

**COMMON EUROPEAN PROCEDURES
FOR THE AUTHORIZATION OF
CATEGORY II AND III OPERATIONS**

(Issue 3)

PREAMBLE

The first edition of this document issued in January 1979 contained all ECAC requirements applicable as of that date for the conduct of Category II and Category III operations which were additional to those contained in ICAO Circular 121-AN/90 (1974).

At its fourth meeting in 1981, the ICAO Operations Panel (OPSP) completed the development of material designed to give guidance to States on the authorization and subsequent control of all-weather operations when take-off and landing are performed in conditions where visual reference is limited by weather conditions. This guidance was issued in the ICAO Manual of All-Weather Operations (Doc No. 9365-AN/910) incorporating material relevant to Category II and III operations and superseding ICAO Circular No. 121-AN/90.

Although the first edition of ECAC/CEAC Doc No. 17 was taken into account by OPSP, the ICAO Manual of All-Weather Operations does not fully reflect procedures developed by ECAC Member States for the conduct of Category II and III operations. The ECAC Working Group on All-Weather Operations (AWO) therefore submitted proposals for supplementary material on the basis of which the second issue of this document was prepared and its implementing Recommendation INT.S/13-4 was developed by the Technical Committee and adopted by the Thirteenth Intermediate Session (INT.S/13, June 1983). Subsequently, endorsing additional proposals by the Technical Committee stemming from AWO's work, the Twelfth Triennial Session (ECAC/12, June 1985), and the Sixteenth Intermediate Session (INT.S/16, June 1987), amended Recommendation INT.S/13-4 with a view to incorporating in it operative clauses on the commencement and continuation of approach and on Category II and III operations by business aviation. Recommendation INT.S/13-4 amended accordingly is reproduced on pages A-3 and A-4 of the present third issue of ECAC/CEAC Doc No. 17 which also incorporates in its Part A all amendments approved by Plenary Sessions up to and including ECAC/13 (June 1988).

Part B of this document contains guidelines for the provision of facilities and the establishment of procedures for aircraft ground operations under limited visibility with a view to improving flight safety during ground manoeuvring phases and to enhance runway protection, particularly during low-visibility operations. These guidelines were prepared by AWO under the guidance of the Technical Committee following concern expressed about the increasing number of ground accidents, some of which resulted in fatalities. The implementing Recommendation INT.S/15-2 adopted by the Fifteenth Intermediate Session (INT.S/15, June 1986) is reproduced on page B-3 of this document.

Part C of this document contains ECAC requirements for mutual acceptance of recurrent inspections flight simulators within ECAC Member States, developed by the AWO working group following a survey which had highlighted commonalities in Member States' flight simulators inspection procedures and taking into account regulations in the United States (FAA-AC/120-40) or in preparation in Europe. The implementing Recommendation INT.S/16-2 adopted by the Sixteenth Intermediate Session (INT.S/16, June 1987) is reproduced on page C-3 of this document.

Attention is drawn to the fact that ECAC requirements referred to in Recommendation INT.S/13-4 and Recommendation INT.S/15-2 are additional to those contained in ICAO Doc 9365-AN/910 (Manual of All-Weather Operations, hereinafter referred to as "the Manual") and in ICAO Doc 9476-AN/927 (Manual of Surface Movement Guidance and Control Systems). It is essential that the material contained in this document, which is a composite of requirements, narrative text and examples of States' practices, be read in conjunction with the above manuals and with any further relevant material which may be developed by ICAO.

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ICAO REFERENCES

- Doc 8168 – Procedures for Air Navigation Services
– Aircraft operations PANS-OPS
 - Doc 9365-AN/910 – Manual of All-Weather Operations
 - Doc 9328-AN/908 – Manual of Runway Visual Range
Observing and Reporting Practices
 - Doc 9476-AN/927 – Manual of Surface Movement Guidance and Control Systems
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PART A

**COMMON EUROPEAN PROCEDURES
FOR THE AUTHORIZATION OF
CATEGORY II AND III OPERATIONS**

RECOMMENDATION INT.S/13-4
COMMON EUROPEAN PROCEDURES FOR THE AUTHORIZATION OF
CATEGORY II AND CATEGORY III OPERATIONS

*(Adopted by the Thirteenth Intermediate Session on 4 June 1983 and amended by the
Twelfth Triennial Session on 18 June 1985 and by the Sixteenth Intermediate Session on
16 June 1987)*

WHEREAS ECAC Member States, having accepted an expressed need to facilitate all-weather operations by business aviation aeroplanes within the ECAC region, have agreed that these operations should be in accordance with mutually acceptable criteria for the conduct of Category II and Category III operations which recognize the differences between business aviation operations and those of commercial air transport;

WHEREAS they also agreed that the development of such standardized requirements or procedures should not overlap any related ICAO activities, they have recognized that the guidance material which has been developed by ICAO for authorization of Category II and Category III operations does not fully satisfy the need for standardized requirements which would facilitate the mutual acceptance among Member States of the various national regulations;

WHEREAS since the adoption by DGCA/40 on 14 December 1978 of a recommendation concerning common European procedures for the authorization of Category II and Category III operations by foreign aircraft, further progress has been made with respect to the development of such common procedures,

THE CONFERENCE RECOMMENDS that

- 1) the aerodrome facilities, the airborne equipment, the operating procedures utilized, the flight crew qualification and training and the establishment of aerodrome operating minima should be in compliance with the requirements for the authorization of Category II and Category III operations detailed in ECAC.CEAC Doc No. 17, Issue 2;
- 2) when considering Category II and III international operations by business aeroplanes, States should apply the provisions of Chapter 7 in ECAC.CEAC Doc No. 17, Issue 2, concerning business aviation

since, where necessary, it adds to or modifies the other requirements for the authorization of Category II and Category III operations detailed in that document;

- 3) the airworthiness certification of the aircraft and its equipment for Category II and Category III operations should be in compliance with Joint Airworthiness Requirements or Federal Airworthiness Regulations;

Note : This is not meant to preclude acceptance of operations by aircraft types in current service which have been certificated in accordance with the requirements of France or the United Kingdom.

- 4) when preparing regulations for the implementation of Category II and Category III operations, Member States should refer for guidance to the documents listed in ECAC.CEAC Doc No. 17, Issue 2, Chapter 8;
- 5) to facilitate Category II and Category III operations by operators of Member States at airports outside their State, each Member State should recognize regulations of other Member States when such regulations are formulated in compliance with the criteria in ECAC.CEAC Doc No. 17, Issue 2; where Member States require notification of aerodrome operating minima which is to be applied by foreign operators in their territory, the authorization to carry out Category II and Category III operations issued by the State of the operator should include a statement that the conditions and regulations under which the authorization is granted are in compliance with ECAC.CEAC Doc No. 17, Issue 2; this should entitle the operator to an automatic acceptance of the operation and the associated operating minima; and
- 6) in complying with ICAO Annex 6, Part 1, Chapter 4, paragraph 4.4.1.2, Member States should formulate rules and regulations in accordance with the criteria in ECAC.CEAC Doc No. 17, Issue 2, Chapter 3, paragraph 3.2, and

DECLARES that this recommendation supersedes Recommendation ECAC/10-17 (first adopted by DGCA/40 on 13-14 December 1978).

CHAPTER 1

AERODROME FACILITIES

1.1 Initial planning and safety assessment

1.1.1 When a runway is to be upgraded to make it suitable for Category II and/or Category III operations, the most important point to be appreciated, during the initial planning phase, is that the lower the visibility the less able the pilot will be to recognize and take action to avoid hazardous situations. It follows that in order to maintain the overall level of safety, a generally higher level of integrity must be achieved in the facilities and procedures which make up the ground environment. In a number of States it has been found that an effective way to ensure that all the elements in the ground environment are properly integrated into the total system is to form a working group composed of representatives of all the sections that are concerned with the improvement. These should normally include the aerodrome operating authority, air traffic services, meteorological services, the major operators and the section responsible for improving the approach aids. The task of such a working group is to establish a preparatory process which will include a timetable for the completion of the necessary preliminary studies, for the installation of visual and non-visual aids and for the development of the procedures required to ensure the safety of the operation. An alternative satisfactory procedure has been to nominate a coordinator who, in liaison with the sections concerned, has been responsible for the accomplishment of the whole task.

1.1.2 No matter how the initial planning is carried out, a preliminary safety assessment must be carried out to establish whether an adequate level of safety can be achieved during low visibility operations. The aim of the assessment is to estimate the level of risk of accident occurring as a result of an inadvertent intrusion by an aircraft or a vehicle on the runway, which would result in a collision with an aircraft landing, or taking off, in low visibilities or which would result in a disturbance of the ILS signal large enough to result in an accident occurring to a landing aircraft. During this exercise the runway and taxiway lay-out should be examined to discover whether it is possible for aircraft taxiing or holding for take-off to be kept clear of the inner approach surface, the inner transitional surface and the balked landing surface as defined in Annex 14 (obstacle free zone) and also clear of the ILS sensitive areas. The road access points round the aerodrome perimeter should be studied to find out whether an inadvertent intrusion could occur in limited visibility, and a review should be carried out of the instructions to personnel who are authorized to drive vehicles on taxiways, aprons and associated access roads. This cannot be anything but an arbitrary assessment but if the use of the procedures and security arrangements normally used for Category I operations are judged inadequate for Category II or Category III operations, special procedures for the control of the ground movement of aircraft and vehicles will be required as well as special security arrangements.

1.2 Physical characteristics of aerodromes

1.2.1 Runways and taxiways

The requirements governing the physical characteristics of runways and taxiways should be those referred to in the ICAO Manual, Chapter 5, paragraph 5.2.2.1.

1.2.2 Obstacle clearance criteria

The requirements for obstacle clearance should be those referred to in the ICAO Manual, Chapter 5, paragraphs 5.2.2.2 and 5.4.

1.2.3 Pre-threshold terrain

The requirements governing the characteristics of pre-threshold terrain should be those contained in the ICAO Manual, Chapter 3, paragraph 3.2.2.3 and Chapter 5, paragraphs 5.2.2.3.1 and 5.2.2.3.2.

1.3 Visual aids

1.3.1 Approach lighting

The requirements for approach lighting should be those referred to in the ICAO Manual, Chapter 5, paragraph 5.2.3.1. Sequenced strobe lighting is considered to be not

compatible with Category II and Category III operations and where such lights are installed for other operations they should be switched off when Category II and Category III operations are in progress.

1.3.2 Runway lighting and marking

The requirements for runway threshold lights, runway edge lighting, end lighting and marking, centre-line lighting and marking and TDZ lighting and marking, should be those in the ICAO Manual, Chapter 5, paragraph 5.2.3.1.

1.3.3 Taxiway lighting and marking

1.3.3.1 The requirements for taxiway lighting and marking should be those in the ICAO Manual, Chapter 5, paragraphs 5.2.3.2 and 5.2.3.3. Experience has shown that taxiway edge lighting combined with centre-line marking is adequate for Category II operations and for Category III operations with RVR minima down to 150 metres, but for operations with RVR minima less than 150 metres, centre-line lights are essential to mark the runway exit point and at least one taxiway route between the runway and the apron. Experience has further shown that low intensity lights are of little use in daylight and that improved centre-line marking is required. Pattern coding of the centre-line markings so as to indicate the proximity and the direction of a curve has been found to be of value in some States. Centre-line lights with an intensity of 80 candelas have been found to be effective at night in RVRs down to 75 metres but higher intensity lights are required by day in visibilities of this order on complicated taxiway routes.

1.3.3.2 The need to give greater protection against intrusion on the runway and into the sensitive areas and the obstacle free zone (OFZ) during Category II and III operations makes it essential for clearly defined holding positions to be installed at entry points to the runway. For operations with RVRs down to 150 metres, taxi-holding position markings painted on the taxiway surface are not always by themselves adequate and they may need to be reinforced by some additional means of identifying the position such as flashing red lights on each side of the taxiway level with the holding position. For operations with RVRs less than 150 metres, remotely controlled stopbars made up of red lights across the width of the taxiway at the holding position are required unless runway security can be provided by other means such as suitable radar equipment for continuous monitoring of ground movement.

1.4 Non-visual aids

1.4.1 The requirements for the ILS ground equipment should be those in the ICAO Manual, Chapter 5, paragraphs 5.2.4.1 to 5.2.4.6.

1.4.2 The signal-in-space may be degraded by re-radiated ILS signals and positive steps should be taken to minimize their effects. These include the use of wide aperture antenna systems for course sector coverage and clearance signal techniques to protect against the effects of re-radiation from structures on the airport and from aircraft on the ground. Standard procedures for the protection of ILS critical areas are defined in Annex 10 but the size and shape of sensitive areas will depend on the characteristics of the particular ILS and the configuration of the particular environment. For Category II operations protection of the OFZ normally provides adequate protection for the appropriate sensitive area. For Category III operations a larger area is required. At Attachment A to this chapter is a diagram of the area safeguarded by one Member State for all Category III operations, including those with no decision height utilizing a fail-operational roll-out system; the area safeguarded by another Member State for Category III operations with a decision height is shown in the diagram at Attachment B to this chapter.

1.4.3 Another possible cause of degradation of the signal-in-space, though less likely, is the presence of extraneous interfering signals such as those emanating from radio and television transmitters or from CB radios. Periodic measurements should be made and the level of any signals detected then compared with an accepted maximum level. Such measurements can be made by positioning a wide frequency band receiver in the vicinity of the middle marker. Complaints by flight crews of signal disturbances should be investigated and special flight checks should be made when there is reason to believe that serious interference is occurring.

1.4.4 3 digits are used to describe the ILS installations.

- a) The first one (I, II or III) gives the compliance with performances described in Annex 10 (white pages) for both localizer and glide-path equipment.
- b) The second one (A, B, C, T, D or E) indicates to which extent the localizer course structure (only) meets course structure requirements for performance Category III (Annex 10, para. 3.1.3.4.2).
- c) The third one (1, 2, 3 or 4) indicates the level of integrity and continuity of service.

Note : This last digit is important to consider, from an operational point of view, in establishing the category of operations which the ILS can support (Cat. I, II or III).

1.4.5 Relationship between category of operation and ILS class

1.4.5.1 The first digit is I

For all classes of ILS, the requirement for course structure is the same up to the point A. The second digit is then at least A. If it is B, C, T, D or E that means that **only the course structure** is better than the minimum one required for Category I facility performance but other performance parameters (e.g., the monitoring alarm limit, the maximum duration of out of tolerance signal radiation, etc...) forbid Category II or III operations. Nevertheless, this second digit is very useful to know to which extent the autopilot can be used (without changing the Cat. I minimums).

1.4.5.2 The first digit is II

Annex 10 requirements imply that in this case the second digit must be at least T. If the second digit is D or E, the course structure is better than the minimum required. But other performance parameters forbid Category III operations.

However, Category II operations can only be contemplated if the third digit is at least 2.

1.4.5.3 The first digit is III

The course structure requirement implies that in this case the second digit must be only E. Nevertheless, a D is suitable for operation of Category III without automatic roll-out.

If the third digit is 1 or 2, Category I and respectively II operations can only be contemplated. If the level 3 is reached, the continuity of service is not adequate to cover the automatic roll-out. So, Category III operations have to be limited to Category III with DH. Level 4 is required to support fail-operational roll-out.

1.4.6 Operator's Information

To assist operators in determining the operational capabilities of an ILS installation, ECAC Member States should classify it in compliance with paragraph 1.4.4 and publish the basic status of the ILS installation in AIP.

1.5 Secondary power supplies

The requirements for secondary power supplies should be those referred to in the ICAO Manual, Chapter 5, paragraph 5.2.5.1.

1.6 Aerodrome services

1.6.1 Ground movement control

The requirements for the control of ground movements of aeroplanes and vehicles, including the requirement for security and surveillance procedures, should be those described in the ICAO Manual, Chapter 5, paragraphs 5.3.2.1 and 5.3.2.2.

1.6.2 Air traffic services

1.6.2.1 The following guidance material should be used in the preparation of specific instructions to air traffic controllers and to those responsible for the operation of the aerodrome.

1.6.2.2 Low visibility procedures

1.6.2.2.1 The responsibilities of air traffic control during Category II and Category III operations do not differ from those in other operations. However, since the safety of the operation is much more dependent on the integrity of the ground system than it is in Category I or non-precision operations, additional safeguards are required. Furthermore, the greater complexity in the combinations of airborne and ground systems which are acceptable for Category II and Category III operations makes it essential that air traffic control be in a position to transmit to flight crews accurate and up-to-date information on the status of the various elements of the ground system. This does not mean that the air traffic control should be given the responsibility of deciding whether or not Category II or Category III operations may be carried out. This must always be a decision for the pilot-in-command to take : the function of air traffic control in this instance is to keep the flight crew informed as to the category of operations which the ILS can support (Cat. I, II or III), the quality of the visual aids and of the implementation of low visibility procedures and safeguarding.

1.6.2.2.2 The following are basic principles which should be used in establishing ATC procedures; these are strictly minimum requirements and the procedures must make some allowance to ensure that they are not infringed :

- a) the OFZ must be clear of all obstacles, such as vehicles and aircraft, at all times that an aircraft making an approach (or carrying out a go-around) is below 200 ft;
- b) as in Category I operations, the ILS critical areas must be clear of all vehicles and aircraft whenever the ILS is being used; and
- c) the ILS sensitive areas must be clear of all vehicles and aircraft capable of causing reflection and/or refraction of the signals, at all times that an approaching aircraft is within 1 NM from touchdown until it has completed its landing run, and at all times that an aircraft taking off is using the ILS localizer for guidance during the take-off ground run (see, in particular, para. 1.6.2.2.4).

1.6.2.2.3 The need for procedures to provide security and surveillance against intrusion by vehicles is described in the ICAO Manual, Chapter 5, paragraph 5.3.2.2. At some aerodromes the security arrangements for normal operations may be adequate for Category II or Category III operations, (i.e. where there is a continuous security fence around the aerodrome and the only vehicle access to the manoeuvring area is via the apron) but where there are uncontrolled access points then special procedures will be required to ensure that such access points are secured, e.g. by closing and locking gates, unless special surveillance equipment is available which can detect any vehicle intrusion. The monitoring of the manoeuvring area with such equipment would normally be done by air traffic control, but the actual carrying out of special security procedures could be the responsibility of other appropriate authorities on the aerodrome provided that the air traffic service is kept fully informed. The procedures should also provide for the control of all services on an aerodrome which have access to the aprons and manoeuvring areas including fire fighting and rescue services, fuelling services, catering services, etc.. Positive control of such vehicles should be maintained whenever they are in manoeuvring areas.

1.6.2.2.4 The special ATC procedures which are necessary are referred to in the ICAO Manual, Chapter 5, paragraphs 5.3.3.1 to 5.3.3.4 and, to accord with the basic requirements detailed above, they should provide sufficient separation between successive approaching aircraft, normally to allow the leading aircraft to land, to turn off the runway and to clear the OFZ and the ILS sensitive areas before the following aircraft reaches a point 2 NM from touchdown. The actual size of the separation will depend upon the configuration of the runway and its exit points, but 10 NM between successive aircraft will generally be found to be adequate. At aerodromes where the traffic density is low, or where the range of the approaching aircraft cannot be monitored by radar, the separation may be increased to 12 NM to enable the leading aircraft to clear the runway and ILS sensitive areas before the following aircraft reaches a point 4 NM from touchdown, i.e. about the position of the outer marker. When departing aircraft are using the same runway as arriving aircraft, it is essential that the take-off aircraft pass over the ILS localizer transmitter antenna before the arriving aircraft reaches a point on the approach where the interference caused by the overflight will have a critical effect. The aim should be for the departing aircraft to pass over the localizer antenna before the approaching aircraft reaches a point 2 NM from touchdown. The experience in some Member States is that to achieve this, the departing aircraft must commence its take-off run before the approaching aircraft reaches a point 6 NM from touchdown. The procedures should also accommodate the requirement for aircraft using automatic landing equipment, to be able to carry out a stabilized approach; accordingly, they should allow approaching aircraft to intercept the ILS localizer at a range 10 NM or more from touchdown. Landing clearances should normally be given to approaching aircraft when the OFZ and the ILS sensitive area are clear, normally before the time it reaches a point 2 NM from touchdown; exceptionally a clearance may be delayed to 1 NM from touchdown provided that the flight crew are warned to expect late landing clearance and also provided that the position of the approaching aircraft can be monitored.

1.6.2.2.5 Runway exit points should be kept clear to allow landed aircraft to move out of the OFZ and the localizer sensitive area with no delay; instructions to air traffic controllers should state that if a landed aircraft cannot clear the OFZ and/or the localizer sensitive area, then the runway is not usable for Category II or Category III operations even though the obstructing aircraft may be well clear of the runway itself. If aerodrome surface surveillance radar is available, the procedures should require that it be used to monitor the clearance of the OFZ and/or the ILS sensitive area, but if it is not available traffic should be directed to leave the runway where there is a positive indication to the flight crew that the aircraft is clear of the OFZ and ILS sensitive area, and flight crews be required to report when the aircraft is clear of these areas. This requirement need not be applied where traffic levels are so low as to make it unnecessary to use the minimum separation between aircraft of 10-12 NM.

1.6.2.2.6 With regard to the control of ground movement of departing aircraft and the movement of vehicles, the instructions to ATC should make it clear which taxiway routes may be utilized during Category II or Category III operations and which holding points at runway entries are to be utilized when these differ from those in use during Category I operations. All vehicles in the manoeuvring area should be under radio control and drivers should be informed of any special requirements in the relevant low visibility procedures.

1.6.2.2.7 The responsibility for authorizing the initiation of, and subsequent cancellation of, low visibility procedures should be allocated to an appropriate authority at the aerodrome. In some Member States it has been found that if delay to aircraft operations is to be avoided, the initiation of such procedures should be authorized when the RVR falls to 800 metres or less, or the cloud ceiling is 200 ft or less, but if the weather is deteriorating rapidly, the procedures may be initiated at a higher value of RVR, the precise value being a matter for judgement based on experience at the aerodrome.

1.6.2.2.8 The procedures should include a description of the responsibilities of the various sections which have a part to play, for example :

- a) the sections responsible for the functioning of the visual and non-visual aids should be informed by ATC when low visibility procedures are in force;
- b) they in turn should immediately advise ATC if the performance of those aids deteriorates below the level promulgated;

- c) ATC should advise the sections responsible for the implementation of any safeguarding requirements that low visibility procedures are to be implemented; and
- d) they in their turn should advise ATC when such safeguarding actions are complete.

1.6.2.2.9 ATC instructions should ensure that air traffic controllers are fully informed as to the information that should be passed to flight crews of arriving aircraft. This must include the current RVR values for the landing runway, which should always be given in the order TDZ, midpoint and stopend when multiple reports are available. The value for the TDZ position should always be given but reports for the other positions should normally only be given when either or both the midpoint or stopend values are :

- a) less than the TDZ and less than 800 metres; or
- b) less than 400 metres.

When values for three positions are passed, the positions need not be identified provided that the values are given in the correct order, but when only two reports are given the positions should be identified. If it is not possible to report the RVR for any reason, the meteorological visibility should be given instead. It is an obvious requirement that information on the status of the ground system should be passed as rapidly as possible when any part falls below its promulgated status, but it must also be recognized that in the final stages of a Category II or Category III approach, flight crews will wish to receive only that information which is essential. Any information should be given in a manner which conforms with the requirements for the promulgation of facilities contained in paragraph 1.6.4 below and ATC instructions should make it clear that the responsibility of the air traffic controllers is to make an accurate report to the flight crew of the category of operations which the ILS can support (Cat. I, II or III). As a general rule, the instructions should indicate that a change in the category of operations which the ILS can support (Cat. I, II or III) and changes in the status of aerodrome lighting and RVR assessment equipment should be reported to the flight crews of aircraft that have not passed the outer marker. Failure of circuits of the aerodrome lighting need not be reported provided not more than one third of the lamps are affected and provided the lighting pattern is not distorted. The information to be given to aircraft that have passed the outer marker should be limited to such items as failure of more than one third of the approach, threshold, TDZ, centre-line lights or runway edge lights or a change in the category of operations which the ILS can support (Cat. I, II or III). When the aircraft is 1 NM or less from threshold, any change in the performance category of the ILS need not be reported.

1.6.2.2.10 The instructions which have been developed by two Member States for application at major international aerodromes are included for information as **Attachments C and D** to this chapter.

1.6.3 Meteorological services

1.6.3.1 The requirements for meteorological services should be those described in the ICAO Manual, Chapter 5, paragraphs 5.3.4.1 and 5.3.4.2 with the following additional ECAC requirements.

1.6.3.2 For Category II operations RVR should be assessed at not less than two positions on the runway, normally in the touchdown zone area and in the midpoint area of the runway. For Category III operations RVR should normally be assessed at three positions unless it can be shown that assessments at two positions are adequate for the planned operation. The positions on the runway should be identified as touchdown zone, midpoint and stopend respectively.

1.6.4 Aeronautical Information service

1.6.4.1 The requirements for AIS are described in the ICAO Manual, Chapter 3, paragraphs 3.3.4.1 to 3.3.4.4. Additional ECAC requirements are that special attention should be given to the rapid dissemination of information to flight crews whenever the operating performance of any part of the ground facilities falls below the level at which it has been

promulgated. This is particularly important if the weather conditions are such that Category II or Category III operations are likely.

1.6.4.2 The wording of NOTAMS or AIP entries should not give the impression that such operations are dependent on the availability of any particular part of the ground system, but should give a full description of each part of the system which is available. This should include a description of any special procedures which will be applied as part of the low visibility procedures, together with the trigger point at which they will be implemented by the air traffic service.

1.6.4.3 Where there are a number of aerodromes in a State at which Category II or Category III operations may be carried out, a general entry should be included in the AGA Section of the AIP in addition to the detailed information relating to specific aerodromes.

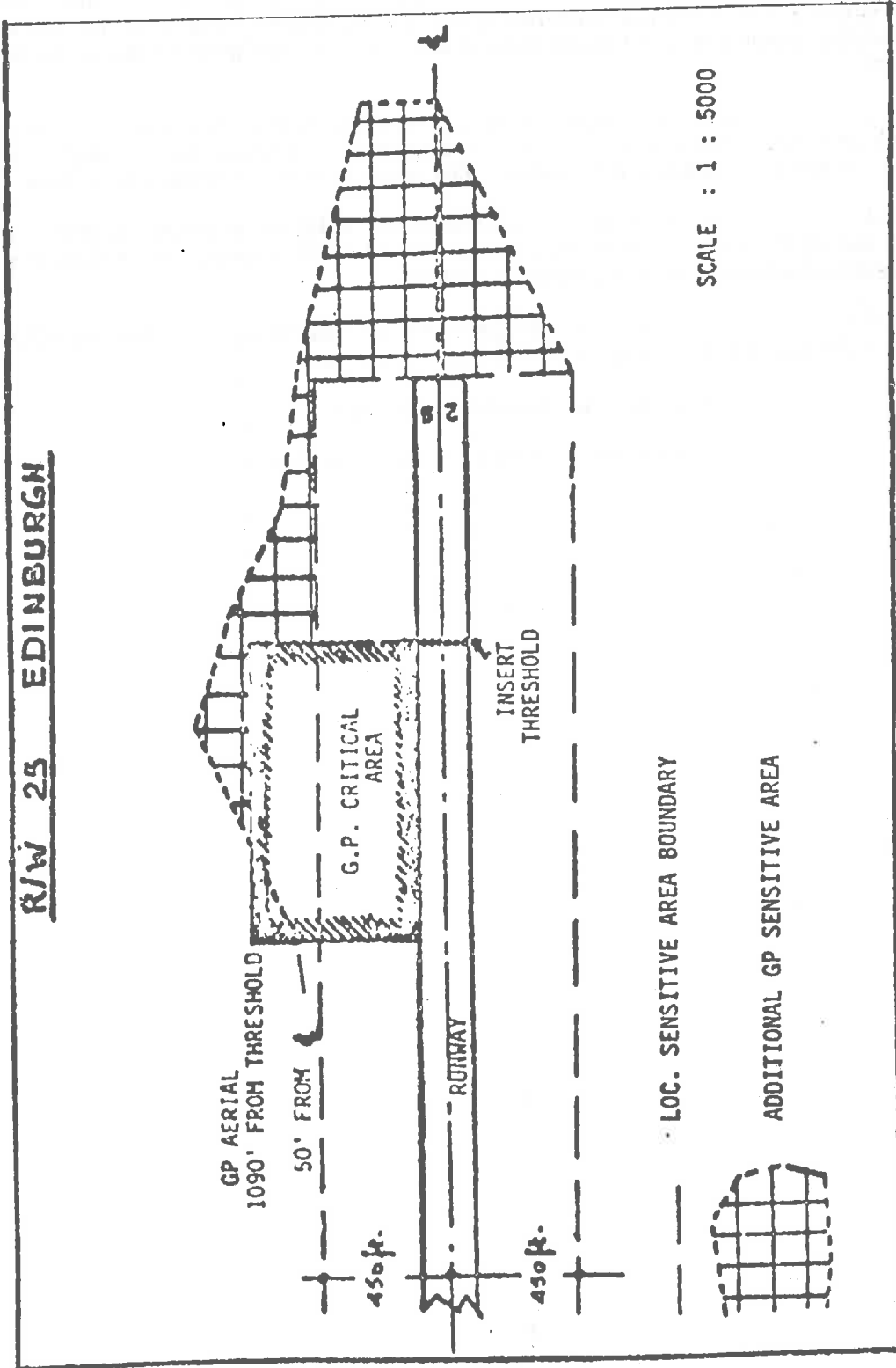
1.6.4.4 It is also recommended that in NOTAMS and in the AIP an entry be made which describes the procedure for foreign operators to obtain authorization for Category II and Category III operations if an authorization is required.

1.6.4.5 The wording which is used by two Member States for entries in a NOTAM and in the AIP is given at **Attachments E and F** to this chapter.

1.7 Use of ILS for coupled approach

See Attachment D to Part 3 AOP of EUR ANP.

CHAPTER 1 — ATTACHMENT A



CHAPTER 3

OPERATING PROCEDURES

3.1 Operating procedures

3.1.1 The operating procedures to be followed during Category II and Category III operations should comply with the requirements described in the ICAO Manual, Chapter 5, paragraphs 5.6.1 to 5.6.5 supplemented by the additional ECAC requirements in the following paragraphs.

3.1.2 For all Category II and Category III operations, the operating procedures should ensure that all height calls below 200 ft are based on the use of the radio altimeter and that one pilot continues to monitor the aeroplane instruments until the landing is completed.

3.1.3 In the development of operating procedures for fail-passive Category III operations, close attention should be paid to the flight deck procedures for final approach. In particular, procedures should be laid down for the operation of the flight control system, for instrument monitoring and for the associated calls and crew drills including the allocation of crew duties intended to cover the items. Account should be taken of possible system failures and the required response to system failure warnings with special emphasis on occurrences below decision height. The procedures should implement or supplement any which are included in the Flight Manual. Below decision height, continuous accurate height information is of great assistance to the handling pilot in the assessment and control of the flare manoeuvre. If special equipment to provide this information is not available, procedures which will require radio heights to be called at frequent intervals should be considered.

3.2 Commencement and continuation of the approach

3.2.1 An approach should be permitted to continue to decision height (DH) provided that at the outer marker, or its equivalent, the runway visual range (RVR) reported for the touchdown zone is not less than the applicable operating minimum. The effect of this recommendation is that the approach may be commenced regardless of the reported RVR, but that it may only be continued past the outer marker, or its equivalent, if at least the reported touchdown zone RVR is equal to or better than the applicable operating minimum. Once past the outer marker the approach may continue to DH regardless of the reported RVR. From DH the approach may be continued to the landing provided that the required visual reference has been established and is maintained. The background to the development of this procedure is given in **Attachment A** to this chapter.

3.2.2 Although the criteria in paragraph 3.2.1 have been developed in relation to Category II and III operations, there is no difference in principle where Category I precision approaches are considered. However, some details may need to be varied in accordance with commonly accepted Category I procedures (e.g. visibility instead of RVR).

CHAPTER 3 — ATTACHMENT A**Background to the criteria for the commencement and continuation of the approach**

A1. In 1983 a questionnaire was sent to all Member States which asked for details of national rules and regulations on the commencement and continuation of the approach. From the responses to the questionnaire it became apparent that States were interpreting the Standard in ICAO Annex 6, Part 1, Chapter 4, paragraph 4.4.1.2 in different ways, and that there were differences as to who was responsible for enforcing the observance of aerodrome operating minima of foreign operators. These differences could confuse flight crews and since this confusion would be more likely to occur in marginal weather conditions there was an obvious effect on safety. Standardization of the criteria for commencing and continuing the approach would eliminate this hazard.

A2. In the late 1970s and early 1980s there was a significant improvement in the quality of automatic flight control systems in aeroplanes and in the associated non-visual and visual ground aids. These improved facilities resulted in much smoother, more stable and more precise approaches and eased the pilots' task during the visual phase of the approach. Consequently it was seen that any standardization of the criteria governing the commencement and continuation of the approach could tend towards some relaxation of the then current criteria so as to permit more approaches to be attempted in the same weather conditions. Such a relaxation was likely to result in a small increase in missed approaches, but the improved aeroplane and non-visual ground aids had reduced the risk in a non-visual missed approach to a point where it was not higher than in a landing.

A3. As the ultimate in relaxation, it could be argued that since RVR is not always representative of what the pilot will see at DH, he should always be permitted to descend to DH and decide there, on the basis of what he actually sees, whether to land or make a missed approach. Unfortunately, there is considerable evidence from accidents, flight trials and simulations that in the highly dynamic situation at DH the pilot is not always able to make the correct decision in marginal conditions. Therefore, it is prudent to prohibit the commencement or continuation of the approach if conditions at DH are likely to be unfavourable for landing.

A4. If the criteria for the commencement and continuation of the approach are applied over a period of time (e.g. during the descent from the initial approach until reaching the outer marker, or from the outer marker until reaching DH) missed approaches will be made simply because of transient reductions in RVR which may well be unrelated to the RVR pertaining when the aeroplane reaches DH; this is particularly true in Category II weather conditions. It is more realistic to apply the criteria at one point during the approach. The point selected should be late in the approach, but not so late as to cause the pilot to be continually aware of the possibility of having to make a missed approach for this reason. The point selected should also be a recognized check-point in the approach so as to avoid introducing yet more check-points. The outer marker meets these requirements.

CHAPTER 4

THE FLIGHT CREW

4.1 Qualification and training

4.1.1 The requirements for the qualification and training of flight crews should be those described in the ICAO Manual, Chapter 5, paragraphs 5.7.1 to 5.7.6. Additional ECAC requirements for crew training in preparation for Category III operations utilizing fail-passive automatic landing systems are that the training programme should include the following items :

- a) normal operation of fail-passive system, both with and without the acquisition of visual cues at decision height;
- b) failures of the system, including those which will result in excessive localizer deviation both above and below decision height, in the minimum visual conditions authorized for the operation; if a head-up display is available, a continuation to a manual landing should be practised, in the appropriate visual conditions if this is possible, following a failure of the head-up display;
- c) where there is a component common to both the approach/landing system and the go-around system, failures of such a component should be simulated during training unless such a failure is assessed as "extremely improbable" according to JAR/FAR criteria (JAR/FAR 25.1309 refers); and
- d) failure of the critical engine either in the final approach to landing, or during the go-around following lack of visual reference at decision height.

4.1.2 The total number of approaches to be practised for each of these cases will depend on the system characteristics and they may be fewer in number when the system includes a head-up display. It should be borne in mind that over-emphasis of the failure case can cause a loss of confidence in the system on the part of the flight crew.

CHAPTER 5

**AUTHORIZATION OF
CATEGORY II AND CATEGORY III OPERATIONS**

5.1 Authorization of the aeroplane

The authorization of an aeroplane to be used in Category II and Category III operations should comply with the criteria in the ICAO Manual, Chapter 6, paragraphs 6.1.4.1 and 6.1.4.2.

5.2 Authorization of the use of an aerodrome

The use of an aerodrome by an operator for Category II and Category III operations should not be authorized by the State of the operator unless the criteria in the ICAO Manual, Chapter 6, paragraphs 6.1.5.1 and 6.1.5.2 have been complied with.

5.3 Authorization of the flight crew

The authorization of the flight crew to carry out Category II and Category III operations should be in compliance with the requirements in the ICAO Manual, Chapter 6, paragraph 6.1.6.

5.4 Authorization of the operation

5.4.1 The approval given to an operator of an ECAC Member State for Category II and Category III operations should comply with the criteria in the ICAO Manual, Chapter 6, paragraphs 6.1.7.1 to 6.1.7.3.

5.4.2 The **Attachment A** to Chapter 5 shows the list of countries where Category II and/or III operational letter of competency for international commercial air transport is required before the commencement of operations.

CHAPTER 5 — ATTACHMENT A

**List of ECAC States where Categories II/III operational letter of competency
is required for foreign commercial operators
before the commencement of operations**

Letter of competency required

Letter of competency not required

CHAPTER 6

AERODROME OPERATING MINIMA

SUB-CHAPTER A – TAKE-OFF MINIMA**6.A.1 General**

The establishment of take-off minima should comply with the principles stated in the Manual of All-Weather Operations Doc 9365-AN/910, Chapter 6, paragraph 6.2.2 supplemented by additional ECAC criteria. There are no additional ECAC requirements for take-off in visibilities corresponding to an RVR of 400 m or more.

6.A.2 The establishment of take-off minima of less than 400 m RVR

Normally operating minima for take-off in visibilities corresponding to an RVR of less than 400 m are expressed in terms of RVR. The application and use of low visibility take-off minima may be limited by the obstacle environment in the take-off and departure areas and considerations of take-off alternates (cf. AWO Manual, para. 6.2.2). The take-off minima should be selected to ensure sufficient guidance to control the aircraft in the event of both a discontinued take-off in adverse circumstances and a continued take-off after failure of the critical engine. The following criteria should be considered.

6.A.2.1 Runway lighting

6.A.2.1.1 The runway lighting should include centre-line lights spaced 30 m or less and edge lights spaced 60 m or less. For take-off in visibility conditions of less than 200 m RVR, the edge light spacing should be also 60 m or less, but the centre-line light spacing should be 15 m or less.

6.A.2.1.2 Secondary power supply to the runway lights should be available with a switch over time of 1 sec. or less.

6.A.2.1.3 Studies in a B747 simulator have shown that a visual segment containing 8 centre-line lights at a spacing of 15 m could be adequate for directional control in the discontinued take-off case for that category of aircraft.

6.A.2.2 Aircraft structural restrictions

The required RVR will be affected by the cut-off angle of the pilot's downward vision over the nose, and his eye height. This could be significant particularly in take-off minima in the order of 200 m RVR or less.

6.A.2.3 Information on visibility conditions along the runway

The information on visibility conditions along the runway is very important to the pilot taking-off in very low visibility, particularly at the point where V_1 is reached. This information is likely to be represented by the midpoint RVR. The availability of multiple RVR reports can lead to the acceptance of lower minima (cf. AWO Manual, Table 6-1). Normally TDZ, midpoint and stopend reports should be available. The TDZ value can be replaced by pilot observation at the start of the take-off run. If instrumented RVR is not available, the assessment of RVR by other means is acceptable.

6.A.2.4 Crosswind, braking action and runway contamination

6.A.2.4.1 These factors could influence the use of a particular take-off minimum. Such limitations are dependent on the handling characteristics of the aircraft concerned.

6.A.2.4.2 The lower the take-off limits, the more consideration should be given to the influence of crosswind, braking action and runway contamination. Simulator studies have shown that for a Category D aircraft a crosswind of 10 Kt and a friction coefficient of $\mu = 0.4$ could be acceptable in an RVR of 150 m.

6.A.2.5 Suitability of the aerodrome low visibility procedures and facilities

6.A.2.5.1 The use of low-visibility minima depends on the existence of suitable runway protection measures, surface movement guidance and control, emergency procedures and apron management (cf. ECAC/CEAC Doc No. 17, Part B).

6.A.2.5.2 Although it is recognized that the implementation of these requirements is basically the responsibility of the appropriate State and aerodrome authority, the operator should assure as far as possible that suitable measures have been taken.

6.A.2.6 Aircraft category

In establishing take-off minima the aircraft category may be taken into account when the take-off performance and manoeuvrability allows deviation from the reference criteria mentioned in paragraph 6.A.2 (cf. Table 1).

6.A.2.7 Crew procedures, training, and qualification

The limited visual segment available during take-off in low visibility conditions requires specific training of the pilot, particularly in the discontinued take-off case. Special requirements should be laid down for crew training and qualification for all operations in RVR below 200 m and for any operations carried out using RVR minima less than those commonly accepted (cf. Table 1). These requirements should be approved by the appropriate authority in the State of the operator. Crew training should be carried out on an approved simulator and should include critical engine failures in the lowest approved RVR condition; these exercises should be repeated at frequent intervals after initial qualification. Particular emphasis should be placed on proper crew procedures, call outs and co-ordination so that the handling pilot does not have to divert his attention from the directional control task. Consideration should be given to the imposition of minimum flight crew experience requirements in relation to the use of low take-off RVR minima (below 200 m RVR).

6.A.3 Take-off in visibility conditions below 150 m RVR

6.A.3.1 All requirements in paragraph 6.A.2 should be met.

6.A.3.2 Take-off minima below 150 m RVR normally require guidance to the pilot by electronic means. A visual reference in the order of 3 centre-line lights should be available. A combination of equipment failure and critical engine failure is considered to be very remote. The guidance system should meet the appropriate JAR certification requirements (JAR-AWO, Sub-part 4) with regard to :

- a) system performance, minimum equipment, limitations and procedures;
- b) failure conditions and warnings;
- c) guidance information and display;
- d) integrity and continuity of service.

6.A.3.3 When an ILS localizer signal is used as a reference to this equipment, the facility performance should meet the requirements for Category III operations in Annex 10, Vol. 1, Part 1, regarding :

- a) course structure;
- b) accuracy;
- c) integrity and continuity of service;
- d) monitoring;

- e) secondary power supply;
- f) sensitive area (cf. ICAO SMGC-Manual and ECAC/CEAC Doc No. 17, Part B, Chapter 3 for protection procedures).

6.A.4 Commonly acceptable take-off minima

The following table contains commonly acceptable minima within ECAC States (1987) for multi-engine aeroplanes; it is intended for the guidance of States of the operator in the implementation, approval and supervision of take-off minima.

Table 1

Lighting	Category of aircraft	RVR
1. Runway edge lights (cf. para. 6.A.2)	A)	250 m
	B, C) (Note 2)	300 m
	D	400 m (Note 3)
2. Runway edge lights and centre line lights (Note 1) (cf. para. 6.A.2)	A, B (Note 2)	150 m
	C, D	200 m (Note 4)
<p><i>Note 1 : One State has accepted 125 m RVR for some aeroplane types provided runway protection equivalent to Category III landing operations is available. This State has also accepted 75 m RVR for an aeroplane type using an approved electronic take-off guidance system.</i></p> <p><i>Note 2 : If aircraft ground handling characteristics permit (cf. para. 6.A.2.4).</i></p> <p><i>Note 3 : 300 m is acceptable, provided the edge light spacing is 30 m or less.</i></p> <p><i>Note 4 : Some States have accepted 150 m as acceptable for Category C aircrafts provided crew procedures, training and qualifications are established in accordance with paragraph 6.A.2.7 and account is taken of crosswind and runway contamination in accordance with paragraph 6.A.2.4.</i></p>		

SUB-CHAPTER B - LANDING MINIMA

6.B.1 General

6.B.1.1 The establishment of aerodrome operating minima for Category II and Category III operations should comply with the principles stated in the ICAO Manual, Chapter 6, paragraphs 6.2.5 and 6.2.6 supplemented by additional ECAC criteria. For ease of reference they are combined in the following material.

6.B.2 Relationship between ILS facility performance category and category of operations

FACILITY PERFORMANCE CATEGORY	ILS CLASSIFICATION LIMIT OF COURSE STRUCTURE (1)	LEVEL OF INTEGRITY AND CONTINUITY OF SERVICES	CATEGORY OF OPERATIONS WHICH THE ILS CAN SUPPORT
I	A	1, 2, 3, 4	I
	B	1, 2, 3, 4	I
	C	1, 2, 3, 4	I
	T	1, 2, 3, 4	I
	D	1, 2, 3, 4	I
	E	1, 2, 3, 4	I
II	T	1	I
	D	1	I
	E	1	I
	T	2, 3, 4	II
	D	2, 3, 4	II
	E	2, 3, 4	II
III	D	1	I
		2	II
		3, 4	III (2)(3)
	E	1	I
		2	II
		3	III (2)(4)
		4	III (2)

- (1) This second digit gives the possibility to use autopilot (see EUR-ANP specifications referenced in para. 1.7).
- (2) Although these specifications of the ILS can support landing operations without any DH, experience has shown that unknown interferences, though on very rare occasions, may result in lateral displacements from the centre line without any resultant indication in the airborne or ground equipment.
- (3) The localizer signal cannot be relied upon for a roll-out guidance.
- (4) The localizer signal cannot support a fail-operational roll-out operation.

6.B.3 Establishment of decision height

6.B.3.1 Category II operations

The minimum decision height for a particular Category II operation is the highest value produced by the following factors :

- a) the minimum decision height in the airworthiness certification;

- b) the minimum height to which the precision approach aid may be used solely by reference to instruments;
- c) the obstacle clearance height or the obstacle clearance limit, whichever is available;
- d) the decision height to which the flight crew is authorized to operate; and
- e) the lowest accepted value for Category II operations.

Note : *If an operator is fully informed as to the location and height of the obstacles which condition the determination of an OCH and is able to apply the criteria in ICAO PANS-OPS Doc 8168 to operations by a specific aeroplane type, then an OCH calculated by the operator can be used in the calculation of the decision height for that operation.*

6.B.3.2 Category III operations

6.B.3.2.1 Fail-passive airborne system

The minimum decision height for a particular Category III operation involving the use of fail-passive automatic landing equipment must not be less than the height from which a non-visual go-around can be carried out under normal conditions without touching the ground. This height is established during the airworthiness certification process and the minimum decision height, therefore, shall not be lower than the minimum included in the airworthiness certification. Aircraft with such systems which are certified in compliance with FAR or JAR will qualify for a decision height not lower than 50 ft but the criteria which have been used by one Member State in the certification of fail-passive automatic landing equipment supplemented by the head-up display described in Chapter 2, paragraph 2.1.4, has enabled that State to specify a decision height in the certification which is lower than 50 ft.

6.B.3.2.2 Fail-operational airborne system

6.B.3.2.2.1 A similar consideration to that in the preceding paragraph applies to the determination of a minimum decision height for a Category III operation involving the use of fail-operational automatic landing equipment and it also shall not be lower than the minimum included in the airworthiness certification. If a minimum decision height is not included, then an acceptable method of determining it is contained in JAR-AWO.

6.B.3.2.2.2 An alternative method of establishing a decision height, for those cases where one is not included in the airworthiness certification, is based on the need to ensure that the interaction between members of a flight crew in the application of the particular flight deck procedure does not result in a delay which would cause the aircraft wheels to touch the ground before the go-around is initiated. In aircraft in current service this is enough to inhibit the go-around mode in the automatic flight guidance system. The pilot of an aircraft in such a case would be committed to a manual go-around from a very low height and if the flight deck procedure was actually completed, i.e. the go-around mode was activated after touchdown, the pilot task could be made more difficult by an unexpected malfunction of the automatic system. An examination of the reaction time of a flight crew in a particular aircraft has shown that with a period of 4 seconds or more between decision height and touchdown, there is a low probability of a touchdown occurring before a go-around is initiated and it is thought that this is sufficiently conservative to cover all current operations. To establish the minimum decision height by this criterion the normal flare profile of the aeroplane should be recorded during an automatic landing and a point selected which is not less than 4 seconds before touchdown. It should be recognized however that the decision height for such an operation should be set low enough for the pitch-up in the flare to be well advanced before the pilot is called upon to make a decision and that a decision height of more than 25 ft is undesirable. If the application of the 4-second allowance produces a height of more than 25 ft, then the flare curve should be re-examined in order to confirm that it is a normal one, or the flight crew reaction time should be assessed to determine whether a time of less than 4 seconds may be assumed.

6.B.4 Establishment of RVR minima

6.B.4.1 Since the inception of precision approach and landing operations various methods have been devised for the calculation of aerodrome operating minima in terms of decision height and runway visual range. It is a comparatively straightforward matter to establish the decision height for an operation but establishing the minimum RVR to be associated with that decision height so as to provide a high probability that the required visual reference will be available at that decision height has been more of a problem.

6.B.4.2 The methods adopted by various States to resolve this relationship in respect of Category II and Category III operations have varied considerably; in one instance there has been a simple approach which entailed the application of empiric data based on actual operating experience in a particular environment. This has given satisfactory results for application within the environment for which it was developed. In another instance a more sophisticated method was employed which utilized a fairly complex computer programme to take account of a wide range of variables. However in the latter case it has been found that with the improvement in the performance of visual aids, and the increased use of automatic equipment in the new larger aircraft, most of the variables cancel each other out and a simple tabulation can be constructed which is applicable to a wide range of aircraft. The basic principles which are observed in establishing the values in such a table are that the scale of visual reference required by a pilot at and below decision height depends on the task that he has to carry out, and that the degree to which his vision is obscured depends on the obscuring medium, the general rule in fog being that it becomes more dense with increases in height. Research using flight simulators coupled with flight trials has shown that :

- a) most pilots require visual contact to be established about 3 seconds above decision height though it has been observed that this reduces to about 1 second when a fail-operational automatic landing system is being used;
- b) to establish lateral position and cross-track velocity most pilots require to be able to see not less than a 3 light segment of the centre line of the approach lights, or runway centre line, or runway edge lights;
- c) to maintain a lateral level most pilots require to be able to see a lateral element of the ground pattern, i.e. an approach lighting cross bar, the landing threshold, or a barrette of the touchdown zone lighting; and
- d) to make an accurate adjustment to the flight path in the vertical plane, such as a flare, using purely visual cues, most pilots require to be able to see a point on the ground which has a low or zero rate of apparent movement relative to the aircraft.

6.B.4.3 With regard to fog structure, data gathered in the United Kingdom over a twenty-year period have shown that in deep stable fog there is a 90% probability that the slant visual range from eye heights higher than 15 ft above the ground will be less than the horizontal visibility at ground level, i.e. RVR. There are at present no data available to show what the relationship is between the SVR and RVR in other low visibility conditions such as blowing snow, dust, or heavy rain, but there is some evidence in pilot reports that the lack of contrast between visual aids and the background in such conditions can produce a relationship similar to that observed in fog.

6.B.4.4 An earlier method of applying these principles is contained in **Attachment A** to this chapter. It makes allowance on a slightly conservative basis for the main variables and is included to illustrate the manner in which they may be combined in establishing minimum values of RVR. This method has now been superseded by the following simplified criteria. The values in **Table 2** applicable to Category II operations were developed from an application of the principles referred to above in a manner similar to that described in **Attachment A** to this chapter. Use of the values in actual Category II operations has resulted in an observed approach success rate of more than 95%. The values in **Table 3** applicable to Category III operations are based on the extent to which the pilot is involved in the control of the roll-out after landing using visual reference and are generally accepted for international operations. Their use in actual Category III operations has resulted in an observed landing success rate of 100%.

Table 2 — Category II operations

Decision Height (ft)	Mode of Operation	
	Manual control at and below DH RVR	Autoland or autocoupled to below DH RVR
100 - 120 121 - 140 141 plus	400 metres 450 metres 500 metres	350 metres 400 metres 500 metres

Note : *The reference to "autocoupled to below DH" in this table means continued engagement of the automatic flight guidance system down to a height of 50 ft.*

Table 3 — Category III operations with a decision height utilizing fail-operational automatic landing equipment

	RVR
No roll-out guidance/control system	200 metres
Fail-passive roll-out guidance/control system	150 metres
Fail-operational roll-out guidance/control system	100 metres

6.B.4.5 Category III operations utilizing fail-passive automatic landing equipment have been introduced as the most recent development and it is desirable that the principles governing the establishment of the minimum RVR for such operations be dealt with in some detail.

6.B.4.6 During an automatic landing the pilot needs to monitor the performance of the aircraft system, not in order to detect a failure which is better done by the monitoring devices built into the system, but so as to know precisely the flight situation. In the event of a failure he is thereby enabled to take manual control swiftly and smoothly. In the final stages he must establish visual contact and, by the time he reaches decision height, he must have checked the aircraft position relative to the approach or runway centre-line lights. For this he will need sight of horizontal elements (for roll reference) and part of the touchdown area. He must check for lateral position and cross-track velocity and, if not within the pre-stated lateral limits, he must carry out a go-around. He must also check longitudinal progress and sight of the landing threshold is useful for this purpose, as is sight of the touchdown zone lights.

6.B.4.7 In the event of a failure of the automatic flight guidance system below decision height, there are two possible courses of action; the first is a procedure which allows the pilot to complete the landing manually if there is adequate visual reference for him to do so, or to initiate a go-around if there is not; the second is to make a go-around mandatory if there is a system disconnect regardless of the pilot's assessment of the visual reference available. If the first option is selected then the overriding requirement in the determination of a minimum RVR is for sufficient visual cues to be available at and below decision height for the pilot to be able to carry out a manual landing. Present data show that a minimum value of 300 metres will give a high probability that the cues needed by the pilot to assess the aircraft attitude in pitch and roll will be

available and this should be the minimum RVR for this procedure but further experience may show that a lower value would be acceptable.

6.B.4.8 The second option, to require a go-around to be carried out should the automatic flight-guidance system fail below decision height, will permit a lower minimum RVR because the visual reference requirement will be less if there is no need to provide for the possibility of a manual landing. However, this option is only acceptable if it can be demonstrated that the probability of a system failure below decision height is acceptably low. It must be recognized that the inclination of a pilot who experiences such a failure would be to continue the landing manually but the results of flight trials in actual conditions and of simulator experiments show that pilots do not always recognize that the visual cues are inadequate in such situations and present recorded data reveal that pilots' landing performance reduces progressively as the RVR is reduced below 300 metres. It should further be recognized that there is some risk in carrying out a manual go-around from below 50 ft in very low visibility and it must therefore be accepted that if an RVR lower than 300 metres is to be authorized, the flight deck procedure should not normally allow the pilot to continue the landing manually in such conditions and the aeroplane system must be sufficiently reliable for the go-around rate to be low. If it can be demonstrated during in-service proving that the probability of a system failure below decision height is not greater than 1×10^{-3} then the minimum RVR for operations involving the use of fail-passive automatic landing equipment without a roll-out guidance/control system may be 200 metres, or if a roll-out guidance/control system is available it may be 150 metres.

6.B.4.9 These criteria may be relaxed in the case of an aircraft with a fail-passive automatic landing system which is supplemented by a head-up display which does not qualify as a fail-operational system but which gives guidance which will enable the pilot to complete a landing in the event of a failure of the automatic landing system. In this case it is not necessary to make a go-around mandatory in the event of a failure of the automatic landing system when the RVR is less than 300 metres, nor is it necessary to demonstrate that the probability of a failure of the automatic landing system is not greater than 1×10^{-3} .

6.B.4.10 These values of minima are considered suitable for operations by medium-sized turbo-jet transport aeroplanes, e.g. B737, BAC 1-11, Caravelle, Trident and B727. The visual sequences which are likely to be seen by pilots of these types of aircraft in this range of visibilities are described in Attachment B to this chapter.

6.B.4.11 The values of RVR minima for Category II and Category III operations which are included in this section may be used by Member States but their acceptance does not preclude the use of a State's own method of determining RVR minima provided an adequate level of safety is maintained.

6.B.5 Minimum ground system requirements for particular Category II and Category III operations

6.B.5.1 General

6.B.5.1.1 General guidance

6.B.5.1.1.1 Under normal circumstances it can be expected that all the facilities detailed in the ICAO Annexes and described in the ICAO Manual will be available for operations on a particular runway. However, it should be recognized that these specifications have been developed so as to be adequate for the most critical case aircraft in the most limiting conditions and that the operation of a less critical case aircraft, or an operation with increased minima, can be accepted with some reduction in the scale of the ground equipment.

6.B.5.1.1.2 The material in the following paragraphs indicates the degree of unserviceability that can be tolerated but it should not be interpreted as meaning that multiple failures are acceptable, nor should it be construed as meaning that some part of the ground system need not be provided. The general rule to follow is that the period of non-availability of parts of the system due to system failure should be kept to an absolute minimum, i.e. that reinstatement should be made as soon as possible but that a withdrawal of part of a system during a period when improvements or changes to the system were being made could be tolerated for a longer period provided that reinstatement was carried out at the first opportunity.

6.B.5.1.1.3 It is the responsibility of the operator to develop adequate operating instructions to flight crews dealing with the deficiencies of ground equipment. Equally it is the responsibility of the appropriate authority to ensure that ATC instructions reflect the general principle of the acceptability of deficiencies in the ground system without the inclusion of the detailed requirements of individual operators.

6.B.5.1.1.4 Guidance material to operators, to be used when preparing instructions to flight crews on minimum ground system requirements, is presented in tabular form in **Attachments D and E** to this chapter.

6.B.5.1.2 Aerodrome lighting circuitry

6.B.5.1.2.1 Annex 14, paragraph 8.2 specifies that for a precision runway the electrical circuits be designed so that the failure of one circuit will not leave the pilot without visual guidance and will not result in a misleading pattern. ECAC States' practice of electrical circuitry of aerodrome lighting is to use from two circuits up to 36 circuits to meet this objective.

6.B.5.1.2.2 Whilst no detrimental effects result from the failure of one or even more circuits in, for example, a 36-circuit system, failure of one circuit in a two-circuit system means the loss of every second light in the affected system. Although the pattern as such is not distorted, the visual guidance by the remaining lights is affected as simulator trials have shown. In order to regain the required visual guidance, it is necessary to increase the required RVR to compensate for the lower density of the lights. In general it can be deduced from the simulator trials performed that the loss of one circuit in the approach or in the runway lighting system, affecting more than one-third of the lamps, should be compensated for by increasing the RVR normally required for the operations concerned, except for the particular assessment of failures in the runway lighting system as covered by paragraph 6.B.5.3.

6.B.5.2 Approach lighting

6.B.5.2.1 The requirements in Annex 14 for approach lighting for a precision runway include a requirement for a system 900 metres in length but a reduced operative length can be shown to be acceptable for particular Category II and Category III operations. This may include the disconnection of outer parts of the approach light system. The basic principle employed is that if any part of the approach light system is concealed by the forward and downward cut-off from the flight deck at the moment that the pilot establishes visual contact, then that part of the approach lights is not an essential requirement for that particular operation. As stated above, most pilots require visual contact to be established about 3 seconds above decision height for Category II operations, reducing to about 1 second above for Category III operations, in order to make an informed decision to land. Assuming an approach speed of 140 kts, it follows that in order to calculate the length of approach lighting concealed by the nose of the aircraft, one must determine the position of the pilot's eyes relative to the landing threshold at a position on glide path corresponding to a wheel height 40 ft above decision height for Category II operations, and 13 ft above for Category III operations.

6.B.5.2.2 The calculation method for the visible part of approach lights during Category II and Category III operations is described in **Attachment C** to this chapter. To simplify the calculation it is assumed that the ILS glide-path receiver antenna and the pilot's eyes are vertically above the main wheels. It follows that the difference between D and O is the minimum length of approach lighting which is essential for a particular operation.

6.B.5.2.3 The generalized result of a calculation employing this method on current types of aircraft is presented in **Table 4**.

Table 4 — Minimum approach lighting operative

(as measured from runway threshold towards approaching aircraft)

	DH (ft)	L (m)
CAT II	100	450
CAT III	50	210
CAT III	< 20	None

6.B.5.3 Runway lighting

6.B.5.3.1 The requirement in Annex 14 is that threshold lights, end lights, edge lights, centre-line lights (at 30-metre spacing for Category II operations and 15-metre spacing for Category III operations) and touchdown zone lights must be available. However, the extent to which a pilot uses the visual aids to gain the visual reference he requires in Category II and Category III operations depends on the task he has to perform and on whether particular elements of the visual aids are visible in the ambient light conditions. In Category II operations the usefulness of the runway lighting depends on the effective intensity of the individual lights and on the level of background luminance. The ICAO Manual of RVR Observing and Reporting Practices shows in Chapter 6, Figures 6-3 and 6-4 that the effective intensity of centre line and runway edge lights perceived by a pilot varies with eye height above the runway and with distance from each light fitting, the rule being that in the range of visibilities for Category II operations, the lower the pilot's eyes and the greater the range, the lower will be the effective intensity. Even with new fittings there is not much difference by day between the distance over which the pilot can see the lights and the Meteorological Optical Range (MOR), and in normal day-to-day operation it is likely that the distance over which the pilot can see the paint markings on the runway will be the same as the distance over which he can see the runway lights, while in bright day fog it is likely that his visual range on the markings will be greater than that on the lights. Under such circumstances, paint markings on the runway surface are as good as, if not better than, runway lighting.

6.B.5.3.2 If it is possible to report the RVR in terms of the distance over which the paint markings on the runway can be seen, i.e. in terms of the Meteorological Optical Range (MOR) determined in accordance with the criteria in the ICAO Manual of Runway Visual Range Observing and Reporting Practices, Appendix B, then Category II operations by day are acceptable when any part of the runway lighting is not available. This procedure is only acceptable if the contrast between the markings and the surrounding runway surface is good and they are not obscured by contamination. Appropriate authorities should not allow the procedure to be introduced unless an inspection of the runway shows that these conditions are met. As a general rule, the runway should be clear and dry and the threshold, touchdown and centre-line markings in the touchdown area in the order of 90% clear of rubber contamination.

6.B.5.3.3 With regard to Category III operations, there has been considerable experience of operations by all types of aircraft on runways on which the spacing of the centre-line lights was 30 metres with RVRs down to 200 metres. In addition all types of aircraft have routinely taken-off on these runways with RVRs down to 150 metres. It follows, therefore, that a failure which results in the spacing of the centre-line lights being increased from 15 metres to 30 metres can be tolerated for Category III operations down to RVR values of 200 metres for landing.

6.B.5.3.4 The figures in the ICAO Manual of Runway Visual Range Observing and Reporting Practices, referred to above, also show that with RVR values of 200 metres or less, i.e. those used in Category III operations, the visual range of the centre-line lights is greater than that of the edge lights in daylight fog with an RVR of 125 metres or less, the edge lights will not be visible to a pilot on the centre line. This reinforces the natural inclination of the pilot to use the centre line as his primary reference to the point, where, by day, it is being used as the sole visual

reference during ground roll. It follows that those Category III operations, in which the pilot is required to utilize outside visual reference for a decision to land and during the ground roll, can be accepted by day when runway edge lights are not available.

6.B.5.3.5 In Category III operations where the pilot is not required to establish visual reference before landing and where the ground roll is carried out by on-board automatic control or guidance, the only requirement is for centre-line lighting to be available to allow for the possibility, albeit remote, that the pilot will need to take manual control of the aircraft during the ground roll.

6.B.5.4 Taxiway lighting

6.B.5.4.1 Unserviceability of taxiway lighting can be tolerated for short periods but it is desirable that an alternative means of guiding aircraft along taxiways be available. For operations in visibilities not less than 150 metres, taxiway markings may be adequate, by day, but at night some form of guidance, such as a "Follow Me" vehicle, may be required. However, if the unserviceability includes lighting at taxi-holding positions which are part of the runway protection system, such as at entry points to the runway, special caution is necessary to ensure that safety is not impaired. Alternative means, such as either blocking or avoiding that holding position may be required.

6.B.5.5 Non-visual aids

6.B.5.5.1 Effects of ILS ground deficiencies on ILS operations

It is recognized that the ILS classification published in the AIP is of a long-term nature, nevertheless on a day to day basis, due to different causes (e.g. equipment defects, environment modification), the ILS status may be impaired.

Two situations can exist : short-term impairment or long-term impairment.

6.B.5.5.1.1 Long-term ILS deficiencies

In the case of long-term ILS deficiencies as for example environment variation causing deterioration of the glide path or localizer course structure, the first digit and in some case the second digit can be changed. In that situation, both the new three digits of the ILS classification (together with plain language description) and the new category of operations which the ILS can support shall be published by Notam.

6.B.5.5.1.2. Short-term ILS deficiencies

6.B.5.5.1.2.1 In the case of a failure of the ground ILS equipment, the short-term effect on the operation shall be reflected by the change of the last digit which characterises the level of integrity and the level of continuity of service.

6.B.5.5.1.2.2 It is an absolute necessity to avoid any misunderstanding by the flight crew in the case of ILS degradation. For that reason, it is necessary to present to the ATC controller a clear information on the maximum category of operation which the ILS can support. In order to receive such an information from the different ILS deficiencies, it is recommended to use an automatic system which can reduce the workload of the ATC controller and to report to the flight crew a clear and unambiguous statement as to the category of operations which the ILS can support.

6.B.5.5.1.2.3 The following table (Table 5) gives the direct relation between the last digit of the ILS classification (integrity and continuity of service level) and the maximum category of operation practicable. The statement on the category of operations which the ILS can support is to be transmitted to the flight crew.

Table 5

ILS LAST DIGIT (INTEGRITY AND CONTINUITY OF SERVICE)	CATEGORY OF OPERATION WHICH THE ILS CAN SUPPORT	MTBO ASSOCIATED (In hours) (effects continuity of service only)
1	I	...
2	II	1 000
3	III	2 000
4	IV	4 000

6.B.5.5.2 Examples of short-term ILS deficiencies and their operational effects

In this section examples are given concerning firstly the level of continuity of service and secondly the level of integrity.

6.B.5.5.2.1 Continuity of service

Two examples are given concerning the continuity of service level. These examples reflect the practice in some States but are not reported here as a standard.

a) Main power supply breakdown

In the case of main power supply breakdown, the ILS service is warranted by the standby power supply which is usually composed of a battery. When the main power supply fails, there is no effect on the continuity of service as far as the standby power supply is operational. But at some stage of the battery discharge, it is considered that it is impossible to maintain the continuity of service level at its nominal level. In this case, the level of continuity of service must be downgraded and the maximum category of operation must be limited to Category I.

So, a battery autonomous alert must downgrade the category of operation to Category I.

b) Standby localizer transmitter failure

In the second example, the effect of a failure of the standby transmitter of the localizer equipment is considered. This example is applicable where an available standby is necessary to assure the required level of continuity of service for Category III operations.

The effect of this failure is the reduction of the MTBO (Mean Time between outage) of the localizer.

In this case, it is very easy to make the relation with the maximum category of operation which the ILS can support. Annex 10 gives the direct relation between the last digit and the localizer MTBO. The table in paragraph 6.5.5.1.2 gives this relation.

6.B.5.5.2.2 Integrity

Regarding the integrity level, two examples are provided (these examples are applicable only where in the integrity equation the far field status is used).

a) Far field monitor alarm

In this case, the far field measurement equipment (usually at the middle marker position) is considered. If the measurement is found in alarm (without any automatic action from the integral monitor of the localizer station), it means that the integrity of the system is reduced and the consequence generally is to limit the operation to Category I.

b) Far field monitor failure

When the far field measurement equipment is out of order, it means that the localizer system has lost one of the major components of its integrity systems. In that case, it is necessary to reduce the maximum category of operation which the ILS can support. The general practice in several States is to downgrade it to Category II level.

6.B.5.5.3 Standby transmitter

6.B.5.5.3.1 A pilot should carry out a missed approach if the ILS signal fails before he has adequate visual reference. Although the frequency of such failures should be kept to an acceptable low value, a missed approach from decision height or above is not an unsafe course of action. It therefore follows that a failure of standby transmitter can be tolerated down to decision height. Below decision height the requirement for the standby transmitter will depend on the extent to which the ILS signal is used. If it is required for an automatic landing, the probability of loss of signal must be kept very low and it follows that the operational standby transmitter is a necessity. If the minimum RVR for the operation is based on manual handling, or reversion to manual handling below decision height, then the loss of the ILS signal can be tolerated and an operational standby transmitter is not a necessity.

6.B.5.5.3.2 In general terms, an operational standby transmitter is an essential requirement for Category III operations, but not for Category II operations.

6.B.5.5.4 Standby/secondary power supply

6.B.5.5.4.1 A failure of secondary power supply for runway lights must be considered in the same way as a failure of the runway lights system.

6.B.5.5.4.2 A failure of the secondary power supply for the approach lighting system should be compensated for by an adequate increase of minimum RVR value for Category II operations, to cater for the possible loss of visual guidance as a result of a total failure of the approach lighting system. The DH is not affected.

6.B.5.5.5 Marker beacons

6.B.5.5.5.1 If the outer marker VHF beacon becomes unserviceable, alternative means of determining the outer marker position should be established. DME, radar range from the threshold, or a facility located near the outer marker position, could be used. A description of the alternative means should be promulgated, but the ILS category should not be downgraded.

6.B.5.5.5.2 The failure of the middle marker will not normally prohibit Category II/Category III operations.

6.B.5.6 Allowable deficiencies of meteo equipment**6.B.5.6.1 Failure of anemometer**

6.B.5.6.1.1 The failure of an anemometer does not prohibit Category II/Category III operations so long as adequate wind information can be delivered to the pilot using other ground sources.

6.B.5.6.2 Failure of RVR assessment unit

6.B.5.6.2.1 If the TDZ RVR assessment unit fails, the State of the aerodrome may, after careful evaluation of the meteorological and climatological conditions, determine that the TDZ RVR value may be derived from the midpoint RVR measurement. Pilots should be informed accordingly.

6.B.5.6.2.2 If both midpoint and stopend RVR assessment units are installed and one of them fails, this does not normally prohibit a Category II/Category III landing operation.

6.B.5.6.3 Failure of cellometer

6.B.5.6.3.1 A failure of the ceilometer does not prohibit a Category II/Category III operation.



CHAPTER 6 — ATTACHMENT A

A1. The method of establishing the minimum RVR for a particular operation is included as an example of the way that the various factors should be combined.

A2. The selection of the dimensions of the required visual segments which are used in the calculations is based on the visual reference requirements described in paragraph 6.B.4.2. For Category II operations they are assumed to be as follows :

- a) a visual segment of not less than 90 metres will be required to be in view at and below decision height for a pilot to be able to monitor an automatic system;
- b) a visual segment of not less than 120 metres will be required to be in view for a pilot to be able to maintain the roll attitude manually at and below decision height; and
- c) for a manual landing using only external visual cues, a visual segment of 225 metres will be required at the height at which flare initiation starts in order to provide the pilot with sight of a point of low relative movement on the ground.

There are few data available from which to determine the visual reference requirements for Category III operations but from those which are available it is possible to deduce that :

- a) the visual segment required at decision height for an operation utilizing fail-passive automatic landing equipment is 175 metres;
- b) the visual segment required at decision height for an operation utilizing fail-operational automatic equipment which does not include roll-out guidance is 120 metres;
- c) the visual segment required at decision height for an operation utilizing fail-operational automatic landing equipment which includes a fail-passive roll-out guidance system is 90 metres; and
- d) when the system includes a roll-out guidance system which is fail-operational, the visual segment required at decision height is 60 metres.

A3. These rather arbitrary values have been adopted for the purpose of developing a means of establishing the minimum RVR for particular operations and do not necessarily represent what will be seen by a pilot in the dynamic situation of actual operation.

A4. The method to be employed in the calculation of the minimum RVR for a particular operation is to determine the slant visual range (SVR) from the pilot eye height at decision height to the far point of the required visual segment and then to use the appropriate factor to make allowance for the difference between SVR and RVR. For operations involving a manual landing a further calculation is required to establish the SVR from the pilot eye height at the initiation of the landing flare to the far point of the visual segment required for that operation and then to use the appropriate factor to establish the RVR. The higher of the two values of RVR should be selected. For operations involving the use of automatic landing equipment, the second calculation is not required.

A5. The relationship between SVR, the visual segment and pilot eye height is shown in the diagram at Figure 1 and the formula for calculating SVR is as follows :

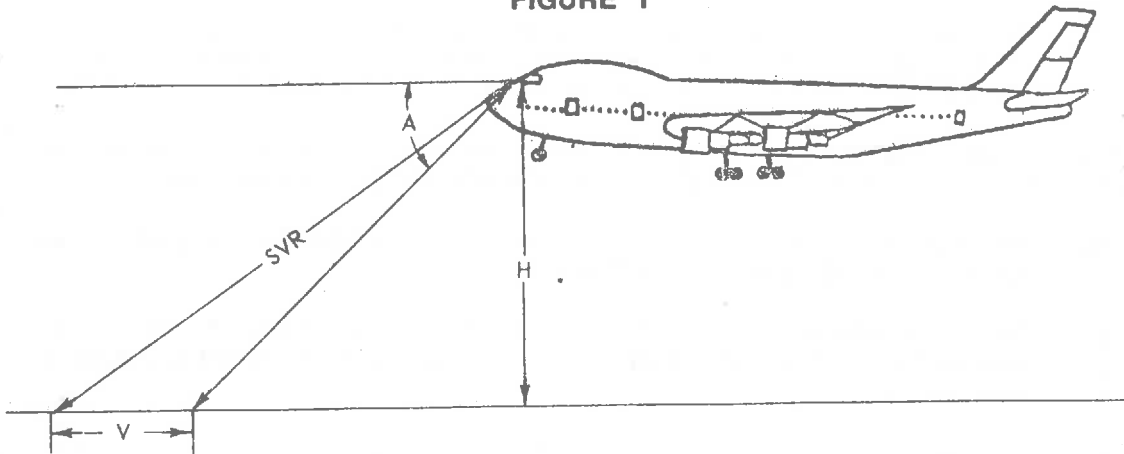
$$SVR = \sqrt{(V + H \cot A)^2 + H^2}$$

where V = required visual segment (metres)

H = pilot eye height (metres)

A = the angle of cut-off of pilot downward view over the nose relative to the horizontal (degrees)

FIGURE 1



A6. To assist in the solution of this equation in respect of particular operations, a list of aeroplane data relating to the height of the pilot's eyes above the wheels and the angle of the downward view cut-off, both with the aeroplane in the approach configuration on 3-degree glide path, assuming zero wind, is given in the following table :

AIRCRAFT TYPE	CUT-OFF ANGLE (degrees)	EYE TO WHEEL HEIGHT (m)
DC9-50	13.7	4.4
DC9-32	13.1	4.2
DC9-33	14.2	3.9
DC9-15	18.3	2.9
DC10-30	15.5	9.1
DC8-62/63	16.5	4.9
A300	13.4	8.0
A310		
L1011	13.8	9.5
B727	15.1	4.7
B737	16.0	4.4
B747	16.5	10.5
B757		
B767		
BAC1-11	18.0	4.0
Trident 1/2	12.4	4.6
Trident 3	14.7	4.3

A7. As described above, the visual reference required by a pilot depends upon the task he has to perform and it follows that there is a correlation between the visual reference required and the mode of operation. A classification of mode of operation against visual segment requirement, based on earlier ECAC work, has been prepared to assist in the determination of RVR minima. This is contained in the following table :

MODE	SYSTEM DESCRIPTION	VISUAL SEGMENT
A	Flight Director - minimum DH not lower than below certification limitation	120 metres
B	Autopilot to DH - manual control below - minimum DH 100 ft	120 metres
C	Autopilot to 50 ft - manual flare or autopilot to touchdown - minimum DH 100 ft	90 metres
D	Fail-passive autopilot to touchdown - minimum DH 50 ft	175 metres
E	Fail-operational autopilot to touchdown - DH lower than flare	120 metres
F (i)	As Mode E plus fail-passive roll-out guidance system	90 metres
(ii)	As Mode E plus fail-operational roll-out guidance system	60 metres

Note 1 : Modes A through C can be employed on an ILS promulgated Category II or III. Before using a Category II ILS for automatic landing, the quality of the localizer between 50 ft and touchdown must be verified.

Note 2 : Modes D and E can only be employed with an ILS promulgated Category III, or a Category II ILS which satisfies the criteria in Chapter 1, paragraph 1.4.2.

Note 3 : Modes F (i) and (ii) can only be employed with an ILS which is promulgated Category III.

A8. The formula in paragraph A5 can now be used to find the SVR required for the pilot to be able to see the specified visual segment at the decision height for a particular operation. To convert this SVR to the RVR minimum, a factor is needed which will make allowance for the relationship between SVR and RVR. The values in the following table have been extracted from a fog model developed in the United Kingdom after analysis of data on the vertical and horizontal structure of fog gathered over a period of some twenty years. They show that SVR is less than RVR at eye heights above 15 ft though it should be appreciated that they mean that SVR can be expected to be this proportion of the RVR or more, 90% of the time. While they are representative of deep stable fog conditions, other values may be applicable in conditions of low visibility caused by blowing snow or heavy rain, or in patchy fog conditions.

EYE HEIGHT	SVR/RVR RATIO
52.5 metres	0.55
45 metres	0.61
37.5 metres	0.66
30 metres	0.70
22.5 metres	0.76
15 metres	0.84
7.5 metres	0.92
4.5 metres	1.00

A9. As indicated in paragraph A4, the calculation of the RVR minimum for modes of operation involving a manual landing should be in two parts, the second part being based on the visual segment required during the flare. In practice, such a calculation for Modes A and B will not produce a higher RVR value than the first part and this procedure need only be applied to Modes C and D. Because of the variation between aeroplanes of the height of initiation of a manual flare, the following table of values has been assumed for the purpose of the calculation. Other values may apply to some aeroplanes. The maximum ground speed value in the table is taken to be V_{Ref} at maximum landing weight expressed as TAS plus a correction for the maximum allowed tailwind component. The formula in paragraph A5 should be used to find the SVR that will enable the required visual segment to be in view from the pilot's eye position at flare initiation. The SVR/RVR ratio for that eye height should then be used to establish the required RVR. This should be compared with the RVR produced by the first part of the calculation and the higher value selected.

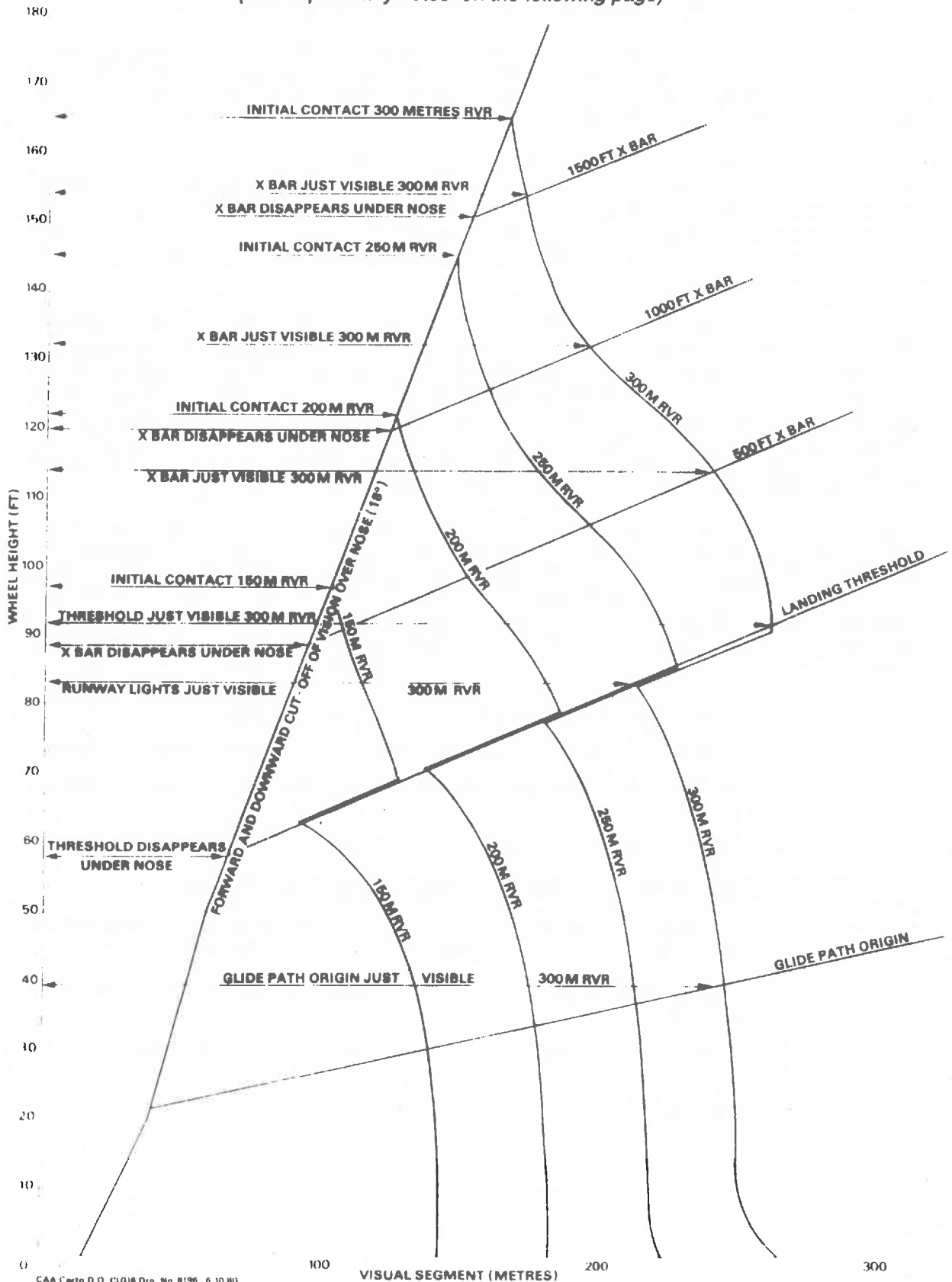
MAX GROUND SPEED	FLARE INITIATION HEIGHT
160 kts	13 metres
150 kts	11 metres
140 kts	10 metres
130 kts	9 metres
120 kts	7 metres
110 kts	6 metres
90 kts	5 metres

A10. The product of the calculations usually will not coincide with one of the values normally used for reporting RVR; odd numbers should therefore be rounded up to the reporting value above, except that where the number is not more than 10 metres above an RVR reporting value of 200 metres or more, or not more than 5 metres above an RVR reporting value below 200 metres, it may be rounded down.

CHAPTER 6 — ATTACHMENT B

Figure 1

Visual sequences for BAC 1-11 aircraft on a runway with Category III lighting in four fog conditions in which the RVR values are respectively 300, 250, 200 and 150 metres
 (See explanatory notes on the following page)



Visual Sequences — Explanatory Notes

Caution : *In the interest of clarity, the diagram is a simplification of that used for operational calculations. It must NOT be used for calculation of BAC 1-11 minima.*

B1. The data for the diagram have been gathered from observations over a 20-year period, in the United Kingdom and elsewhere, of mature, deep and stable fogs.

B2. The diagram is designed to show what the pilot will see in varying values of RVR at the wheel heights shown on the vertical axis. These visual sequences – or better – can be expected on 90% of occasions when the reported RVR is as shown and when standard ICAO Category III lighting is available.

B3. It will be appreciated that the coaming cut-off line is independent of visibility. For instance, on a 3° glide path, the approach lighting cross-bar 1 000 feet before the threshold will disappear under the nose at 120 feet wheel height, regardless of RVR. For aircraft with different coaming cut-off angles, the appropriate line may be readily substituted for that shown on the diagram. Coaming cut-off angles for some other types of aeroplane are available in **Attachment A** to this chapter.

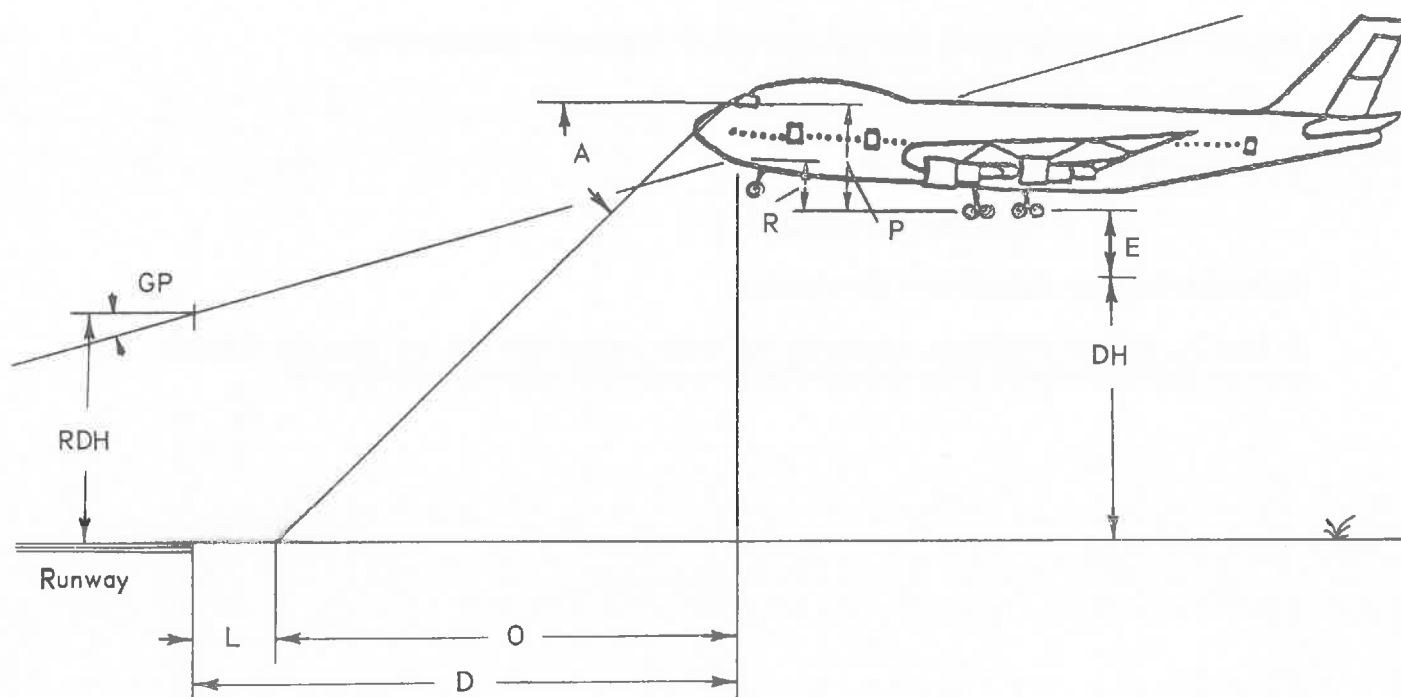
B4. The diagram gives the wheel heights at which first visual contact is achieved in varying RVRs. The visual segment at any wheel height is the ground distance between the nearest visible light that has not quite disappeared below the coaming cut-off, to the furthest visible light that can be seen through the fog. On the graph, this visual segment for any wheel height is represented by the length of a horizontal line at that height from the coaming cut-off to the appropriate RVR curve. For an example of contact height derivation, the cross-bar at 500 feet before threshold will first be seen at 114 feet in 300 metres RVR, at 108 feet in 250 metres RVR, at 98 feet in 200 metres, and at 90 feet in 150 metres RVR.

B5. The run back in the RVR lines at the threshold signifies a reduction in the visual segment, and is explained by the reduced intensity of runway lighting compared with approach lights; hence, for a given RVR the aircraft will have to descend further to re-establish the same visual segment using runway lights. This gives the illusion on the flight deck of a temporary worsening of visibility but the visual cues are not necessarily significantly degraded. If one takes the 300 metres RVR curve as an example, it can be seen that the following sequence occurs :

- 1) Initial contact on one approach light at 165 feet (wheel height).
- 2) Visual segment expands to include more approach lights as the aircraft descends.
- 3) 1 500 feet cross-bar appears through the fog at 154 feet, but disappears under the nose at 151 feet.
- 4) Visual segment continues to expand, reaching 90 metres by 124 feet.
- 5) 1 000 feet cross-bar appears at 132 feet, but disappears at 120 feet.
- 6) 500 feet cross-bar appears at 114 feet, and landing threshold is also visible by 92 feet. 500 feet cross-bar disappears under the nose at 90 feet.
- 7) The visual segment decreases in length ("run back") from 170 metres at 92 feet, to 130 metres at 83 feet.
- 8) The visual segment expands again to include the glide-path origin (aiming point) by 39 feet. The visual segment is now nearly 200 metres.
- 9) At touchdown the visual segment is more than 250 metres.

CHAPTER 6 — ATTACHMENT C

Calculation method for the visible part of approach lights during Category II and Category III operations



C1. The minimum length of approach lighting which is essential, in particular for Category II and Category III, is given by the equation :

$$L = D - O$$

where D is the distance of the aircraft from the landing threshold, and O is the obscured segment under the nose. In this equation :

$$D = (DH + E + R - RDH) \cotan GP$$

and $O = (DH + E + P) \cotan A$

where E = height allowance (40 ft or 13 ft) for exposure time (i.e. 3 secs or 1 sec)

R = height of GP receiver antenna above the wheels

P = height of pilot's eyes above the wheels

RDH = ILS reference datum height, and

A = cockpit cut-off angle

GP = glide-path angle

C2. The distance from the pilot's eye position to the landing threshold will, for Category II operations, be :

$$D = (DH + 40 \text{ ft} + R - RDH) \cotan GP$$

and for Category III operations will be :

$$D = (DH + 13 \text{ ft} + R - RDH) \cotan GP$$

The point on the ground visible over the nose will, for Category II operations, be :

$$O = (DH + 40 \text{ ft} + P) \cotan A$$

and for Category III operations will be :

$$O = (DH + 13 \text{ ft} + P) \cotan A$$

both being distances forward from the pilot's eye.

In each category of operations subtracting the second value from the first gives the distance from the landing threshold of the first point on the ground that will be seen by the pilot.

CHAPTER 6 — ATTACHMENT D

D1. The table below can be used as a guideline for a safe and rapid decision to be taken by the cockpit crew, in case of reported ground deficiencies.

D2. The table summarizes the possible ground deficiencies referred to in ECAC/CEAC Doc No. 17. The paragraph references which are given in the notes to the table are included for the convenience of the person preparing such a table and are not intended to be handed over to the cockpit crew (see also Attachment E).

Conditions for use of ILS-landing minima

List of conditions		Requirements for use of following minima			
		DH/ft	<50	50	100
		VIS/m	-	-	-
		RVR/m	100	200	350
Ground equipment	ILS	Operational status ¹⁾ Category acc. Annex 10	3	3 ¹¹⁾	2
		Stand-by capability	Yes	Yes ¹⁰⁾	
	App. lighting system CAT II/III		Yes ²⁾	Yes ²⁾	Yes ²⁾
	RWL	RWY edge lighting system	Yes	Yes	Yes ³⁾
		CLL	Yes	Yes ⁴⁾	Yes ⁴⁾
		TDL	Yes ⁶⁾	Yes	Yes ⁵⁾
		Secondary power for RWL ⁷⁾	Yes	Yes	Yes
	TDZ RVR ⁸⁾		Yes	Yes	Yes
	Wind measuring equipment ⁹⁾		Yes	Yes	Yes
	Other equipments (e.g. T/W lighting; Stopbars etc.)		Do not affect AOM		

Notes to table

For details
see reference

- Note 1** : Required ILS components LLZ; GP; OM, or appropriate substitute as indicated in the procedure (6.B.5.5.1.1)
- Note 2** : Increase of the visibility minimum according to Chapter 6, Attachment A, if necessary.
- No increment for the visibility minimum is necessary if the following conditions are met :
 - DH between 200 ft and 100 ft, at least the inner 450m APL available.
 - DH between 100 ft and 50 ft, at least the inner 210m APL available.
 - DH < 50 ft, no APL available (6.B.5.2)
 - Failure of secondary power supply for APL affects CAT. II RVR minimum only (6.B.5.5.4.2)
- Note 3** : During daytime an operation down to 100 ft/350m is acceptable, if MOR is reported and contrast between the RW markings and the runway surface is good. (6.B.5.3)
- Note 4** : A failure of every second light (resulting in spacing of the 30m) can be tolerated. (6.B.5.3)
- Note 5** : During daytime, an operation down to 100 ft/350m is acceptable, if a failure of TDL and/or CLL occurs. (6.B.5.3)
- Note 6** : A failure of TDL does not affect the fail operational landing minima without DM. (6.B.5.3.5)
- Note 7** : A failure of secondary power supply for RWL must be considered in the same way as a failure of RWL system (see also Notes 3 and 5). (6.B.5.5.4.1)
- Note 8** : If the TDZ RVR is not available, the State of aerodrome may, after careful evaluation of local meteorological and climatological conditions, determine that the TDZ RVR may be derived from mid-point RVR measurements and the pilot should be informed accordingly. (6.B.5.6.2)
- Note 9** : Wind information from other ground sources can be accepted. (6.B.5.6.1)
- Note 10** : Does not affect fail passive operation. (6.B.5.5.3)
- Note 11** : The LLZ course structure must comply to CAT. III down to point D. The GP must comply to CAT. II. (1.4.5)

CHAPTER 6 — ATTACHMENT E

**Guide for preparing instructions to flight crews on effect on landing minima
of temporary failures or downgrading of ground equipment**

For the failures listed other than those of ILS, there is no effect on DH. The terms CAT. II and CAT. III refer to the associated RVR value.

() = paragraph reference

N/A – Not applicable

Failed or downgraded equipment		Effect on landing minima	
		CAT. II	CAT. III
ILS (see Note 1)	ILS localizer downgraded to CAT. II	N/A	(1.4 and 6.B.5.5)
	ILS localizer downgraded to CAT. I	CAT. II not authorized	CAT. III not authorized
	ILS glidepath downgraded to CAT. II	N/A	(1.4 and 6.B.5.5)
	ILS glidepath downgraded to CAT. I	CAT. II not authorized	CAT. III not authorized
	ILS LLZ and/or GP stand-by transmitter u/s	N/A	(1.4 and 6.B.5.5.3)
	Outer Marker	(6.B.5.5.5.1)	(6.B.5.5.5.1)
	Middle Marker	(6.B.5.5.5.2)	(6.B.5.5.5.2)
RVR (see Note 4)	Touchdown zone RVR not available	(6.B.5.6.2)	(6.B.5.6.2)
	Midpoint or stopend RVR not available	(6.B.5.6.2)	(6.B.5.6.2)
Approach lights (see Notes 1 and 3)	No approach lights	(6.B.5.2)	(6.B.5.2)
	210m of approach lights available as measured from threshold	(6.B.5.2)	(6.B.5.2)
	450m of approach lights available as measured from threshold	(6.B.5.2)	(6.B.5.2)
	Secondary power for approach lights not available	(6.B.5.5.4)	(6.B.5.5.4)

Table (continued)

Failed or downgraded equipment		Effect on landing minima	
		CAT. II	CAT. III
Runway lights (see Notes 1 to 4)	No runway lights available (RW edge, threshold, end, centre-line and TDZ lights u/s)	(6.B.5.3)	(6.B.5.3)
	Runway edge lights (including threshold and end lights) not available. (Centre-line and touchdown lights normal)	(6.B.5.3)	(6.B.5.3)
	Centre-line lights not available	(6.B.5.3)	(6.B.5.3)
	Touchdown zone lights not available	(6.B.5.3)	(6.B.5.3)
	Centre-line light spacing increased to 30m	(Annex 14 and 6.B.5.3)	(6.B.5.3)
	Secondary power for runway lights not available	(6.B.5.5.4)	(6.B.5.5.4)
Taxiway lights	Taxiway lighting	(1.3.3)	(1.3.3)
Other equipment	Anemometer normally serving the RW in use	(6.B.5.6.1)	(6.B.5.6.1)
	Ceilometer	(6.B.5.6.3)	(6.B.5.6.3)

Note 1 : In case of downgrading of ILS and deficiencies in lights determine first what approach category applies. Then check effect of lighting deficiencies for that category.

Note 2 : For runway lights multiple failures other than indicated in table are not approved.

Note 3 : Deficiencies of approach and runway lights are treated separately and do not affect each other.

Note 4 : Deficiencies in runway lights and RVR reporting are not allowed together.

CHAPTER 7

CATEGORY II AND III OPERATIONS BY BUSINESS AEROPLANES

7.1 Applicability, level of safety and definition

7.1.1 Business aviation operates under Annex 6, Part II to the ICAO Convention in which there are no provisions for low visibility operations. However, the provisions of this document are intended to apply equally to the Category II and III operations of business aviation in the ECAC region as to those of commercial air transport. It is recognized that there are significant differences between these two types of operations and, therefore, the intent of this chapter is to add to or modify the rest of this document so as to reflect the differences but at the same time to promote a similar level of safety in business aviation Category II and III operations as that achieved in commercial air transport operations.

7.1.2 Business aviation is defined for the purposes of this document as :

"That part of general aviation which concerns the operation of aircraft by companies for the carriage of passengers or goods as an aid to the conduct of business, flown for purposes generally considered as not for public hire and piloted by individuals having, as a minimum, a valid Commercial Pilot's Licence with an Instrument Rating."

7.2 Introduction of Category II operations and subsequent maintenance of standards

7.2.1 Before operating to the lowest authorized aerodrome operating minima, there should be an operational evaluation stage during which the operational procedures and practices are used in Category I weather conditions or better, in order to test the procedures, evaluate airborne equipment and accumulate experience. When the operation has been formally established, there will be a need for continued monitoring so as to assist in the maintenance of required standards. These arrangements should be as described in Chapter 2 for both the introduction of the operation and for its continued use.

7.3 Company flight operations organization

7.3.1 It is important for flight safety that Category II and III operations are properly organized and supervised. One person within the flight department of the company should be put in charge of these operations.

7.4 Operations manual or manual of Category II and III operations

7.4.1 Business aviation as part of general aviation is not required to have operations manuals, nor does ECAC seek to impose such a requirement. However, because the nature of low visibility operations is critical and demands precision to be achieved in a rapidly developing dynamic situation near the ground, there is a need for procedures and techniques to be both developed and codified. Therefore, when no operations manual exists, each operator should produce a manual of Category II and III operations. This manual on Category II/III contents of the OPS manual as appropriate should be scrutinized by the State of operator before the operator is authorized for Category II or II and III operations and subsequently when, for example, amendments are proposed. A copy should be carried in each aeroplane and it may be incorporated in an existing operations manual.

7.4.2 Since there is a need for uniformity within the Member States of ECAC, a set of guidelines are included at Attachment A to this chapter. The guidance is primarily concerned with necessary additions to or variations from Category I operations and is designed to cover, in accordance with this document and therefore with the ICAO Manual, the following topics :

- a) aerodrome equipment and procedures;
- b) aeroplane equipment;
- c) modes of operation;
- d) operating procedures (normal and abnormal);

- e) limitations;
- f) flight crew qualifications, training and crew complement;
- g) aerodrome operating minima;
- h) company organization; and
- i) monitoring Category II and III operations.

7.4.3 All instructions in the manual must be compatible with the limitations and mandatory procedures in the Flight Manual.

7.5 The aerodrome

The requirements for the aerodrome equipment and procedures are given in Chapter 1. Chapter 6, paragraph 6.4 gives the minimum ground system requirements for particular Category II and III operations.

7.6 Aeroplane equipment

The requirements for the aeroplane equipment are given in Chapter 2.

7.7 Modes of operation and operating procedures

The operating procedures which should be used are given in Chapter 3.

7.8 Flight crew

7.8.1 General

Chapter 4 sets out the requirements for the qualifications and training of flight crews. These requirements apply to flight crews of business aeroplanes but with the variations and additions as set forth in paragraphs 7.8.2 and 7.8.3 below.

7.8.2 Training and testing

7.8.2.1 For initial Category II qualifications a flight simulator of the operational aeroplane, which has been approved by an ECAC State for the purpose, should be used for training in flight deck procedures and aeroplane handling and for the qualifying check flight.

7.8.2.2 If a flight simulator of the operational aeroplane is not available, use should be made of both the "live" aeroplane and a flight simulator of any other aeroplane type that has approval from an ECAC State for training in Category II operations.

7.8.2.3 The value of using a flight simulator which is **not** specific to the operational aeroplane, lies in the pilot being able to practise the transition from instrument to visual flight and making the "land/go-around" decision, having familiarized himself with the required visual reference(s). In order to achieve valuable training it is most important that the realizable visual segments for specific combinations of RVR and DH, the final approach speeds (and therefore rates of descent) and the responses of the surrogate simulator to the use of the primary flight controls, together with the height loss experienced in a missed approach, are closely comparable to those of the operational aeroplane. It is emphasized that simulation in performance is more important than similarity in equipment, instrumentation or configuration. The pilot should use the procedures for his operational aeroplane, as far as is practicable.

7.8.2.4 Recurrent/revalidation Category II checks should whenever possible be made on a type-specific flight simulator. When such a simulator is not readily available, the check may be made in the "live" aeroplane. When the "live" aeroplane is used, the training and testing should be reinforced by viewing a film or video tape of actual Category II approaches and

landings. Each check should be supported by preparatory training as necessary in the simulator or in the aeroplane as applicable.

7.8.2.5 Whenever the aeroplane is used for training or testing, best means for simulating Category II conditions in flight for the pilot being trained or tested should be provided and should be approved by the State of the operator for this purpose.

7.8.2.6 For initial and recurrent Category III training and testing, a flight simulator of the operational aeroplane, approved by an ECAC State for the purpose, must be used.

7.8.2.7 All flight and simulator training should be supported by comprehensive ground instruction which should cover those items mentioned in paragraph 5.7.2.1 of the ICAO Manual. This is especially important when a non-specific flight simulator is used.

7.8.2.8 The minimum number of Category II/III approaches per calendar period for each pilot and the frequency of the competency checks should be the same as that required for pilots qualified for Category II and III operations in commercial air transport operations. The State of the operator should approve the syllabus of ground, flight and simulator tests, including the pass/fail standards, for issue of the Category II and III operations qualification, if the State so wishes.

7.8.2.9 Records should be kept of initial and recurrent pilot training and competency checks and of the approaches and landings each pilot makes using Category II and III procedures in Category II and III conditions or better, so that the competence of each pilot may be readily assessed. Pilots should practice Category II and III procedures as often as possible.

7.8.3 Crew complement and qualifications

Whenever it is intended to carry out Category II or III operations or there is a possibility of such operations, the crew complement shall consist of two pilots, even though the flight manual may call for only one pilot. Each pilot must have, at least, a valid Commercial Pilot's Licence with a valid Instrument Rating and be qualified for Category II or II and III operations on the specific aeroplane type.

7.9 Authorization

7.9.1 Chapter 5 describes the authorization requirements for commercial air transport. These requirements also apply to Category II and III operations by business aviation.

7.9.2 The Attachment B to Chapter 7 shows the list of countries where Category II operational letter of competency for foreign operators is required before the commencement of the operations.

7.10 Aerodrome operating minima

7.10.1 Chapter 6 explains the rationale for the calculation of aerodrome operating minima. Unless there are to be interim minima, the State of the operator will normally authorize the lowest acceptable minima in terms of the capabilities of the approach aid, the aeroplane and its equipment and the flight crew, necessarily discounting other factors that may vary from location to location. Chapter 6, paragraph 6.2.1, shows that, since the DH for Category II is the highest value derived from a number of factors, the actual DH to be used may sometimes be greater than the authorized minimum DH. In turn, the effect on RVR (and mode of operation) of a greater value of DH may be seen in Chapter 6, paragraph 6.3.4, Table 1.

7.10.2 There is a further factor affecting the value of DH deriving from the use of radio altimeters. Since height calls and therefore the DH should be based on the use of an (approved) radio altimeter (see Chapter 3, para. 3.1.2), it will be necessary to determine the value of the radio height which is equivalent to the promulgated Category II OCH, since the DH is usually taken to equate to the OCH (provided the value is not less than 100 feet). The radio height is usually calculated by the State of the aerodrome and published on proprietary

approach charts or plates (or through other media). When this is not done, the pilot will need to refer to the official ICAO precision approach terrain charts and make the adjustment for himself.

7.10.3 Revised values of DH or RVR may be subject to scrutiny or approval by the State of the aerodrome.

7.10.4 It will be necessary to consider the effect on minima of abnormal situations such as failures of an automatic flight control system, withdrawal of certain ground aids or crew incapacitation. The resulting reversionary minima should normally be those for Category I operations, at least. Chapter 6, Attachments D and E give guidance on reversionary minima in relation to failures of ground aids.

CHAPTER 7 — ATTACHMENT A

Guidelines for the Category II and Category III operations content of the operations manual or for the manual of Category II and III operations

1. Definitions

2. Category II and III operations

Note: Not all items are necessarily applicable when Category II operations only are intended. Guidance should be sought from the national administration concerned.

2.1 Aerodrome equipment and procedures

2.1.1 A brief description of the equipment and its characteristics that is provided at aerodromes approved, in accordance with ICAO criteria, for Category II and III operations, e.g. approach lighting, runway and taxiway marking and lighting, holding positions and indicators, RVR assessment systems, types/categories of ILS installations. A statement of the minimum facilities acceptable for Category II and for Category III operations.

2.1.2 A statement of the functions and principles of obstacle clearance criteria, obstacle free zones, precision approach terrain charts, sensitive areas.

2.1.3 A general description of air traffic control and ground movement control procedures and, in particular, aerodrome low visibility procedures intended to protect the ILS signal in space from interference and the runway in use from inadvertent intrusions.

Note: Category I ILSs may, subject to prior flight check in clear weather, be used when training or system proving, in Category I conditions or better.

3. Aeroplane equipment

3.1 A brief description of the instruments and equipment available in the aeroplane in accordance with the airworthiness certification requirements for the intended mode(s) of operation.

—
—
Chapter 1 and its various references to the ICAO Manual.

Paras 6.4.1.3 and 6.4.1.4.

—
—
Chapter 2, para. 2.1 and reference to the ICAO Manual, Tables 5-1 and 5-2.

4. Modes of operation

4.1 A description of those modes of operation to be used, e.g. manual approach and landing, "coupled" approach to decision height, fail-operational and fail-passive automatic landing, automatic roll-out, automatic missed approach.

5. Operating procedures

Note: This section may be logically divided into normal and abnormal procedures sub-sections.

5.1 A statement of the minimum visual references at and below decision height on landing e.g. the number and pattern of approach/runway-lights/markings with the associated visual segments. (Visual segments of 120 metres for a manual landing and 90 metres for an automatic landing should be regarded as the normal minimum values).

5.2 Action in the event of the deterioration of visual reference for landing.

5.3 Action to be taken in relation to wind velocity, wind shear and turbulence information.

5.4 Fuel policy – especially requirements to allow for ATC delays associated with low visibility operations.

5.5 Procedure for an approach to land on a runway at which aerodrome low visibility procedures are not fully in force.

5.6 Autoland – a description of the sequence of events from 500 feet radio height to touchdown and roll-out or go-around.

5.7 Flap settings for autoland and missed approach.

5.8 The land or go-around decision to be made by the pilot-in-command.

5.9 Action in the event of :

- i) Failures above and below alert height.
- ii) ILS deviation warnings.
- iii) Autopilot disconnect.
- iv) Auto-throttle disconnect.
- v) Autoland status changes.
- vi) Electrical failures.
- vii) Engine failure.

Chapter 3 and para. 3.1 reference to the ICAO Manual para. 5.6.2.

Chapter 3 and para. 3.1 reference to the ICAO Manual paras 5.6.3 and 5.6.4.

- viii) Failures at and below decision height.
- ix) Incapacitation of the pilot-in-command.

5.10 All descriptions of procedures will necessarily need to include such aspects of crew co-ordination and distribution of flight deck duties as :

- i) Handling the aeroplane, including designation of handling and non-handling pilots.
- ii) Tuning of navigation receivers.
- iii) Use of the autopilot/automatic flight control system.
- iv) Use of check lists.
- v) Handling of radio communications.
- vi) Monitoring and cross-checking of instruments (in accordance with para. 3.1.2 of this document).
Cockpit calls.
- vii) Altitude/height calls (in accordance with para. 3.1.2 of this document).

5.11 A statement of the "approach ban" policy in each destination State. A statement of any voluntary company "approach ban" requirement to augment the State's policy if necessary.

6. Limitations

6.1 Effect, if any, of the use of low visibility aeroplane systems or handling procedures on aeroplane performance calculations, especially on landing distance required.

6.2 Maximum/minimum acceptable glide-path angles.

6.3 Maximum allowable tail and cross-wind components in Category II and III weather conditions.

6.4 Limitations, with descriptions as necessary, of the autopilot/automatic flight control system including auto throttle and auto go-around capability when applicable.

6.5 The effect of terrain profile in the approach area on radio altimeter readings and on the automatic flight control system.

6.6 A description of the minimum aeroplane equipment (allowable deficiencies) required for Category II and III operations covering :

Flight Manual and as advised by the national authority concerned.

- a) The start of a Category II or III approach.
- b) The final approach for an automatic landing.
- c) The automatic landing, with or without automatic roll-out control.

7. Flight crew qualifications, training and crew complement¹

7.1 Curriculum for a structured course of ground training including all subjects mentioned in paragraphs 1 to 6 above.

Note: If the resources of or available to the company do not enable a formal course to be given, a one-to-one tutorial arrangement supported by directed self-study, may be acceptable.

7.2 Curriculum for flight simulator and flight training, including the practical aspects of all subjects mentioned in paragraphs 1 to 6 above.

Note 1: The allocation of exercises between the simulator and the aeroplane will depend on whether or not the simulator is specific-to-type and has an adequate visual attachment. When it is and it has been approved by an ECAC State for Category II and III training, most of the exercises may be best done in the simulator.

Note 2: When training in conditions better than Category II or III, interference with the ILS may occur, since low visibility procedures will not be in force, even when they exist.

7.3 Recency requirements. Number of Category II and III approaches to be made by each pilot-in-command, regardless of the weather conditions, in a stated calendar period.

7.4 Curriculum for recurrent/revalidation training and testing including a statement of the period of validity of Category II/III check.

7.5 Description and example of the method to be used for the recording of pilot training and testing, initial and recurrent, and of recent experience.

7.6 Crew qualifications and complement. Statement of minimum crew complement and licences, ratings and qualifications to be held by each crew member for Category II or III operations.

Chapter 4 and para. 4.1 reference to the ICAO Manual paras 5.7.1 and 5.7.2.

Chapter 4 and para. 4.1 reference to the ICAO Manual para. 5.7.3

Chapter 4 and para. 4.1 reference to the ICAO Manual para. 5.7.6

Chapter 4 and para. 4.1 reference to the ICAO Manual para. 5.7.4

¹ The texts for these items need not be included in the copy of the Manual carried in the aeroplane.

8. Aerodrome operating minima*Chapter 6*

8.1 Statement of lowest landing minima accepted or approved by the State of the operator. —

8.2 Statement of reversionary minima and the circumstances in which these are to be used. —

8.3 Minima to be applied at each runway to be used. —

Note: It will often be acceptable to refer to approach plates or charts which indicate values of minima which are acceptable to the State of the aerodrome.

8.4 A statement of the minima required for landing alternates. —

8.5 A statement of the minima required for an engine inoperative landing. —

9. Company organizations¹

9.1 A brief description of any special arrangements within the company for the conduct of Category II and III operations, if such arrangements are found necessary. In any case, the nomination of the person within the organization, to be in charge of Category II and III operations. —

10. Monitoring of Category II and III operations¹

Chapter 2 and para. 2.2 reference to the ICAO Manual paras 5.5.2, 5.5.4 to 5.5.5.2 and 5.5.5.3.

10.1 A description of the method to be used to monitor the quality of Category II and III operations to ensure that operating standards are maintained. This should include allocation of tasks and responsibilities and a description or example of the form to be used by pilots for reporting on the success or otherwise of each Category II or III approach, as may be required by the State of the operator.

Note 1: This system will need to be co-ordinated with that used by the engineering and maintenance organization responsible for the serviceability of the relevant aeroplane equipment.

Note 2: See Annex to this Attachment for an example of a pilot's report proforma.

¹ The texts for these items need not be included in the copy of the Manual carried in the aeroplane.

ANNEX

OPERATOR'S NAME

EVALUATION OF CATEGORY II/III OPERATION

CAPTAIN	REGISTRATION
DATE	LANDING TIME
AERODROME	RUNWAY.....
AEROPLANE TYPE	RUNWAY STATE
CATEGORY OF APPROACH – II/III*	
APPROACH MODE	
PRACTICE/OPERATIONAL*	
REPORTED SURFACE WIND	REPORT RVR-TDZ
	MIDPOINT.....
	STOPEND.....

APPROX. LDG. WT.....

TURBULENCE – NIL/SLIGHT/MODERATE*

AUTOPILOT ENGAGE SEQUENCE (If applicable) :

PREMATURE AUTOPILOT DISCONNECT (If applicable) :

- WHEN?
- WHY?

- STATE OF TRIM AND ANGLE OF BANK AT DISCONNECT :

AUTOLAND STATUS WARNING – YES/NO*

If Yes : WHEN?

ILS DEVIATION WARNING – YES/NO*

If Yes : Glide path? YES/NO; Localizer? YES/NO; Missed approach? YES/NO

CAUSE OF MISSED APPROACH (If applicable) :

STATE OF TRIM AT NORMAL A/P DISCONNECT :

SERVICEABILITY OF REQUIRED ON-BOARD EQUIPMENT :

ANY COMMENTS :

(ILS disturbance, Wind shear, etc.)

(* Delete as necessary)

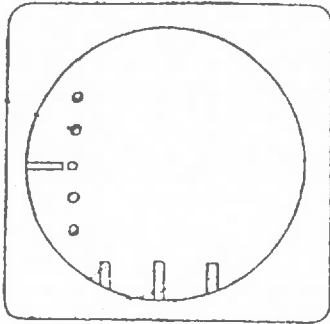
SIGNATURE.....

Note : Complete reverse when approach or landing not successful, e.g. when missed approach made necessary by aeroplane equipment failure or by breakdown of procedures or by inadequate visual references or when touchdown is outside prescribed area for Cat. III landing.

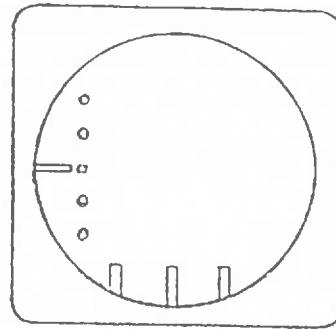
REPORT ON APPROACH OR LANDING

I. INSTRUMENT INDICATIONS OF POSITION

INDICATE GLIDESLOPE AND LOCALIZER DISPLACEMENT AT :



300 ft. Radio or Middle Marker



DH (STATE VALUE)

II. VISUAL ASSESSMENT OF POSITION

A. At DH

Indicate position in relation to centre line and give approximate distance to threshold, at DH (state value), when A/P disconnected and/or when go-around started.

B. On becoming visual before DH

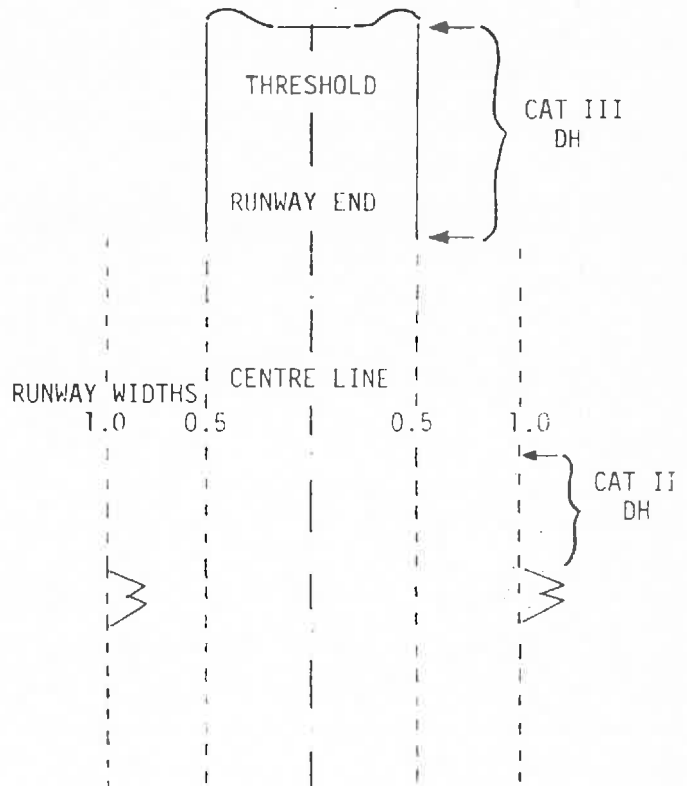
Indicate position in relation to centre line and give approximate distance to threshold.

C. On touchdown

Manual or autoland (state which)

State approximate distances :

- i) left/right of centre line
- ii) from threshold



CHAPTER 7 — ATTACHMENT B

**List of ECAC States where Categories II/III operational letter of competency
is required for foreign business aviation operators
before the commencement of operations**

Letter of competency required

Letter of competency not required

CHAPTER 8

**GUIDANCE MATERIAL FOR USE WHEN PREPARING REGULATIONS
FOR THE INTRODUCTION
OF CATEGORY II AND CATEGORY III OPERATIONS**

8.1 The regulations for the introduction and control of Category II and Category III operations which are applied in France, in the Federal Republic of Germany, and in the United Kingdom incorporate the requirements which are recommended by ECAC. Member States which are about to prepare new regulations, or to amend existing regulations, are recommended to use those of the above-named Member States as guidance.

8.2 The titles of the documents provided by the respective States are as follows :

FRANCE	Règlement opérationnel - Décision n° 3437 DTA/T/OU du 2 juin 1975 relative à l'exécution des approches de précision de Catégories II et III avec hauteur de décision
GERMANY	Rules for Category II all-weather operations Rules for Category IIIA all-weather operations
UNITED KINGDOM	Operating requirements for all-weather operation Categories II, IIIA and IIIB (CAP 359)

8.3 The information required from operators seeking authority from their own State administration for the commencement of Category II and Category III operations is similar in the three above-named Member States. It is recommended that the submissions listed below should be used as guidance on the areas, and on the detail, to be covered in the examination of an operator's preparation of Category II and Category III operations.

FRANCE	Dossier de conformité aux exigences de la réglementation opérationnelle pour l'exécution d'approches de précision - de Catégorie II - de Catégorie III avec hauteur de décision
UNITED KINGDOM	British Airways Tristar all-weather OPS programme General submission for Category II operations General submission for Category IIIA operations

8.4 The above-named documents can be obtained by writing to the respective States at the following addresses :

Direction générale de l'aviation civile
Service de la formation aéronautique et du
contrôle technique
93 Boulevard du Montparnasse
75270 - PARIS Cedex 06
FRANCE

Federal Ministry of Transport
Civil Aviation Department
Kennedyallee 72
D-5300 BONN 2
FEDERAL REPUBLIC OF GERMANY

Civil Aviation Authority
Director of Operational Planning and Development
Aviation House
South Area, Gatwick Airport
Gatwick, West Sussex RH6 OYR
UNITED KINGDOM

PART B

**COMMON EUROPEAN PROCEDURES
FOR
GROUND OPERATIONS UNDER LIMITED VISIBILITY**

**RECOMMENDATION INT.S/15-2
AIRCRAFT GROUND OPERATIONS UNDER LIMITED VISIBILITY**

(Adopted by the Fifteenth Intermediate Session on 24 June 1986)

WHEREAS ECAC Member States have agreed that it would be desirable to have an integrated European multidisciplinary approach to the whole range of problems raised by aircraft ground operations under limited visibility conditions and to achieve harmonization of the required safety measures in Europe; and

WHEREAS they also agreed that the development of such an integrated approach should not overlap any related ICAO activity, however they have recognized that the various documentation which has been developed by ICAO does not constitute a comprehensive set of conditions fully appropriate for the particular needs of Europe and does require additions, upgrading and amendment,

THE CONFERENCE RECOMMENDS

that procedures and facilities established by Member States for ground operations under limited visibility conditions should be in accordance with ECAC.CEAC Doc No. 17, Issue 3, Part B.

CHAPTER 1

INTRODUCTION

Ref : SMGCS Manual
Chapter 1

Aircraft may be required to manoeuvre on the aerodrome in visibilities down to and below 100 m before take-off and after landing.

The specific equipment and procedures which need to be provided for the safe conduct of these ground operations depend on the operating minima chosen and the extent to which aircraft and vehicles can come in conflict. Conflicting traffic can be eliminated by restrictions of movements and selection of the right facilities for the particular aerodrome lay-out and traffic density planned. The means adopted will vary with the size and complexity of the manoeuvring area and with the movement rate required.

Ground operations of aircraft during limited visibility conditions become more demanding as visibility decreases. The first objective must be to make the runway area sterile and safe.

Ref : SMGCS Manual
Chapter 1
(amendment)

The first limitation occurs when visual surveillance of the manoeuvring area by ATC is no longer possible and the full extent of the runway and the access points cannot be seen. Procedures and facilities must be instituted to prevent intrusions into the manoeuvring area, in particular to the runway.

The required safety level for avoidance of collision by pilots of aircraft taxiing to and from the runway may not be achieved without aids and proper assistance by ATC at visibility conditions corresponding to an RVR value somewhat less than 200 metres.

At these very low visibilities additional means are therefore necessary to ensure that aircraft can move safely, orderly and expeditiously. This may be done by extra visual aids, procedures and/or electronic means.

As regards the ability of pilots taxiing aircraft on visual guidance in the manoeuvring area, the limit is assumed to be lower than approximately 100 metres visual range.

CHAPTER 2

AERODROME SAFETY ASSESSMENT

Ref : SMGCS Manual
Chapters 5 and 7
(amendment)

During the safety assessment preceding the introduction of low visibility operation, it is essential that all aspects which might be affected should be examined. An effective method is to form a working group composed of representatives of all parties involved in the operation. The working group should identify the required action to be taken in the various fields and establish a work programme (flow chart), based on a time schedule, in which all subjects to be examined are included. Part of the work of such a group is to study the suitability of the procedures and facilities for safe ground operation under low visibility conditions. A safety assessment should be carried out, basically in accordance with the ICAO All-Weather Operation Manual, Chapter 5, paragraph 5.2.1 and the ICAO Manual for Surface Movement and Guidance Control Systems (SMGCS), Chapter 5, paragraph 5.5. Taking into account the lowest RVR at which operations are planned, an assessment of the magnitude of any increase in operating risk, due to the lack of control by visual means should be made. If the risk is determined to be significant, it must be cancelled out by the imposition of additional control techniques, procedures and aids as contained in this document. The study must first focus on the probability of runway intrusion by taxiing aircraft and vehicles when aircraft are in the take-off or landing phase, where the potential for a fatal accident is high. Then the group should concentrate on the other parts of the movement area to assess any necessary adjustment. In that respect generally the following actions should be taken :

- a) examination of aerodrome lay-out with particular attention to taxi routes between terminal areas and runways, ground traffic routes, ground traffic control points, movement area entrances and existing aids;
- b) examination of the existing ATC instructions, operations orders and company rules that are relevant to the general movement scenario;
- c) examination of aeronautical climatological records and movement statistics for aircraft and other vehicles;
- d) examination of any past records of runway intrusion and taxiway junction incidents. If no records are available it may be necessary to establish a picture of past intrusions and incidents by gathering information from controllers and inspecting authorities, etc.;
- e) examination of existing airport security procedures. The use of general security procedures may have significant effect upon the overall intrusion probability; and

Ref : SMGCS Manual
Chapters 5 and 7
(amendment)

- f) after the initial study the actual situation regarding paragraphs a) through e) should be verified by an inspection on the aerodrome accompanied by relevant experts and responsible authorities.

The safety assessment should be considered by the working group as part of a complete system approach and must be completed in an early stage of the implementation process.

The general picture derived from the study and the particular areas which are expected to have a higher level of risk than acceptable, will be used to establish measures to be implemented before the low visibility operations could be approved.

In addition to the revision or introduction of the procedures, the protection measures, the visual – and non visual facilities, a basic decision should be made on selecting the components of a Surface Movement Guidance and Control System (SMGCS). Such a system could be based primarily upon procedural methods of control and visual means to maintain separation between aircraft and/or vehicles or the separation could be obtained by using in addition a radar system, or other suitable technical means, which meets specific operational performance requirements and technical specifications.

Experience has shown that a major intrusion risk is from vehicles authorized on the movement area. Consequently, such authorization should be kept to the bare minimum and under strictly controlled conditions.

To prevent recurrence, the responsible authority should establish procedures for the reporting and the investigation of incidents during ground operations, where aircraft or aircraft and vehicles are involved. Arrangements should be made to compile and analyze the relevant information.

After the ground operations under low visibility conditions are authorized, it is necessary to establish a machinery to ensure that the required provisions are amended or updated as a consequence of new developments or time variable factors affecting the safety assessment.

It is also necessary to establish a system for quality control within the aerodrome organization to ensure that facilities, equipment and operating conditions are in accordance with current safety regulations and local instructions.

The size and organization of this quality control system should be adjusted to local conditions in order to ensure an adequate monitoring of aerodrome operations.

This system should include routines for initiating corrective actions when deviations from described standards are detected and the following-up of such actions.

CHAPTER 3

VISIBILITY CONDITIONS AND ASSOCIATED ACTIONS

3.1 Definition of visibility conditions

Ref : SMGCS Manual
Table 2-1

Visibility condition 1

Visibility sufficient for the pilot to taxi and to avoid collision with other traffic on taxiways and at intersections by visual reference and for personnel of control units to exercise control over all traffic on the basis of visual surveillance.

Visibility condition 2

Visibility sufficient for a pilot to taxi and to avoid collision with other traffic on taxiways and at intersections by visual reference, but **insufficient** for personnel of control units to exercise control over all traffic on the basis of visual surveillance.

Visibility condition 3

Visibility less than 400 m RVR (low visibility operations).

3.2 Additional requirements for associated actions

3.2.1 Visibility condition 1

Ref : SMGCS Manual
Chapters 4, 5 and 7
(amendment)

No additional ECAC requirements to the provisions in the relevant ICAO documentation are necessary for ground operations by aircraft during visibility condition 1.

3.2.2 Visibility condition 2

Ref : SMGCS Manual
Chapters 4, 5 and 7
(amendment)

Actions required in visibility condition 2 are also dependent on the dimensions of the manoeuvring area and the position of the control tower in this area. Procedures and visual aids (signs, markings, lights) should be designed and published to allow the pilot to determine his position and follow the required route. In the lower ranges of visibility condition 2, procedures might limit the movement rate taking into account the physical lay-out of the aerodrome and the availability of a Surface Movement Radar or other technical means.

Adequate safeguards against undetected runway intrusions should be provided, such as limited taxi routing, additional procedures and/or intensified radar assistance stopbars at runway access points or other technical means.

When the visibility decreases to a value corresponding to about 1 000 m RVR, and is expected to fall further :

ECAC.CEAC Doc No. 17
para. 1.6.2.2.4

- the withdrawal of vehicles and personnel involved in construction-maintenance-and other non essential activities on the manoeuvring area should be initiated;
- the ILS sensitive area should be cleared of all traffic.

At a visibility corresponding to 600 m RVR the withdrawal of non essential vehicles and personnel from the manoeuvring area should be completed.

3.2.3 Visibility condition 3 (low visibility operations)

At and below this visibility, ATC will ensure that the ILS sensitive area is clear of known traffic before issuing landing clearance.

At a visibility corresponding to 400 m RVR measures to protect runway and ground movement should be completed. ATC is responsible for the movement of ground vehicles on the manoeuvring area.

In visibility conditions corresponding to 200 m RVR and less, it may be necessary to further restrict the operation of vehicles and persons on the manoeuvring area. Procedures should be developed for ATC to assist the fire and rescue services in case of an accident or incident.

When the visibility decreases to 150 m RVR and less, the published procedures and the equipment availability should be compatible with the requirement that ATC accepts increased responsibility for collision avoidance.

Ref : SMGCS Manual
Table 2-1
(amendment)

To determine the ability of the pilot to taxi as described in the definition of the visibility conditions, the following facilities should be taken into account for suitability :

- the taxiway lights;
 - the taxiway markings;
 - the location and characteristics of the position and route information signs.
-

CHAPTER 4

THE USE OF RUNWAY VISUAL RANGE FOR GROUND OPERATIONS

Ref : Annex 3
para. 4.1.7 and
para. 4.6.2
(amendment)

The provision of RVR information is to meet the requirements of aircraft landing and take-off operations and not primarily aircraft ground operations in low visibility.

To implement low visibility ground procedures, the RVR information from one or more observation positions which are considered to be representative of the selected taxiing route, supplemented by pilots' reports if available, should be used. At aerodromes being operational under very low visibility conditions, where taxiing routes are extensive, the appropriate authorities should provide for additional observations¹, when runway observation positions are not representative for the particular aircraft ground operation due to large distances and local meteorological and climatological factors.

1 Additional observations may consist of human observations or observations by technical means (e.g. transmissometer, TV camera)

5.5 Taxiway centre-line lights

Ref : Manual "Visual Aids"
para. 4.6.2
(amendment)

The design of the taxiway and the taxiway centre-line lighting intended to be used for operations in visibility conditions corresponding to RVRs of less than 400 metres, should be based on the cockpit centre-line tracking technique.

5.6 Coding of distance

Ref : Manual "Visual Aids"
Table 1-1
(amendment)

For low visibility operations the provision of visual aids in addition to those in Table 1-1 of the Aerodrome Design Manual, Part 4, (coding of distances) should be considered. Safety of operation can be enhanced by visual systems indicating the proximity of the runway exit for aircraft on the runway, the boundary of the ILS sensitive area, the transition between the manoeuvring area and apron, etc..

Green/yellow coded taxiway centre-line lights should be used at runway exits. The colour coding should begin at the edge of the runway and continue at least to the Cat. II/III holding position or, when not provided, to where the ILS-sensitive area terminates.

5.7 Taxiling guidance signs

Ref : Manual "Visual Aids"
Chapter 11
(amendment)

A standard system of signs to identify the position of aircraft adequately, in particular at intersections and to enable the pilot to proceed safely, should be established at the aerodrome.

Annex 11
para. 2.12
(upgrading)

The designation of taxiways, exits and entries should be done in a manner which simplifies the orientation on the aerodrome, particularly in limited visibility conditions.

For ground operations in low visibility conditions, the signs essential to the ground operation should be located on both sides of the taxiway. This should normally include all relevant mandatory and location signs.

The location laterally from the taxiway centre line and the dimensions of the signs should be determined by the appropriate authority, taking into account the minimum visibility during which the aerodrome is used and the most restrictive aircraft type expected to operate at the aerodrome. Based on the visual cues relevant for a pilot of a Boeing 747 under very low visibility conditions, the distance from the taxiway centre line could be considered in the order of 30 metres. In this respect, attention should be given to the construction being able to resist the exposure to the blast of the aircraft engines.

On the selected taxiroutes for the low visibility ground operations the signs, essential to the ground operations, should be lighted, preferably internally.

5.8 Surface markings

Ref : AWO Manual
para. 5.2.3

Annex 14
para. 5.3.16.1

ECAC.CEAC Doc
No. 17
para. 1.3.3.1

When surface markings are the sole taxiway centre-line reference to the users in low visibility conditions, the aerodrome authorities should ensure that they are kept free of contamination and are sufficiently conspicuous to the users throughout the taxiroutes. Furthermore, it must be assured that other essential markings in connection with low visibility procedures must be treated accordingly.

5.9 Stopbars

Ref : Manual "Visual Aids"
para. 10.4
(amendment)

Annex 14
para. 5.3.19
(amendment)

PANSRAC
Part V
para. 6.6

SMGCS Manual
Chapter 7
paras 7.3.5, 7.4.3
and 7.4.4

Stopbars should be provided at all taxiways giving access to active runways during limited visibility conditions unless the aerodrome lay-out and applied procedures enable protection by equivalent means at the discretion of the responsible authority.

Stopbars, when provided, should be operated and monitored at least in visibility conditions corresponding to RVRs of less than 400 m.

CHAPTER 6

SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEMS (SMGCS)

Ref : SMGCS Manual
(upgrading)

The provision of guidance and control of all aircraft, vehicles and personnel on the movement area of an aerodrome should be in accordance with the ICAO Manual on Surface Movement Guidance and Control Systems (Doc 9476-AN/927) with the following additional ECAC requirements.

6.1 General

Ref : SMGCS Manual
(Chapter 2)

The degree of sophistication of the SMGCS and thus the associated operational limitations should in principle be synchronous to the aerodrome lay-out, expected movement rates and the aerodrome minima applied by operators or the minima established by the State for that aerodrome. When an essential component of the SMGCS is temporarily unserviceable or does not meet the minimum performance or technical requirements, then the operational use of the aerodrome should be restricted. As a consequence the traffic movement rate may be limited; arriving and departing aircraft should be informed (ATIS, RT) and a NOTAM with the appropriate information should be distributed.

An SMGC system monitored by a Surface Movement Radar (SMR) should be provided at heavy traffic density aerodromes used for ground operations in visibility conditions corresponding to an RVR of less than 400 m. (For the use of SMR for separation purposes, see para. 6.9).

For aerodromes having a medium or light traffic density and/or a system of well segregated ground movement routes, the appropriate authority might decide upon an SMGC system without SMR monitoring. The collision avoidance of aircraft could then be based on a procedural method when it has been assessed that an adequate level of safety will be obtained.

Provided that essential local traffic information is given by ATC, pilots can be expected to see and avoid other traffic at visibilities down to 200 m RVR.

Ground operations in visibility conditions corresponding to RVRs of less than 200 m should only be allowed when the task of separating and spacing aircraft and/or vehicles on the manoeuvring area is shared by ATC. Means should be available to ATC to fulfil this task.

Local conditions, like long taxi distances and the availability of information on the visual range along the taxi route by instrument observations, could require alteration of this value on discretion of the appropriate authority.

Ref : SMGCS Manual
(Chapter 2)

The following two basic concepts are found to be appropriate :

- **Control by visual means only**

Preferred taxi routes for arriving and departing aircraft and for aircraft taxiing from the taxi-holding position back to the apron, should be nominated and marked clearly and unambiguously. In order to maintain a required movement rate and separation, information must be available to the ATC-unit regarding the positions of aircraft on the manoeuvring area. This can be done by a system in which the taxi route is divided into identifiable blocks.

- **Control by visual means and assisted by a Surface Movement Radar (SMR)**

In addition to the visual means discussed in the previous paragraph the ground operation of aircraft is facilitated by use of a Surface Movement Radar which meets a minimum performance objective and specific technical criteria. Procedures for its use should be laid down for the ATC personnel. Guidance material on the use and the performance objectives of SMR is contained in **Attachments 1 and 2** to this document and in the ICAO Air Traffic Services Planning Manual (Doc 9426-AN/924), Part II, Section 5, Chapter 4.

The ground navigation of aircraft (location and taxiing, excluding separation), is at present based on the use of visual aids by the pilot as a suitable (electronic) alternative has not yet been developed.

Great emphasis should therefore be put on the means (and specifications) necessary to enable the pilot to locate the position (location signs, stopbars) and to follow a defined taxi route (selective taxiing centre line lights, guidance signs) in low visibility conditions.

In that respect, special attention should also be given to specify an unacceptable level of deficiencies of the required visual aids, the monitoring criteria including the presentation to the ATC unit, and the action to be taken when the movement rate is being affected.

The operation of ground vehicles in the movement area involves normally different authorities and services. The SMGC system should include procedures which enable the responsible authority to control the parties involved when the visibility deteriorates. During visibility conditions corresponding to RVRs of less than 400 m, vehicular traffic should be restricted to the essential minimum.

Ref : Annex 11
para. 3.8.2
(amendment)

Below a visibility corresponding to an RVR of less than 200 m, no persons or vehicles should be allowed on the manoeuvring area unless under special exemption by ATC.

SMGCS Manual
Chapters 2 and 5

At aerodromes with a heavy traffic density, which are operational during visibility conditions corresponding to RVRs of less than 400 m, radar monitoring of vehicles in the manoeuvring area should be required. This includes the assistance of emergency and rescue vehicles to a crash site in

order to avoid runway/taxiway intrusion and to meet an acceptable response time.

6.2 Operational requirements

- Ref : SMGCS Manual
Table 2-3
(amendment)
- Fall back procedures should be established by the appropriate ATC - units in case of a failure of essential components of the surface movement guidance and control system.

6.3 Determination of taxi routes to be followed

- Ref : SMGCS Manual
Chapter 3,
paras 3.2.4 and 3.5
- Many airports which have justified the provision of equipment to support operations at RVRs of less than 400 m have a medium to heavy traffic density. To meet the demand for capacity and economy of operation taxiway systems tend to be complex and the choice of several runway exits is offered during normal operation. When operations take place at RVRs of less than 400 m it is necessary to reduce the complexity of the taxiway system and limit the number of runway exits in order to minimize potential conflicts on the taxiways and to guard the runway and ILS sensitive areas against intrusion.

The safest way to do this would be the use of a single one-way taxiway loop system having : no active taxiway intersections; single taxi routes to/from the runway; one taxiway holding position; and one runway exit. However, such a basic system could only be applied where traffic density is very light and planners are usually required to maintain the maximum safe capacity of the airport. Nevertheless, in maintaining a proper balance between the requirements of safety and capacity, planners should be guided by the above basic system parameters, and ensure that the introduction of additional taxiway route complexity and runway exits is matched by procedures and/or equipment designed to offset any potential hazards introduced.

- Ref : Annex 4
Chapter 13
- The taxi routes and all relevant details should be published in the appropriate part of the Aeronautical Information Publication.

6.4 Control of other than aircraft traffic on the manoeuvring area

- Ref : SMGCS Manual
Chapter 3,
paras 3.2.6
(amendment)
- A Surface Movement Radar (SMR) should assist vehicles permitted to operate on the manoeuvring area of aerodromes with a heavy traffic density during visibility conditions corresponding to RVRs of less than 400 m.

6.5 Division of responsibility between controller and pilot

- Ref : SMGCS Manual
Chapter 3,
paras 3.2.8
(amendment)
- The responsibility for avoiding collision is a joint pilot/ATS responsibility with the controller always responsible for the resolution of intersection conflicts where an air traffic control service is provided. In the lower visibilities, the overall responsibility for the avoidance of collision becomes increasingly that of the ATC unit.

CHAPTER 7

APRON MANAGEMENT SERVICE

Ref : Annex 14
para. 9.6

Airport Services
Manual, Part 8,
Chapter 10

SMGCS Manual
Chapter 8

The requirements for the apron management service should be those in ICAO Annex 14, paragraph 9.6 and Attachment A, paragraph 18, ICAO Airport Services Manual, Part 8 (Doc 9137-AN/898), Chapter 10 and ICAO Manual on Surface Movement Guidance and Control Systems (Doc 9476-AN/927), Chapter 8, with the following additional ECAC requirements.

Safe and effective movement requires management as well as traffic regulation. The demand for traffic regulation will considerably increase in the very low visibility conditions where pilots and drivers of vehicles are hampered in identifying position and routing and in the ability to avoid collision. Therefore, special procedures should be developed by the unit operating the apron management service to regulate the movement of aircraft and vehicles on the apron for the lowest visibility conditions under which the aerodrome will maintain operations. These procedures should be employed at a visibility condition corresponding to RVRs of less than 200 m. In this respect, attention should be given to :

- separation and control of arriving and departing aircraft;
- visual and other means to guide the aircraft from the taxiway to the aircraft stand and vice versa (aircraft stand manoeuvring lights, markings, signs);
- identification and publication of taxiway/apron limits (centre-line colour coding, stopbars, signs, markings);
- where appropriate, the transfer of control to and from ATC;
- restrictions to the permission and movement of persons and vehicles on the apron;
- instructions to and training of drivers and other personnel on the apron and the compliance with the procedures;
- RT communication of apron staff with drivers of vehicles and personnel on the apron in charge of the various activities;
- apron safety lines, apron routes and guidance to the drivers of vehicles on the apron;
- liaison between the aerodrome authority, aircraft operators and ATC; and
- maintenance of all visual aids to ensure legibility.

CHAPTER 8

RESCUE AND FIRE FIGHTING

Ref : Annex 14
para. 9.2.17

Airport Services
Manual, Part 1,
para. 2.7-11.1.7

Airport Services
Manual, Part 8,
Chapter 17

SMGCS Manual
Chapter 4
para. 4.7

The following ECAC requirements are in addition to the quoted references.

The first need, during emergencies requiring assistance, is to establish the location of the aircraft as accurately as possible and to enable rescue and fire fighting vehicles to proceed to this location. In low visibility conditions this could be a main problem. To obtain a response time as close as possible to the response time achieved in optimum conditions of visibility, it is essential to have procedures and facilities for continuous communication between ATC and leading rescue and fire fighting vehicles. All navigation aids available, including the surface movement radar when installed, should be used to assist the rescue and fire fighting vehicles to the location of the emergency.

For optimum employment of the rescue and fire fighting vehicles during low visibility conditions, strategically located fire stations and/or stand-by positions should be used on the movement area. Service roads and emergency access roads should be provided with adequate signs and markings which enable the driver to establish the position and route in the lowest visibility conditions in which the aerodrome maintains operations.

All personnel involved in rescue and fire-fighting should be trained and exercises should regularly be held, preferably during low visibility conditions, in close co-ordination with ATC in order to become familiar with the limited ability in orientation and the assistance by ATC.

CHAPTER 9

UPGRADING OF ICAO ANNEXES MATERIAL

The ECAC requirements imply that, for ground operations under low visibility conditions in addition to ICAO Standards, at least the following recommendations should be implemented.

9.1 Annex 11

9.1.1 For operations during visibility conditions corresponding to an RVR below 400 m, the following recommendations should be implemented :

Para. 2.12.1 Establishment of standard routes for taxiing aircraft

Para. 3.8.2 Control of persons and vehicles at aerodromes

Para. 6.3.12 Surface movement control service.

9.2 Annex 14

9.2.1 For operations during visibility conditions corresponding to an RVR below 400 m, the following recommendations should be implemented :

Para. 3.7.3 This concerns clearance distances regarding the design of taxiways

Para. 3.7.4 Width of taxiways

Para. 5.2.9.3 This concerns Category II or III position marking

Para. 5.2.10.1 This concerns taxiway intersection marking, application and location

Para. 5.2.10.2

Para. 5.3.16.4 This concerns specification of taxiway centre-line lights

Para. 5.3.16.6.c) This concerns spacing of taxiway centre-line lights

Para. 5.3.16.8 This concerns spacing of taxiway centre-line lights in curves

Para. 5.3.16.9 This concerns taxiway centre-line lights on rapid exits of runways

Para. 5.3.16.10

Para. 5.3.16.11 This concerns taxiway centre-line lights on other exit taxiways.

Para. 5.3.16.12

Para. 5.4.1.1 Location of signs

Para. 5.4.2.4 This concerns holding position signs, taxiway/runway intersection signs

Para. 5.4.3.3 This concerns location of information signs

Para. 5.4.3.4

Para. 9.6 Apron management service.

9.2.2 For operations during visibility conditions corresponding to an RVR below 200 m the following recommendation should be implemented :

Para. 5.3.24.1 This concerns application of aircraft stand manoeuvring guidance lights.

PART B — ATTACHMENT 1**Guidance material on the use of radar in the aerodrome control service on the manoeuvring area**

(PANS-RAC, Part X, Para. 4 refers)

1. Functions

1.1 The information presented on an aerodrome surface movement radar display may be used to perform the following functions, within the limitations of radar coverage, specifically related to the provision of aerodrome control service :

- a) provide radar monitoring of traffic on the manoeuvring area;
- b) provide routing instructions to surface traffic using the radar displayed information to avoid points of traffic congestions and select aircraft routes to maintain traffic flow;
- c) provide "hold short" instructions to hold short at intersections to avoid traffic conflicts;
- d) provide information that runway is clear of other traffic particularly in periods of low visibility;
- e) provide assistance in timing of runway operations to provide maximum runway utilization while avoiding conflicts of departure and arrival aircraft in cases of intersecting or single runway operations;
- f) provide, on request, guidance information to an aircraft uncertain of its position; and
- g) provide guidance information to emergency vehicles.

2. General radar aerodrome control procedures**2.1 Pushback**

2.1.1 The aerodrome Surface Movement Radar (SMR) may be used during periods of low visibility to ensure that granting of the requested pushback authorization will not conflict with traffic on the manoeuvring area.

2.2 Taxi authorization

2.2.1 Upon receipt of a request for taxi authorization the air traffic controller should, during periods of low visibility, make use of the SMR to assure that granting of the requested authorization will not create a conflict in the taxiway network. The SMR should also be used to survey the traffic distribution on the taxiway network as an aid to selecting the proper taxiway routing to be given to the pilot by the controller at the time of taxi authorization.

2.3 Taxiing control

2.3.1 The application of separation between aircraft during taxiing is not normally a service provided by the controller. Although the SMR precision is adequate to apply proper separation criteria, controller workload, coupled with the very small separation distances which are possible on the airport surface, usually preclude the performance of this function. The primary function of the SMR for taxi control is for monitoring the position of traffic on the manoeuvring area to assure compliance with routing instructions and to monitor traffic progress along the prescribed routes.

2.4 Intersection control

2.4.1 During periods of low visibility, the SMR may be used to assist in conflict resolution at intersections and as an aid to assignment of intersection priorities where a possible conflict exists. This function should be performed by the issuance of "holding" instructions. Observing the general traffic pattern and points of congestion on the SMR should provide cues to the controller regarding which aircraft are to be given priority at the intersection.

2.5 Runway clearance

2.5.1 During periods of low visibility the SMR should be used to assure that a runway is clear of traffic before clearance is given for a landing or take-off on that runway. An arriving aircraft leaving the runway should report "clear" of the runway on the appropriate frequency. During periods of low visibility, however, it is sometimes difficult for the pilot to determine that the aircraft is clear of the runway in use. The SMR should, therefore, be used to verify a clear of runway report from the pilot. An aircraft approaching a runway on an intersecting taxiway who has been given an instruction to hold should be monitored on the SMR to confirm compliance. Intersecting runways should be monitored on the SMR for possible conflicts prior to clearing aircraft for take-off or landing.

2.6 Runway operations

2.6.1 Runway utilization during periods of restricted visibility can be significantly enhanced through the use of SMR for those runway configurations which entail interaction of arrival and departure traffic during take-off or landing, e.g. mixed arrival and departure traffic on a single runway. Anticipation of runway turn-off of an arrival can be gained through radar. Compliance with "line up and hold" instructions to departures, commencement of take-off roll and lift-off can be monitored on SMR. Use of the SMR, coupled with knowledge of the spacing between arriving aircraft, can significantly increase utilization of departure release opportunities during low visibility conditions for those runway configurations with strong arrival/departure interaction.

2.7 Aircraft guidance

2.7.1 Limited guidance for aircraft can be provided through use of the SMR. This guidance would normally take the form of turn instructions such as "Turn right (or left) at the next intersection". In very limited visibility conditions the controller, even with the assistance of SMR should not attempt to provide assistance to aircraft to maintain the taxiway centre line or to maintain the correct turn radius at intersection.

PART B — ATTACHMENT 2**Performance objectives for Surface Movement Radar (SMR)****1. Introduction**

1.1 The purpose of providing SMR is to aid the air traffic services in achieving their objectives as defined in Annex 11. These are :

- a) to prevent collisions between aircraft;
- b) to prevent collisions between aircraft on the manoeuvring areas and obstructions in that area;
- c) to expedite and maintain an orderly flow of traffic;
- d) to provide advice and information useful for the safe and efficient conduct of flight; and
- e) to notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

1.2 Technical specifications for SMR do not exist in ICAO documents. An example of some possible performance objective as developed by the Surface Movement Guidance and Control Systems (SMGCS) Study Group is provided in paragraph 2 hereafter for information.

1.3 Caution should be exercised however in that these objectives do not address all of the SMR operational requirements in the various regions of the world. Additional work would be necessary to refine and expand these performance objectives into a minimum performance requirement with a world-wide acceptability.

2. Example of performance requirements for Surface Movement Radar (SMR)**2.1 General**

2.1.1 Performance is considered in terms of the requirement for :

- a) medium-sized aerodromes;
- b) a major aerodrome; and
- c) limited surveillance.

SMR for the medium-sized aerodrome is conceived as an inexpensive reliable equipment offering high definition coverage and good detection capability, but without labelling or other special refinement. That for the major aerodrome includes provision for labelling and the more advanced display techniques applicable to complex aerodrome lay-outs and heavy traffic. It is feasible that there could be a considerable degree of commonality between components for medium and major systems, but the limited surveillance equipments are seen as specialized developments.

2.2 Requirements for the medium-sized aerodrome

2.2.1 Coverage

- a) Azimuth 360 degrees
- b) Range 150 to 6 000 metres (capable of modification to local need within reasonable degree)

(See 2.4 for limited area surface surveillance systems)

2.2.2 Target detection

In weather ranging from clear to 16 mm/hr of precipitation, traffic normally involved in movement on the manoeuvring area, from large jet aircraft to small surface vehicles or objects with an equivalent radar surface of 1 m², shall provide a radar return sufficient for detection and display over the entire surface range to a probability of at least 90 per cent.

2.2.3 Resolution

The definition on the operational displays shall be sufficient to discriminate between target spaced 15 metres apart, to distinguish between large, medium and small aircraft, and between aircraft and vehicles, by target size and shape, and to map pertinent aerodrome features. Resolution shall be equal to or better than :

- a) Range 9 metres
- b) Azimuth 10 metres at 1 km range.

2.2.4 Information rate

The normal requirement stated for SMR is an antenna scan rate of not less than 60 rpm, but there are advantages in terms of power consumed, wear and structural stress for slower rates of rotation. An aircraft taxiing at 30 knots will travel about 15 metres between scans at 60 rpm and 22 metres between scans at 40 rpm; even at the slower scan rate the distance travelled between scans is less than the average commercial aircraft's fuselage length. Such an information renewal rate is likely to be adequate for many, if not most, aerodromes, and a slower scan rate may make the difference between high and moderate installation and running costs. Since the controller's display characteristics may be governed by the scan conversion display system, rather than by the scan rate, the lower rotational rate should not introduce "flicker" or other display problems.

2.2.5 The antenna scan rate preferably shall be 60 rpm, but shall be not less than 40 rpm.

2.2.6 Tower height

The system shall be suitable for operating at antenna heights from 20 to 90 metres.

2.2.7 Resistance to weather

Expressed in general terms, SMR should be available in all-weather conditions in which flying takes place at an aerodrome. Throughout the world there will be wide variation in the conditions to which an SMR scanner will be exposed, but allowing that in the harshest environments the scanner is likely to be protected by a radome or highly specialist design, it is a matter of judgement as to the worst weather in which routine operations are likely to continue and SMR prove of value.

2.2.8 It is likely that the upper limits of demands would be met by external equipment which could accept :

- | | | |
|----|-----------------------|-------------------------|
| a) | Temperatures | -20 to +55 deg. Celsius |
| b) | Sustained windspeed | 75 knots |
| c) | Gusts | 95 knots |
| d) | Survival (stationary) | 130 knots. |

2.2.9 Display

The operational display shall be suitable for viewing at arms length distance preferably without hooding or screening in normal daylight conditions. There shall be no "flicker" discernible to the operator. The display jitter shall be less than 0.05 per cent of the display diameter; variable display ranges between 1 km and 6 km shall be provided with off-centering facilities to the edge of the display and appropriate expansion ability. As an option it should be possible to reduce or suppress the luminance of non-operational areas and to provide synthetic mapping of the outline of runways, taxiways and other operational areas.

Video mapping and other display features shall remain in registration on change of range or use of off-centering.

2.3 Requirements for the major aerodrome

2.3.1 General

These requirements may be taken as additional to, or as an extension of, those listed for medium-sized aerodromes. The features of a major as compared with a medium aerodrome, and which call for refinement of the SMR provision, include :

- a) greater area of required coverage, entailing in some instances reduced angle of vision at extremities and greater risk of "shadowing";
- b) due to increased size of manoeuvring area, a greater probability of loss of visual contact between controller and aircraft;
- c) more traffic, and a greater number of aircraft and vehicles moving on the manoeuvring area at any given time;
- d) a more complex manoeuvring area lay-out with its attendant routing and control problems;
- e) a greater generation of unwanted radar clutter from buildings, fuel tanks, power lines, etc...; and
- f) a large number of SMR display position.

2.3.2 Coverage

No change is proposed to the requirement listed in 2.2.1. Should this be inadequate due to the lay-out of an aerodrome then two radars may need to be provided. In the event of the installation of two SMRs at an aerodrome the two radars shall be required to operate compatibly and without mutual interference. The system outputs shall be compatible with any digital processing subsystem.

2.3.3 Display

A bright flicker-free presentation of radar information is required with characteristics as given in 2.2.9. At least two display channels independently controllable in range and off-centering should be provided with the option for increasing the number of channels. It shall be possible to operate several display monitors in parallel on each channel.

2.3.4 Video mapping

There shall be the facility for synthetic mapping of runways, taxiways and other operational areas, with a brightness control independent of other display data and automatic maintenance of registration with radar range and offset.

2.3.5 Background suppression

A facility is required for reducing, or eliminating, returns from areas within coverage which have no operational significance.

2.3.6 Labelling

Where labelling is provided it should comply with the following conditions :

- a) Method of label acquisitions : as decided by the provisioning authority.
- b) Labelling zone :
 - arriving aircraft — from entry into coverage until clear of manoeuvring area;
 - departing aircraft — from entry into manoeuvring area to limit of radar coverage.
- c) Label cancellation : preferably automatic with manual override.
- d) Label brightness : separate control required.
- e) Label format : as decided by the provisioning authority. The label writing algorithm should prevent one label overwriting another, failing this, minimum label overlap must be ensured. Orientation of the labels in relation to the radar target to be adjustable by the controller. Contents must include identification, may include other information such as aircraft type or destination within the aerodrome. Labels must stay in register with change of range or offset. System must cope with closely parked holding aircraft.
- f) Character size : regardless of range setting, characters must be clearly legible to a controller sitting in a normal working position at arms length from the display.

2.3.7 Additional facilities

The system configuration should be such that future requirements can be accommodated by the appropriate addition of hardware and software modules, e.g. for the representation of the taxiing and stop-bar lights set up in a selective lighting control system.

2.4 Requirements for limited area surface surveillance systems

2.4.1 General

Limited area coverage has three main forms :

- a) to supplement normal SMR by covering "blind" areas;
- b) to provide coverage of the runway and immediate environs where this is adequate to the surface surveillance needs of an aerodrome; and
- c) to provide specialized runway and approach path surveillance.

Generalizations may not be made since the requirement in each instance of the use of limited area surveillance is likely to be linked to a specific and particular need.

2.4.2 Supplemental coverage

Coverage : as is appropriate to the need.

Target detection Resolution Information rate Display		Comparable with the main SMR and as listed in 2.2
Video mapping Background suppression Labelling Additional facilities		If specified, compatible with the main SMR and as listed in 2.3

2.4.3 Runway surface surveillance

Coverage : to include at least the runway strip dimensions, i.e. extending laterally to a distance of at least 150 metres on each side of the runway from a point 60 metres before threshold to 60 metres beyond the end of the runway.

Target detection Resolution Information rate Display		As in 2.2
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If runway surveillance is adequate to an aerodrome's surface surveillance needs, the more advanced techniques described in 2.3 are unlikely to be required.

PART B — ATTACHMENT 3

ICAO documentation considered to be appropriate to ground operations under limited visibility

1.	ICAO - Annex 11	
	Para. 2.12 (Rec)	Establishment and identification of standard routes for taxiing aircraft
	Para. 3.8.2 (Stand)	Control of persons and vehicles at aerodromes under low visibility conditions
	Para. 6.3 (Stand/Rec)	Surface movement control service.
2.	ICAO - Annex 14	
	Para. 3.7.3 (Rec)	Clearance distances regarding the design of taxiways
	Para. 3.7.4 (Rec)	Width of taxiways
	Para. 5.2.9.3 (Rec)	Category II or III holding position marking
	Figure 5-6-C	- idem -
	Para. 5.2.10.2 (Rec)	Taxiway intersection marking
	Para. 5.3.16.1 (Stand)	Taxiway centre-line lights
	Para. 5.3.16.4 (Rec)	Specification of taxiway centre-line lights
	Table 5-2	Characteristics for taxiway centre-line and stop-bar lights
	Para. 5.3.16.6.c (Rec)	Spacing of taxiway centre-line lights
	Para. 5.3.16.8 (Rec)	Spacing of taxiway centre-line lights in curves
	Para. 5.3.16.9/10 (Rec)	Taxiway centre-line lights on rapid exit taxiways
	Para. 5.3.16.11/12 (Rec)	Taxiway centre-line lights on other exit taxiways
	Para. 5.3.18 (Rec)	Taxiing guidance system
	Para. 5.3.19 (Rec)	Application of stopbars
	Para. 5.3.20.1 (Rec)	Application of clearance bars
	Para. 5.3.21.1 (Rec)	Application of taxiholding position lights
	Para. 5.3.24 (Rec)	Application of aircraft stand manoeuvring guidance lights
	Para. 5.4.1.1 (Rec)	Location of signs

Para. 5.4.2.3 (Stand)	Category II/III holding position sign
Para. 5.4.2.4 (Rec)	Holding position sign – taxiway/runway int. sign
Para. 5.4.2.5/7 (Stand)	Location of mandatory instruction signs
Para. 5.4.3.3/4 (Rec)	Location of taxiway location signs
Para. 8.3 (Rec)	Monitoring
Para. 8.4 (Rec)	Fencing
Para. 8.7 (Stand)	Aerodrome vehicle operations
Para. 9.2.17 (Rec)	Response time rescue and fire fighting service
Para. 9.4.15 (Rec)	Unserviceability of stopbars
Para. 9.6 (Rec)	Apron management service
Attachment A	
Para. 17.3.4	Vehicles – appropriate navigation equipment
Para. 18.4	Periodic checks operators
Aerodrome Design Manual Part 4 — Visual aids (Doc 9157-AN/901) second edition 1983	
Para. 1.3.3.8	Operating requirements, taxiing guidance Cat. III
Para. 1.4.3.21	Runway exit guidance
Para. 1.4.3.22	Distance information
Para. 1.4.3.23	Taxiing guidance
Para. 1.4.3.24	Selective taxiway centre-line lights
Para. 1.4.3.25	Docking/parking guidance
Para. 4.3.3	Visual range limitations Cat. III
Para. 4.4.1	Taxiing operating procedures in Cat. III A and B
Para. 4.6.1.4	Beam coverage taxiway lights
Para. 4.6.2.2	Category III visual segment
Para. 4.6.2.5	Taxi steering technique
Para. 4.6.2.6/11	Spacing and beam coverage of taxiway centre- line lights
Para. 4.6.2.12	Intensity and beam coverage of stop-bar lights

3.

Chapter 10 Surface movement guidance and control systems

Chapter 11 Taxi guidance signs

Para. 12.2 Aircraft stand manoeuvring lights.

4. **ICAO Surface Movement Guidance and Control Systems Manual (Doc 9476-AN/927)¹**

Chapter 1 Introduction

Chapter 2 Designing an SMGCS system for an aerodrome

Chapter 3 Functions and responsibilities

Chapter 4 Procedures

Chapter 5 Low visibility operations

Chapter 7 Runway protection measures

Chapter 8 Apron management service.

5. **All-Weather Operations Manual (Doc 9365-AN/910)**

Chapter 3 Provision of facilities and services at aerodromes, in particular :

Para. 3.2.4.4 General paragraph on visual taxiing aids

Para. 3.2.5.3.6 Protection critical and sensitive area.

Chapter 5 Additional requirements for Cat. II and III operations, in particular :

Para. 5.1.1 e), f), g), h) Additional factors to be considered

Para. 5.2.2.1.1 Limitations to ground movement of vehicles

Para. 5.2.3.2 Effectiveness of surface taxiway markings

Para. 5.2.3.3 Use of stopbars

Para. 5.2.3.4 Monitoring

Para. 5.3.1 Aerodrome safety assessment

Para. 5.3.2 Ground movement control of a/c and vehicles

Para. 5.7.2.1 n) Ground training in low visibility taxiing procedures.

¹ Chapter 6 has been intentionally omitted, since this chapter is related to high traffic volume operations.

6. **Airport Services Manual Part 1 — Rescue and fire fighting, second edition 1984 (Doc 9137-AN/898)**

Para. 2.7.3 Response time in less than optimum conditions of visibility

Para. 4.1.2.b) Guidance to rescue and fire fighting vehicles during low visibility conditions

Para. 11.1.7 Additional procedures during adverse weather in poor visibility.

7. **Airport Services Manual Part 8 — Airport Operational Services first edition 1983 (Doc 9137-AN/898)**

Para. 17.5.6 Operational requirements during conditions of low visibility

Chapter 10 Apron management and apron safety.

8. **PANS/RAC-DOC 4444/501/12 — Procedures for Air Navigation Services, twelfth edition 1985, Part V, Aerodrome Control Service**

Para. 11.4 Control of other than aircraft traffic on the manoeuvring area

Para. 12 Separation of aircraft and of aircraft and vehicles on the manoeuvring area.

PART C

**MUTUAL ACCEPTANCE OF RECURRENT INSPECTIONS
OF FLIGHT SIMULATORS WITHIN ECAC MEMBER STATES**

RECOMMENDATION INT.S/16-2
MUTUAL ACCEPTANCE OF RECURRENT INSPECTIONS
OF FLIGHT SIMULATORS WITHIN ECAC MEMBER STATES

(Adopted by the Sixteenth Intermediate Session on 16 June 1987)

WHEREAS ECAC Member States have agreed that it would be advantageous to mutually accept recurrent inspections of approved flight simulators; and

RECOGNIZING that the requirements for initial approval and recurrent inspections in a majority of ECAC Member States are to a high degree identical,

THE CONFERENCE RECOMMENDS

- 1) that the competent authority should perform recurrent inspections of flight simulators at intervals not exceeding 12 months in accordance with the provisions as laid down in **Attachments 1 and 2¹** to this recommendation or should ensure that such inspections are performed under delegated authority;
- 2) that a report of the results of recurrent inspections including modifications of the original status of the flight simulator in respect of cockpit lay-out, equipment as well as flight and system performance should be made available to ECAC Member States on request; and
- 3) that upon receipt of the reports mentioned under Clause 2), ECAC Member States whose operators are using the flight simulators in question should :
 - a) increase the intervals between their own recurrent inspections;
or
 - b) refrain from their own regular recurrent inspections.

¹ Reproduced in Chapters 1 and 2 of Part C of this document.

CHAPTER 1

GENERAL STANDARDS

1.1 Purpose

1.1.1 This recommendation on mutual acceptance of recurrent evaluations for approved flight simulators within ECAC Member States is assigned for highly sophisticated flight simulators only which are installed and being used for aircraft type conversions and based on checking of pilots and flight engineers on modern turboprop and/or turbojet aircraft.

1.1.2 For a mutual acceptance of a recurrent evaluation the initial approval of the flight simulator should not date back more than 10 years from the date of the recurrent evaluation in question. The requirements stated in this recommendation shall be considered as minimum performance standards and tolerances.

1.2 Simulator standards — General

1.2.1 An aircraft flight simulator in this respect is a ground based training device which accurately represents the flight deck of a specific aircraft type and model to the extent that the mechanical, electrical and electronics systems appear to function as in the aircraft both on ground and in flight.

1.2.2 All controls, switches, instruments and indicators should be compatible with those in the aircraft and operate in the correct sense. Circuit breakers affecting procedures and functions resulting in observable cockpit indications should be functionally accurate.

1.2.2.1 All systems must be operational and designed so that normal, abnormal and emergency procedures can be performed without any exceptions. An approved Minimum Equipment List (MEL) for an aircraft flight simulator – where available – must be observed.

1.2.2.2 The telecommunication and navigation equipment must correspond to that installed in the simulated aircraft and must function within the range of tolerance prescribed for the equipment of the aircraft. The results of the crews actions, whether correct or not, must be accurately simulated.

1.2.3 The effects of aerodynamic changes for various combinations of drag and thrust which may be encountered during flight must correspond to actual flight conditions. In order to guarantee a realistic reproduction of changes, especially in aircraft attitude, drag, thrust, altitude, temperature, mass, centre of gravity etc., a motion system shall be installed and operative.

1.2.3.1 Motion cues must be representative of those felt at the pilot's position in the aircraft. There must be no excessive lag in the response of the motion system to flight control inputs, and acceleration cues at the pilot's position must not exceed those felt in the aircraft in flight in the same manoeuvre.

1.2.3.2 In addition to linear and rotational acceleration cues associated with normal flight, the motion system must provide cues associated with engine failure, high and low speed buffet, operation of secondary flight controls, atmospheric turbulence, touchdown of individual wheels where appropriate, normal touchdown (with bounce where appropriate), representation of tyre bursts etc.

1.2.3.3 The co-ordination of the motion system with the sound and visual system should be realistic.

1.2.4 The forces on flight controls and any other control devices, the sense and amplitude of movement must correspond to those of the simulated aircraft. The rate of change

of simulator instrument readings and of control forces should be identical to those on the simulated aeroplane under actual flight conditions for any given change in forces applied to the controls, in the applied engine power or in aeroplane configurations.

1.2.5 A visual system is mandatory for flight simulators approved for all-weather Category I, II or III operations. The visual scene must faithfully represent the instantaneous field of view presented to the pilots on the flight deck of the aircraft, using natural head movements, in relation to attitude, flightpath, manoeuvres and the various simulated meteorological conditions.

1.2.5.1 The visual system must be capable of providing at least a 45-degree horizontal field of vision for each pilot.

1.2.5.2 The scene when viewed from the pilot's position must conform to that which would be expected from flight instrument indications.

1.2.5.3 For night or dusk scenes the visual effects of landing lights and strobe lights must be realistically simulated.

1.2.5.4 The airfield and the approach and runway lighting must be representative. The intensity of the lighting systems must be variable and the colours for the approach and runway lighting must be realistic.

1.2.5.5 The weather conditions displayed in the visual system must be capable of adjustment to below Category I, II and/or III operating minima. It must also be capable of reproducing the effects of an uneven cloudbase, ragged cloud below the main cloudbase, fog, fog patches, shallow fog (with its influence on slant and vertical visibility) and the effects of fog on approach lighting and runway.

1.2.5.6 In addition it must be possible to simulate variation of RVR along the runway length, and provide the appropriate low visibility taxiway lighting patterns.

1.2.6 Where appropriate to type a training flight engineer's station must be provided from which the flight engineer's systems panel can be clearly seen, and the actions of the flight engineer adequately monitored.

1.2.6.1 A training pilot's station must be provided on the flight deck from which system malfunctions can be activated, visual conditions as seen by the acting pilots can be observed and adjusted, the progress of the flight can be monitored in relation to navigation, communication with the crew maintained, and from which the flight instruments of both pilots can be seen easily. Occupation and operation of the training pilot's station must be possible without disturbing the illusion of a real flight situation for the crew.

1.2.6.2 An observer's seat must be provided from which the actions of the crew and training crew can be observed.

1.2.6.3 All seats on the flight deck must be equipped with safety harness.

1.2.7 The flight simulator should meet the requirements as stated above in all phases of flight during normal, abnormal and emergency manoeuvres of the aircraft.

1.2.7.1 Where some aspect of these requirements is not met fully the respective authority may issue a restricted approval describing the scope of training for which the simulator is suitable.

1.2.7.2 It is impossible to specify all possible flight simulator deficiencies with associated restrictions to its use. Therefore, where differences between the aircraft and flight simulator exist the appropriate restriction to its use will be at the discretion of the authority concerned up to a degree where an operation within the range of use is ensured.

CHAPTER 2**PERFORMANCE STANDARDS AND TOLERANCES**

2.1 The performance standards and tolerances for recurrent simulator evaluations as listed in this chapter are based on the two proposals (being in preparation by France and United Kingdom in 1985) for the approval of flight simulators and the FAA-Advisory Circular 120-40.

2.2 The technical requirements for the acceptance of flight simulators as specified by a number of ECAC Member States are almost identical to those of the FAA. This simplifies the task of the operator and manufacturer in demonstrating performance standards both during initial validation and in normal operation.

2.3 The following functional and performance test is the corresponding part of a complete test for the initial approval of a flight simulator.

2.4 In order to be accepted by another civil aviation authority, the critical examination of a simulator for a recurrent evaluation requires a representative amount of check items out of this test to be performed. This can be done according to the operator's own simulator check programme, the latest edition of the manufacturer's Approval Test Guide (ATG) or a test programme compiled from this guide.

2.5 As far as it can be verified that the performance characteristics of the simulator still agree with those of the aircraft and all applicable regulatory requirements are still met, a combination of several check items in one flight manoeuvre (e.g. crosswind take-off and instrument take-off or ILS approach and engine(s) out approach etc.) as well as spot checks on certain items is possible. This will limit the recurrent evaluation procedure to an acceptable time period. In principle the recurrent evaluation check includes :

- a) detailed information about any significant changes especially in the software programme of the simulator computer section;
- b) a thorough inspection of all switches, indicators and systems at all crew member's and instructor's stations to make sure the cockpit design is compatible with the approved aircraft configuration;
- c) a simulator functional test; and
- d) a simulator performance test.

2.6 Further details and ground or flight manoeuvres to be evaluated are discussed below.

2.6.1 Computer software control

2.6.1.1 In modern flight simulators differing configurations of digital computer systems are in use. It therefore has become essential to be fully aware of the hardware and especially software programming of a flight simulator.

2.6.1.2 For recurrent evaluations it is sufficient to notify all significant changes to software programmes since the initial approval or the preceding recurrent evaluation which are used in training and testing and which influence handling and performance characteristics of the flight simulator.

2.6.1.3 The change should be unambiguously specified and put on record together with the reasons for the change.

2.6.1.4 The operator has to demonstrate to the authority his method of software-control.

2.6.1.5 An amendment to the test guide should be offered.

2.6.2 Recheck of the cockpit design

Recheck of the cockpit design is self-explanatory and part of the functional test.

2.6.3 Simulator functional test

2.6.3.1 Functional tests are subjective tests of simulator characteristics and system operation evaluated from each crew member's position.

2.6.3.2 Besides the system operation these tests include normal, abnormal and emergency procedures and manoeuvres under all adverse atmospheric conditions which can be simulated (visibility, wind, icing conditions, runway contamination, etc.).

2.6.3.3 Ground and flight manoeuvres to be evaluated are in particular as follows :

a) Preflight

- Cockpit check.

b) Engine start

- Normal start
- Alternate start procedure
- Abnormal and emergency procedures during start.

c) Taxi

- Thrust response (including brake away thrust)
- Ground handling
- Brake operation (normal and alternate/emergency).

d) Take-off and climb

- Powerplant checks (instrument readings)
- Acceleration characteristics
- Nose-wheel and rudder steering
- Aborted take-off
- Normal take-off
- Take-off with engine failure at V_1
- Maximum crosswind take-off (acc. Ops Manual)
- Landing gear, flaps, leading-edge device operation
- Climb performance (normal and engine(s) out)

- Abnormal and emergency procedures associated with take-off and climb
- Minimum control speed with most critical engine(s) inoperative.

Note : *Particular attention should be paid to rotation characteristics, handling characteristics and rudder forces required with engine(s) inoperative.*

e) Cruise

- Control of all parameters (speed vs. power)
- High speed buffet, V_{MO}-M_{MO} warnings
- Turns with/without spoilers
- Normal and steep turns
- Approach to stalls at high and low altitude, where applicable, a full stall and recovery in the approach to land configuration shall be performed
- All systems operation
- Abnormal and emergency procedures associated with cruise configuration.

f) Descent

- Normal descent
- Emergency descent.

g) Approach and landing

- Approach and landing all engines operating, normal conditions
- Landing gear, flaps, speedbrake normal and abnormal operation
- Engine(s) out approach and landing
- ILS, autocoupled, auto-throttle, autoland approaches dependent on the all-weather operating status the simulator is evaluated for
- No flap approach and landing, where applicable
- Engine(s) out go-around
- Maximum crosswind approach and landing according to Operations Manual
- Rejected landing
- Spoiler operation
- Use of reverse thrust
- Brake operation (normal, alternate/emergency).

h) Engine shutdown and parking

- Systems operations
- Parking brake operation

i) Visual system

- In CAVOK conditions – apron, taxiway/runway dimensions, markings and lighting.
- In conditions of RVR appropriate to the AWO-evaluation status of the simulator – markings and lighting with particular reference to low visibility taxiing patterns, approach and runway lighting in cloudbase and RVR appropriate to the approved minima for take-off and ILS Category I, II or III approaches and landings.

2.6.4 Simulator performance test

2.6.4.1 Simulator performance and system operation should be objectively evaluated by comparing each performance test conducted in the simulator to aeroplane performance. When a recurrent evaluation is to be done it must be expected that simulator performance data can be compared to the approved aeroplane flight test data available for each test. In general for the recurrent evaluation of a flight simulator a test guide will be made available by the applicant. This test guide must make provisions to verify the parameters of aerodynamic behaviour and aircraft performance listed in the following paragraphs.

2.6.4.2 The specified tolerances for dynamic tests and when indicated by an asterisk (*) in the tolerance column are :

- Pitch angle and angle of attack	$\pm 1\ 1/2^\circ$
- Roll angle	$\pm 2^\circ$
- Yaw angle	$\pm 2^\circ$
- Airspeed	$\pm 5.56\text{ km/h (3 kts)}$
- Altitude 0 - 30.48 m (100 ft)	$\pm 3.05\text{ m (10 ft)}$
30.48 m (100 ft) - 152.4 m (500 ft)	$\pm 10\%$
> 152.4 m (500 ft)	$\pm 15.24\text{ m (50 ft)}$
- Rate of climb	$- 0.51\text{ m/s (100 ft/min)}$

2.6.4.3 When difficulties arise in matching simulator performance to aeroplane performance throughout a time history, differences may be rationalized by providing a comparison of elevator, aileron and rudder surface position.

2.6.4.4 The ground and flight tests which must be evaluated as well as the tolerances considered as acceptable for the indicated parameters and the different flight regimes in which the test must be performed and the aerodynamic behaviour in comparable conditions of maximum mass, centre of gravity, altitude, and IAS are listed in the following tables.

2.6.4.5 The codes of the different flight phases in these tables are :

- 1) Ground handling
- 2) Take-off
- 3) Climb (1st and 2nd segment)
- 4) Cruise (including en-route climb)
- 5) Descent
- 6) Approach
- 7) Landing.

TABLES

			Tolerances	Flight Phase
(1) Static control checks				
a)	Pitch control		$\pm 2^\circ$ elevator ± 2.22 daN (5 lb) or 10%	1
b)	Roll control		$\pm 2^\circ$ aileron $\pm 2^\circ$ spoilers ± 2.22 daN (5 lb) or 10%	1
c)	Directional control		$\pm 2^\circ$ rudder ± 2.22 daN (5 lb) or 10%	1
d)	Nose-wheel	displacement force	$\pm 2^\circ$ or 5% ± 1.33 daN (3 lb) or 10%	1
e)	Flap	displacement force	$\pm 5\%$ ± 1.33 daN (3 lb) or 25%	1
f)	Speedbrake	displacement force	$\pm 5\%$ ± 1.33 daN (3 lb) or 25%	1
g)	Throttle	displacement force	$\pm 5\%$ ± 1.33 daN (3 lb) or 10%	1
(2) Taxi (tests to be performed on dry surface)				
a)	Minimum radius turn		± 3.05 m (10 ft) or 10%	1
b)	Rate of turn vs nose-wheel deflection		$\pm 10\%$	1

	Tolerances	Flight Phase	
(3) Take-off (normal maximum mass and centre of gravity)			
a)	Ground acceleration time and distance	$\pm 5\%$ time and distance or $\pm 5\%$ time ± 60.96 m (200 ft) distance	2
b)	Accelerate-stop time and distance	$\pm 5\%$	2
c)	Minimum ground control speed	± 9.26 km/h (5 kts)	2
d)	Minimum unstick speed	± 5.56 km/h (3 kts)	2
e)	Normal take-off	*	2 and 3
f)	Engine out take-off	*	2 and 3
g)	Crosswind take-off	*	2 and 3
h)	Stopping time and distance with auto-brake	$\pm 5\%$ of time $\pm 5\%$ or ± 60.96 m (200 ft) of distance	2
(4) Climb			
a)	Normal climb	$\pm 5\%$ angle or rate or ± 0.51 m/s (100 ft/min) whichever is greater	3
b)	Engine out 2 nd segment	$\pm 5\%$ angle or rate or ± 0.51 m/s (100 ft/min) whichever is greater	3
c)	Engine out approach climb	$\pm 5\%$ angle or rate or ± 0.51 m/s (100 ft/min) whichever is greater	6
(5) Longitudinal stability and control			
a)	Power change forces or dynamics	± 2.22 daN (5 lb) or 20%	4 $\pm 1\ 1/2^\circ$ pitch or 20% ± 5.56 km/h (3 kts) ± 0.51 m/s (100 ft/min)
b)	Flap change forces or dynamics	± 2.22 daN (5 lb) or 20%	3, 6, 7 $\pm 1\ 1/2^\circ$ or 20% ± 5.56 km/h (3 kts) ± 0.51 m/s (100 ft/min)
c)	Gear change forces or dynamics	± 2.22 daN (5 lb)	2, 6 $\pm 1\ 1/2^\circ$ or 20% ± 5.56 km/h (3 kts) ± 0.51 m/s (100 ft/min)
d)	Longitudinal trim	± 1 unit; 1° pitch; 0.05 EPR	6, 7

		Tolerances	Flight Phase
e)	Longitudinal static stability (stick movement and force vs IAS from 1,3 V _S to limit IAS)	± 10% or ± 1.78 daN (4 lb)	3, 4, 5, 6
f)	Longitudinal manoeuvre stability (stick movement and force to maintain manoeuvres up to 1,5 g)	± 10% or ± 1.78 daN (4 lb)	3, 4, 5, 6
g)	Phugoid mode	± 10% of period and time to half amplitude	3, 4, 5, 6
(6) Lateral and directional stability and control			
a)	Minimum control speed air	± 9.26 km/h (5 kts)	1 or 7
b)	Roll response	± 10% of roll rate or ± 2°/sec	4, 6, or 7
c)	Roll overshoot	± 10% of bank or ± 2°	6 or 7
d)	Engine out trim	± 1 unit of rudder trim	3, 6, or 7
e)	Rudder response	± 2°/sec or ± 10% of yaw rate per pedal or surface deflection	3, 6
f)	Yaw rate response to engine failure (without flight control input)	± 10% bank; pitch attitude and sideslip within 5 sec.	3, 4, 6
g)	Dutch roll dynamics	± 1 sec or ± 10% of period and time to 1/2 (or double) amplitude	4, 6, 7
h)	Cross control	for a given rudder position ± 5° or ± 10% of wheel or surface deflection; ± 1° bank/slip	6, 7
i)	Spiral stability	correct trend in bank, ± 10% or 3° within 30 secs. ± 10% or ± 5° wheel deflection to maintain given bank angle	2 (gear up) 4, 6

	Tolerances	Flight Phase
(7) Landing		
a) Normal landing	*	7
b) Engine(s) out landing	*	7
c) Crosswind landing acc. Operations Manual	*	7
d) Autocoupled landing	*	7
e) Stopping time and distance with brakes only	± 5% of time; ± 5% of distance or ± 60.96 m (200 ft)	7
f) Stopping time and distance with brakes and reverse thrust	± 5% of time; ± 5% or ± 60.96 m (200 ft) of distance	7
g) Stopping time and distance with auto-brake	± 5% of time; ± 5% or ± 60.96 m (200 ft) of distance	7
Note : <i>Stopping time and distance shall be measured on a dry runway and at least once on a contaminated runway.</i>		
(8) Additional performance tests		
a) All engines climb at recommended speeds after take-off	± 10% or ± 0.51 m/s (100 ft/min) rate of climb	3
b) 2 nd segment climb following engine failure	± 10% or ± 0.38 m/s (75 ft/min) rate of climb	3
c) Level acceleration time from 1.3 V _S to limiting IAS	± 10%	4
d) Level deceleration time from limiting IAS to 1.3 V _S (with and without speedbrake at both high and low altitude)	± 10%	4
e) Descent at normal speed, power and configuration, clean and approach	± 10% or ± 0.51 m/s (100 ft/min) rate of descent	5
f) Missed approach IAS and configuration	± 10% or 0.51 m/s (100 ft/min) rate of climb	6
g) Gear, flap/slat, speed- brake extension and retraction time	± 2 sec or 20%	2, 6
h) Stickshaker, buffet and stall speeds	± 5.56 km/h (3 kts)	3, 4, 6, 7
i) Engine response time (accelerating and decelerating)	± 1 sec or ± 10%	2, 4, 6

Tolerances

Flight Phase

(9) Motion system

Operator certified test results of tests will alleviate the requirement to rerun the tests during recurrent evaluations.

(10) Visual system

a) The distances at which runway features are visible may not be less than those listed below.

b) Distances are equivalent distances measured from the runway threshold to an aircraft in normal landing configuration aligned with the runway centre line on an extended 3° glide slope :

i)	Recognition of runway and taxiways	minimum of 8 000 m	6
ii)	Longitudinal separation of threshold markings	minimum of 3 200 m at day and dusk conditions or within range of landing lights at night	6
iii)	All runway details	minimum of 800 m at day and dusk conditions	6
iv)	Strobe, approach and runway edge lights	minimum of 8 000 m	6
v)	Centre-line lights	minimum of 5 000 m	6
vi)	Threshold lights and runway end lights	minimum of 3 200 m	6
vii)	Touchdown zone lights	minimum of 3 200 m	6
viii)	VASI/PAPI lights	minimum of 8 000 m	6

(11) Additional evaluation checks

- a) Instrument indications of all receivable radio navigation aids, including identification and frequencies, when positioned at a major aerodrome programmed in the simulator computer. The radio navigation aids should be receivable at the lowest height in a holding pattern, serving the particular airfield.
- b) In relation to the ILS a check should be made of :
 - i) Localizer and glide slope beam width
 - ii) Alignment of localizer with the runway
 - iii) Glide-path angle
 - iv) Alignment of glide path with BASIs or PAPI
 - v) Positioning and indications of marker beacons.
- c) Flight instrument indications during an ILS approach using the flight director.
- d) Flight instrument indications during a non-precision approach.
- e) Flight instrument indications during a standard instrument departure and arrival route including a holding pattern.
- f) GPWS operation.
- g) Malfunctions of all aircraft systems.

2.6.4.6 It is accepted that every aspect to the Functional Test Schedule and the Performance Test Schedule would be impossible within the timescale of one evaluation. Thus items may be checked on a spot check basis after a test programme has been laid down before evaluation flight check.

APPENDIX

**TERMS OF REFERENCE FOR THE AWO GROUP
ECAC/12 (Report, page 39) — June 1985**

Development of common requirements for use by ECAC Member States which would facilitate the full exploitation of the improved performance of aircraft systems used in conjunction with precision approach facilities. The task should embrace :

- a) updating of ECAC/CEAC Doc No. 17, Issue 2, taking into account the new ILS classification;
- b) aircraft ground operations under limited visibility and related problems;
- c) mutual acceptance of flight simulators; and
- d) further study of any common requirements in all-weather operations additional to those specified by ICAO, for use by ECAC Member States.

— END —