USE OF RADAR IN THE APPROACH CONTROL SERVICE

1. Introduction

The indications presented on the ATS surveillance system named radar may be used to perform the aerodrome, approach and en-route control service:

At IVAO, the ATS surveillance system is the software IvAc which simulates a secondary radar.

In this document, all items referred to as “ATS surveillance systems” in official regulations documentation is translated by the generic word “radar” as IVAO only provides a secondary radar system.

2. Radar in the air traffic control service

Direct pilot controller communications shall be established prior to the provision of radar services.

The number of aircraft simultaneously provided with ATS surveillance services **shall not exceed that which can safely be handled** in function of:

- the structural complexity of the control area and sector capacity
- the functions to be performed within the control area
- the controller workload
- the technical availability of the radar

The radar system can be used in order to help ATC to perform its tasks:

- The information provided by the radar and presented on a situation display may be used to perform the function of air traffic control service:
- Provide radar 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**.
- Provide vectoring to departing aircraft for the purpose of facilitating an expeditious and efficient departure flow and expediting climb to cruising level
- Provide vectoring to aircraft for the purpose of resolving potential conflicts
- Provide vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence
- Provide vectoring to assist pilots in their navigation to or from a radio navigation aid and/or away from or around areas of adverse weather
- Provide separation and maintain normal traffic flow when an aircraft experiences communication failure within the area of coverage
- Maintain flight path monitoring of air traffic

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- When applicable, maintain a watch on the progress of air traffic, in order to provide a procedural control with:
  - Improved position information regarding aircraft under control
  - Supplementary information regarding other traffic
  - Information regarding any significant deviations by aircraft

2.1. Real Life and IVAO differences

In real life, an ATS surveillance system provides:

- Conflict alert (available in IvAc)
- Minimum safe altitude warning (not available in IvAc)
- Conflict prediction (partially available in IvAc with VERA tool only)
- Duplicated SSR code (available in IvAc)
- Aircraft identification (available in IvAc)

In IvAc radar software, today, it is not possible to handle minimum safe altitude warning and extended conflict prediction like in the real ATS surveillance systems.

2.2. Radar identification procedure

Identification of aircraft consists of:

- Aircraft label on radar shall identify the aircraft : aircraft call sign or SSR transponder code (A,C,S or ADS-B) and if available pressure altitude derived level information
- Position indication

At IVAO, the radar label is automatically displayed on the IvAc radar screen if the transponder code is compatible with a controlled code.

The figure shows an identified aircraft plot.

When the radar is not displaying an aircraft label, in order to identify an aircraft, ATC can:

- Correlate a particular radar position indication with the information known
- Correlate the position with an aircraft which is known
- Instruct the pilot to execute one or more changes of heading of 30° or more and correlating the movements of one particular radar position indication
- Correlate the movements of a particular radar position indication with manoeuvres currently executed by an aircraft having so reported
- Change the transponder code and/or use the transponder IDENT procedure

The separation between aircraft is possible when radar provides:

- SSR transponder is mandatory in the area
- Identification of aircraft is established and maintained.

2.3. Position report

An aircraft shall be informed of its position under radar surveillance service in the following circumstances:

- Upon identification (before identification established when necessary)
- When the pilot requests this information
- When the pilot is instructed to resume own navigation after vectoring if the aircraft had been diverted from a previously assigned route
- Immediately before termination of ATS surveillance service, if the aircraft is observed to deviate from its intended route

Position information can be one of the following possibilities:

- A well-known geographical position
- Magnetic track and distance to a significant point, an en-route navigation aid, or an approach aid
- direction and distance from a known position
- distance to touchdown, if the aircraft is on final approach
- distance and direction from the centre line of an ATS route

2.4. Separation

2.4.1. Vertical separation minimum

The vertical separation minimum (VSM) is 300m (1000ft) below FL290 and 600m (2000ft) above FL290.

For the airspace where the reduced vertical separation minimum (RVSM) is applicable, the separation minimum is 300m (1000ft) below FL410 and 600m (2000ft) above FL410.

2.4.2. Default horizontal separation minimum

The horizontal separation minimum based on radar and/or ADS-B shall be 5NM (9.3km).

In some cases, the horizontal separation may be reduced to 3NM or 2.5NM. Please consult the “IFR separation using radar” document to read the information about the application of this reduced separation.

2.5. Speed control

A controller may, in order to facilitate sequencing or to reduce the need for vectoring, request aircraft to adjust their speed in a specific manner.

2.6. Transfer of control

The transfer point, the direction of flight, specified levels, transfer of communication points and agreed minimum separation between aircraft have been made the subject of specific instructions or of a specific letter of agreement between the 2 adjacent ATC units.

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

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3. Radar vectoring

Vectoring is the process for an air traffic controller to issue to the pilot specific headings which enable the aircraft to maintain the desired track.

When vectoring an aircraft, a controller shall comply with the following points:

- The aircraft shall be vectored along track on which the pilot can monitor the aircraft position with reference to navigation aids. This will minimize the amount of navigational assistance required and alleviate the consequences resulting from air traffic controller radar failure.
- When an aircraft is given its initial vectors diverting it from an assigned route, the pilot shall be informed what the vector is to accomplish and the limit of the vector shall be specified (example: Vectors start at GAKTI intersection for an ILS approach runway 04)
- Aircraft shall not be vectored closer than 2.5NM (4.6km) or a distance equivalent to 1/2 of the separation minimum if it is greater than 5NM, next to another aircraft.
- Controlled flights shall not be vectored into uncontrolled airspace except in the case of emergency or in order to circumnavigate adverse meteorological conditions
- The controller shall issue clearances to IFR aircraft such that the prescribed obstacle clearance will exist at all times until the pilot will resume own navigation.
- Minimum vectoring altitude should be sufficiently high to minimize activation of aircraft ground proximity warning systems.

4. Navigation assistance

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 such deviation is likely to affect the service of the controller

The pilot of an aircraft requesting navigation assistance from an air traffic control unit shall state the reason.

An aircraft which has been informed that it is provided with ATS surveillance service shall be informed immediately when the service is interrupted or terminated.

Pilots shall be informed by the air traffic controller about adverse weather, in good time to permit the pilots to decide on an appropriate course of action to circumnavigate the adverse weather area, if so desired. When vectoring aircraft for circumnavigating an area of adverse weather, the controller shall ascertain that the aircraft can be returned to its intended flight path.

4.1. Emergencies

The progress of an aircraft in emergency shall be monitored and whenever possible plotted on the situation display until the aircraft disappears from the radar system coverage.

Its position information shall be provided to all air traffic services units which may be able to give assistance to the aircraft.

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4.2. Collision hazard

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:

- 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
- be notified when the conflict no longer exists

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

- be informed as to the need for collision avoidance action to be initiated. A course of avoiding action should be suggested if the situation warrants
- be notified when the conflict no longer exists

Information regarding traffic on a conflict path shall be given, whenever practicable, in the following form:

- Relative bearing of the conflicting traffic in terms of the 12-hour clock
- Distance from the conflicting traffic in nautical miles or kilometres
- Direction in which the conflicting traffic appears to be proceeding
- Level and type of aircraft or, if unknown, relative speed of the conflicting traffic

4.3. Aircraft radio transmitter failure

If two-way communication is lost with an aircraft, the controller shall determine whether or not the aircraft's receiver is functioning by instructing the aircraft:

- to make a specified manoeuvre and by observing the aircraft's track,
- to operate IDENT or to make SSR code and ADS-B (text communication for IVAO) changes.

Where it has been established that aircraft's radio receiver is functioning, continued control can be effected using SSR transponder code or ADS-B transmission (text communication for IVAO) change or IDENT transmissions to obtain acknowledgement of clearance issued to the aircraft.
When a controlled aircraft experiencing complete communication failure is operating or expected to operate in a controlled airspace, the controller shall continue to apply adequate separation to all aircraft.

Separation shall be applied between identified aircraft and all unidentified aircraft observed along the expected route of the aircraft with the communication failure.

4.4. Radar failure

In the event of complete failure of the radar system where voice communication remains, the controller shall take the necessary action to establish procedural separation between the aircraft and, if necessary limit the number of aircraft permitted to enter the area.

As an emergency measure, use of flight levels spaced by half the applicable vertical separation minimum may be used as a temporary separation method, if standard procedural separation cannot be provided immediately.

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5. Use of radar in the approach control service

5.1. Radar Functions

The indications presented on the radar system may be used to perform the following additional functions in the provision of approach control service:

- Provide vectoring of arriving traffic on to final approach aids
- Provide flight path monitoring of parallel ILS approach and instruct aircraft to take appropriate action in the event of possible or actual penetration of the no transgression zone (NTZ)
- Provide vectoring of arriving traffic to a point from which a visual approach can be completed
- Provide vectoring of arriving traffic to a point from which a precision radar approach or a surveillance radar approach can be made (partially simulated at IVAO due to IvAc limitations)
- Provide flight path monitoring of other pilot-interpreted approaches
- Provide separation between succeeding departing aircraft
- Provide separation between succeeding arriving aircraft
- Provide separation between a departing aircraft and succeeding departing aircraft

This last item imposes to ATC not to change the arrival flow due to departing traffic.
Departing aircraft shall not jeopardize the arrival sequence.

5.2. Vectoring procedure

Prior to vectoring for approach, the pilot shall be advised of the type of approach and the runway to be used.

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

Aircraft vectored for final approach shall 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 descent point or glide path (if an ILS or radar approach is to be made), and should provide an intercept angle with the final approach track of 45 degrees or less.
- The controller should anticipate the interception manoeuvre and should provide interception about 30sec minimum before the final approach fix or point.
- Whenever an aircraft is assigned a vector which takes it through the final approach track, it will be advised accordingly, stating the reason for the vector. This means that the clearance of the final approach track is issued with the last vector in the interception of the final approach track.
- An aircraft vectored to intercept a final approach aid (ILS, VOR, NDB) 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.
- Vectoring will normally terminate at the time the aircraft leaves the last assigned heading to intercept the final approach track.

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5.3. Separation

The controller is responsible for maintaining separation minimum between succeeding aircraft on the same final approach except that the responsibility may be transferred to the aerodrome controller in accordance with procedures defined by your country regulations and your IVAO division rules, and if the aerodrome controller has a radar system.

5.4. Transfer of control

Transfer of control of succeeding aircraft on final approach to the aerodrome controller shall be done in accordance with procedures prescribed by your country regulations and your IVAO division rules.

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

This means that transferring an aircraft on short final, or beyond 4NM from runway threshold is not the right way to perform this transfer.

If there is no procedure, the transfer of control should be done when the aircraft has intercepted the final approach track but not before 15NM from the runway threshold.

5.5. Vectoring radar before visual approach

The controller may initiate a vectoring of an aircraft for visual approach and meteorological conditions are such that, with reasonable assurance, a visual approach and landing can be completed.

Clearance for visual approach shall be issued only after the pilot has reported the aerodrome or the preceding aircraft in sight, at which time vectoring will normally be terminated.

5.6. Radar approaches:

There are two types of radar approaches: Precision (PAR) and Surveillance (ASR). Controllers conducting radar approach shall be in possession of information regarding the obstacle clearance altitude/heights established for the type of approach to be conducted. (For the IVAO network, each controller shall have charts of their area of responsibility).

In aviation, approach surveillance radar (ASR or SRA) is a type of radar instrument approach provided with active assistance from air traffic control. The only airborne radio equipment required for radar approaches is a functioning radio transmitter and receiver.
The radar controller vectors the aircraft to align it with the runway centreline. The controller continues the vectors to keep the aircraft on course until the pilot can complete the approach and landing by visual reference to the surface.

As these approaches are specific and used mainly in military airfields, and as the **IVAC controller tool is not fully compatible with them,** we do not develop this subject in this document.

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When authorized by country regulations and IVAO division air traffic control operation rules, radar systems may be used in the provision of aerodrome control service to perform the following functions:

- Flight path monitoring on final approach
- Flight path monitoring of other aircraft in the vicinity of the aerodrome
- Establishing separation between succeeding departing aircraft
- Providing navigation assistance to VFR flights

Special VFR shall not be vectored unless under special circumstances, such as emergencies.

Normal VFR should not be vectored unless under special circumstances (emergencies, assistance requested by pilot) or specific regulations depending on the airspace class. The controller shall ensure that the VFR aircraft vectored does not inadvertently enter instrument meteorological conditions (IMC).

In real life, the use of an ATS surveillance system like radar **will not be detrimental to visual observation of aerodrome traffic**.

But at IVAO, the radar simulated by IvAc software is today the primary method to control an aerodrome airfield due to the better performance provided by this system than the view created by a flight simulator system which simulates the external visual observation of the manoeuvring area.

The IvAc Radar can be used as surface movement radar and the controller uses it to assist with:

- Monitoring of aircraft and vehicles on the manoeuvring area for compliance with clearance and instructions
- Determining that a runway is clear of traffic prior to a landing or take off
- Providing information on the local traffic on or near the manoeuvring area
- Determining the location of aircraft and vehicles on the manoeuvring area
- Providing directional taxi information to aircraft when requested by the pilot or deemed necessary by the controller

6. Use of ATS surveillance systems in the flight information service

The radar information may be used to provide identified aircraft with:

- Information regarding any aircraft observed to be on a conflicting path with the identified aircraft and, suggestions or advices regarding avoiding actions.
- Information on the position of significant weather
- Information to assist the aircraft in its navigation when requested by the pilot or deemed necessary by the controller

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