at such distance therefrom as may be specified by the appropriate ATS authority, taking into account the capability of the equipment concerned. The approach may be monitored to touchdown and information may continue to be provided as necessary at the discretion of the controller in charge of the precision approach in which case the aircraft shall be informed when it is over the threshold.

16.8.8.2.8 MISSED APPROACHES

When information provided by the elevation element indicates that the aircraft may be initiating a missed approach, the controller shall take the following action:

a. when there is sufficient time to obtain a reply from the pilot (e.g. when the aircraft is more than 4 km (2 NM) from touchdown), the controller shall transmit the aircraft's height above the glide path and ask if the pilot intends to make a missed approach. If this is confirmed by the pilot, the controller shall pass missed approach instructions (see 16.8.7.1.8);

b. when there is not sufficient time to obtain a reply from the pilot (e.g. when the aircraft is at 4 km (2 NM) or less from touchdown), the precision approach should be continued, emphasizing the aircraft's displacement, and terminated at the normal termination point. If it is apparent from elevation information that the aircraft is making a missed approach, either before or after the normal termination point, the controller shall pass missed approach instructions (see 16.8.7.1.8).

16.9 USE OF ATS SURVEILLANCE SYSTEMS IN THE AERODROME CONTROL SERVICE

16.9.1 Functions

16.9.1.1 When authorized by and subject to conditions prescribed by the appropriate ATS authority, ATS surveillance systems may be used in the provision of aerodrome control service to perform the following functions:

a. flight path monitoring of aircraft on final approach;

b. flight path monitoring of other aircraft in the vicinity of the aerodrome;

c. establishing separation specified in 16.7.4 between succeeding departing aircraft; and

d. providing navigation assistance to VFR flights.

16.9.1.2 Special VFR flights shall not be vectored unless special circumstances, such as emergencies, dictate otherwise.

16.9.1.3 Caution shall be exercised when vectoring VFR flights so as to ensure that the aircraft concerned does not inadvertently enter instrument meteorological conditions.

16.9.1.4 In prescribing conditions and procedures for the use of ATS surveillance systems in the provision of aerodrome control service, the appropriate ATS authority shall ensure that the availability and use of an ATS Surveillance system will not be detrimental to visual observation of aerodrome traffic.

Note. Control of aerodrome traffic is in the main based on visual observation of the manoeuvring area and the vicinity of the aerodrome by the aerodrome controller.

16.9.2 Use of surface movement radar (SMR)

Note. Requirements concerning the provision of SMR are contained in Annex 14, Volume I, Chapter 9. Guidance material on the use of SMR is contained in the Air Traffic Services Planning Manual (Doc 9426), Part II.

16.9.2.1 GENERAL PROVISIONS

16.9.2.1.1 The use of SMR should be related to the operational conditions and requirements of the particular aerodrome (i.e. visibility conditions, traffic density and aerodrome layout).

16.9.2.1.2 SMR systems shall to the extent possible enable the detection and display of the movement of all aircraft and vehicles on the manoeuvring area in a clear and unambiguous manner.

16.9.2.1.3 Aircraft and vehicle position indications may be displayed in symbolic or non-symbolic form. Where labels are available for display, the capability should be provided for inclusion of aircraft and vehicle identification by manual or automated means.

16.9.2.2 FUNCTIONS

16.9.2.2.1 SMR should be used to augment visual observation of traffic on the manoeuvring area and to provide surveillance of traffic on those parts of the manoeuvring area which cannot be observed visually.

16.9.2.2.2 The information displayed on an SMR display may be used to assist in:

a. monitoring of aircraft and vehicles on the manoeuvring area for compliance with clearances and instructions;

b. determining that a runway is clear of traffic prior to a landing or take-off;

c. providing information on essential local traffic on or near the manoeuvring area;

d. determining the location of aircraft and vehicles on the manoeuvring area;

e. providing directional taxi information to aircraft when requested by the pilot or deemed necessary by the controller. Except under special circumstances, e.g. emergencies, such information should not be issued in the form of specific heading instructions; and

f. providing assistance and advice to emergency vehicles.

16.9.2.3 IDENTIFICATION OF AIRCRAFT

Where SMR is used, aircraft may be identified by one or more of the following procedures:

a. by correlating a particular position indication with:

i. an aircraft position visually observed by the controller;

ii. an aircraft position reported by the pilot; or

iii. an identified position indication displayed on a situation display;

b. by transfer of identification when authorized by the appropriate ATS authority; and

c. by automated identification procedures when authorized by the appropriate ATS authority.

16.10 EMERGENCIES, HAZARDS AND EQUIPMENT FAILURES

16.10.1 Emergencies

16.10.1.1 In the event of an aircraft in, or appearing to be in, any form of emergency, every assistance shall be provided by the controller, and the procedures prescribed herein may be varied according to the situation.

16.10.1.2 The progress of an aircraft in emergency shall be monitored and (whenever possible) plotted on the situation display until the aircraft passes out of coverage of the ATS surveillance system, and position information shall be provided to all air traffic services units which may be able to give assistance to the aircraft. Transfer to adjacent sectors shall also be effected when appropriate.

Note. If the pilot of an aircraft encountering a state of emergency has previously been directed by ATC to select a specific transponder code and/or an ADS – B emergency mode, that code/mode will normally be maintained unless, in special circumstances , the pilot has decided or has been advised otherwise. Where ATC has not requested a code or emergency mode to be set, the pilot will set the transponder to Mode A Code 7700 and/or the appropriate ADS-B emergency mode.

16.10.2 Collision hazard information

16.10.2.1 When an identified controlled flight is observed to be on a conflicting path with an unknown aircraft deemed to constitute a collision hazard, the pilot of the controlled flight shall, whenever practicable:

a. be informed of the unknown aircraft, and if so requested by the controlled flight or if, in the opinion of the controller, the situation warrants, a course of avoiding action should be suggested; and
b. be notified when the conflict no longer exists.

16.10.2.2 When an identified IFR flight operating outside controlled airspace is observed to be on a conflicting path with another aircraft, the pilot should:

a. be informed as to the need for collision avoidance action to be initiated, and if so requested by the pilot or if, in the opinion of the controller, the situation warrants, a course of avoiding action should be suggested; and

b. be notified when the conflict no longer exists.

16.10.2.3 Information regarding traffic on a conflicting path should be given, whenever practicable, in the following form:

a. relative bearing of the conflicting traffic in terms of the 12-hour clock;

b. distance from the conflicting traffic in kilometres (nautical miles);

c. direction in which the conflicting traffic appears to be proceeding;

d. level and type of aircraft or, if unknown, relative speed of the conflicting traffic, e.g. slow or fast.

16.10.2.4 Pressure-altitude-derived level information, even when unverified, should be used in the provision of collision hazard information because such information, particularly if available from an otherwise unknown aircraft (e.g. a VFR flight) and given to the pilot of a known aircraft, could facilitate the location of a collision hazard.

16.10.2.4.1 When the pressure-altitude-derived level information has been verified, the information shall be passed to pilots in a clear and unambiguous manner. If the level information has not been verified, the accuracy of the information should be considered uncertain and the pilot shall be informed accordingly.

16.10.3 Failure of equipment

16.10.3.1 AIRCRAFT RADIO TRANSMITTER FAILURE

16.10.3.1.1 If two-way communication is lost with an aircraft, the controller should determine whether or not the aircraft's receiver is functioning by instructing the aircraft on the channel so far used to acknowledge by making a specified manoeuvre and by observing the aircraft's track, or by instructing the aircraft to operate IDENT or to make SSR code and/or ADS-B transmission changes.

Note 1. Transponder – equipped aircraft experiencing Radiocommunication failure will operate the transponder on Mode A Code 7600.

Note 2. ADS - B – equipped aircraft experiencing radiocommunication failure may transmit the appropriate ADS-B emergency and/or urgency mode.

16.10.3.1.2 If the action prescribed in 16.10.3.1.1 is unsuccessful, it shall be repeated on any other available channel on which it is believed that the aircraft might be listening.

16.10.3.1.3 In both the cases covered by 16.10.3.1.1 and 16.10.3.1.2, any manoeuvring instructions shall be such that the aircraft would regain its current cleared track after having complied with the instructions received.

16.10.3.1.4 Where it has been established by the action in 16.10.3.1.1 that the aircraft's radio receiver is functioning, continued control can be effected using SSR code/ADS-B transmission changes or IDENT transmissions to obtain acknowledgement of clearances issued to the aircraft.

16.10.3.2 COMPLETE AIRCRAFT COMMUNICATION FAILURE

When a controlled aircraft experiencing complete communication failure is operating or expected to operate in an area and at flight levels where an ATS surveillance service is applied, separation specified in 16.7.4 may continue to be used.

However, if the aircraft experiencing the communication failure is not identified, separation shall be applied between identified aircraft and all unidentified aircraft observed along the expected route of the aircraft with the communication failure, until such time as it is known, or can safely be assumed, that the aircraft with radiocommunication failure has passed through the airspace concerned, has landed, or has proceeded elsewhere.

16.10.3.3 AIRCRAFT TRANSPONDER FAILURE IN AREAS WHERE THE CARRIAGE OF A FUNCTIONING TRANSPONDER IS MANDATORY

16.10.3.3.1 When an aircraft experiencing transponder failure after departure is operating or expected to operate in an area where the carriage of a functioning transponder with specified capabilities is mandatory, the ATC units concerned should endeavour to provide for continuation of the flight to the aerodrome of first intended landing in accordance with the flight plan. However, in certain traffic situations, either in terminal areas or en-route, continuation of the flight may not be possible, particularly when failure is detected shortly after take-off. The aircraft may then be required to return to the departure aerodrome or to land at the nearest suitable aerodrome acceptable to the operator concerned and to ATC.

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16.10.3.3.2 In case of a transponder failure which is detected before departure from an aerodrome where it is not practicable to effect a repair, the aircraft concerned should be permitted to proceed, as directly as possible, to the nearest suitable aerodrome where repair can be made.

When granting clearance to such aircraft, ATC should take into consideration the existing or anticipated traffic situation and may have to modify the time of departure, flight level or route of the intended flight. Subsequent adjustments may become necessary during the course of the flight.

16.10.4 FAULT REPORTING

The radar controller shall report to the watch supervisor or senior controller on duty any fault in the equipment, or any circumstances such as radar clutter which make it difficult or impractical to provide radar service.

16.10.5 ATS SURVEILLANCE SYSTEM FAILURE

16.10.5.1 In the event of complete failure of the ATS surveillance system where air-ground communications remain, the controller shall:

a. plot the positions of all aircraft already identified, take the necessary action to establish procedural separation between the aircraft; and

b. if necessary, limit the number of aircraft permitted to enter the area.

16.10.5.2 As an emergency measure, use of flight levels spaced by half the applicable vertical separation minimum may be resorted to temporarily if standard procedural separation cannot be provided immediately. In such cases, essential traffic information shall be relayed to all aircraft involved.

16.10.6 DEGRADATION OF AIRCRAFT POSITION SOURCE DATA

In order to reduce the impact of a degradation of aircraft position source data, for example, a receiver autonomous integrity monitoring (RAIM) outage for GNSS, the appropriate ATS authority shall establish contingency procedures to be followed by control positions and ATC units in the event of data degradation.

16.10.7 GROUND RADIO FAILURE

16.10.7.1 In the event of complete failure of the ground radio equipment used for control, the controller shall, unless able to continue to provide the ATS surveillance service by means of other available communication channels, proceed as follows:

a. without delay inform all adjacent control positions or ATC units, as applicable, of the failure;

b. apprise such positions or units of the current traffic situation;

c. request their assistance, in respect of aircraft which may establish communications with those positions or units, in establishing and maintaining separation between such aircraft; and

d. instruct adjacent control positions or ATC units to hold or re-route all controlled flights outside the area of responsibility of the position or ATC unit that has experienced the failure until such time that the provision of normal services can be resumed.

16.10.7.2 In order to reduce the impact of complete ground radio equipment failure on the safety of air traffic, the appropriate ATS authority should establish contingency procedures to be followed by control positions and ATC units in the event of such failures. Where feasible and practicable, such contingency procedures should provide for the delegation of control to an adjacent control position or ATC unit in order to permit a minimum level of services to be provided as soon as possible, following the ground radio failure and until normal operations can be resumed.

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