

getting to grips with
CAT II / CAT III operations



***GETTING TO GRIPS WITH
CATEGORY II AND III
OPERATIONS***



FOREWORD

The purpose of this brochure is to provide Airbus aircraft operators with the agreed interpretations of the currently applicable AWO regulations.

Should any deviation appear between the information provided in this brochure and that published in the applicable AFM and MMEL, the information given in AFM and MMEL shall prevail at all times unless agreement is obtained from the national operational authorities.

The brochure's objective is to provide recommendations that satisfy Category II and Category III operational and reliability requirements in order for an airline to obtain operational approval from the presiding operational authorities.

All recommendations conform to the current regulatory requirements and are intended to assist the operators in maximizing the cost effectiveness of their operations.

All brochure holders and users are encouraged to forward their questions and suggestions regarding this brochure.

Any questions with respect to information contained herein should be directed to:



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SUMMARY

This document outlines the purpose of and concepts behind Category II and Category III operations, as well as the approval process required to obtain Category II and Category III certification.

The objective of CAT II / CAT III operations is to provide a level of safety when landing in low visibility conditions, equivalent to that of 'normal' operating conditions. Category II / Category III constitutes the main part of All Weather Operations (AWO), which also consists of Category I, take-off, and taxiing in low visibility conditions.

Although CAT II / CAT III represents a significant investment for an airline, it is the most effective way in which an airline can maintain its schedule throughout the year without any diversions due to the weather. This results in lower costs incurred by otherwise expensive diversions and passenger compensation, as well as preventing degradation of the airline's image.

Although ICAO, the FAA and JAA regulations are slightly different, all refer to the same concepts for CAT II and CAT III operations.

The main difference between CAT II / CAT III operations is that Category II provides sufficient visual reference to permit a manual landing at DH, whereas Category III does not provide sufficient visual references and requires an automatic landing system.

Approval for CAT II / CAT III operations is dependent on four elements in order to maintain the required level of safety:

- the aircraft
- the airfield
- the flight crew
- the operator

All of these elements must comply with the regulations established by the operator's responsible authority. An aircraft type must be approved for CAT II / CAT III operations with an automatic landing system, which provides automatic control of the aircraft during approach and landing. Similarly, the airfield must be approved for CAT II / CAT III operations.

Crew training for CAT II / CAT III is divided into two parts. Firstly ground instruction and the philosophy of All Weather Operations, and secondly flight training carried out in either a simulator or during airborne training.

The start of the approval process consists of **filing** for CAT II / CAT III operations.

The "file" includes aircraft type, aerodrome, flight crew training and procedures, and a maintenance program. Once filed, and after flight crew training, the operator's authority will require an operational demonstration, in order to establish if an appropriate level of safety is being met.

Following this an operator may be certified for Category II or for Category III operations.

The Airbus Family Concept and Category II and III operations

The flight decks of the A320 Family and the A330 and A340 are virtually identical, and their handling characteristics, systems and procedures are so similar that there is an unprecedented level of commonality.

Because of this commonality the training for CAT II / CAT III operations will also be so similar that once a crew is qualified on one of the family types the process to go on to another will be that much quicker.

This unique capability will help operators in their training and proficiency of crews and impact positively on the training costs associated with these kinds of operations.

Even though A310/A300-600 cockpits are different, the Airbus CAT II / CAT III concepts are the same.

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CHAPTER 1

1. INTRODUCTION

1.1 GENERAL

1.2 A BRIEF HISTORY

1.3 ECONOMIC ASPECTS

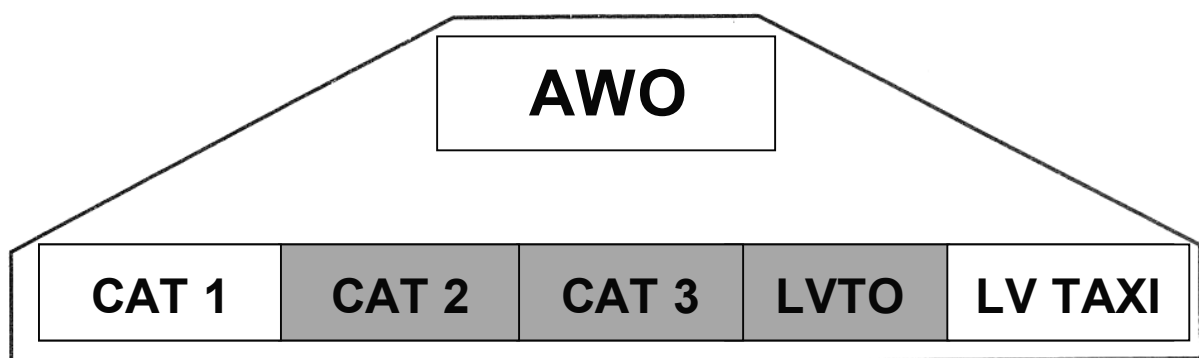
1.1 GENERAL

Landing in low visibility is perhaps one of the most "exciting" ways to operate an aircraft but is certainly the most demanding. Such progress in civil aviation was made possible by huge improvements in aircraft automatic control systems over the last 30 years coupled with stringent requirements for airfield equipment and crew qualification. In Category III, pilots see the runway lights only few seconds (about 5 seconds) before touchdown, therefore there is no margin for error.

The basis for Category II/III operations, such as aircraft certification or airline operational demonstration, ensures a high level of safety. Moreover, approach success rate in actual in-line services is now **nearly 100%**.

This brochure discusses all aspects of Category II, Category III and LVTO operations, which are the main part of AWO (All Weather Operations). The term AWO also includes Category I operations, and taxiing in low visibility, as shown below.

Figure 1.1

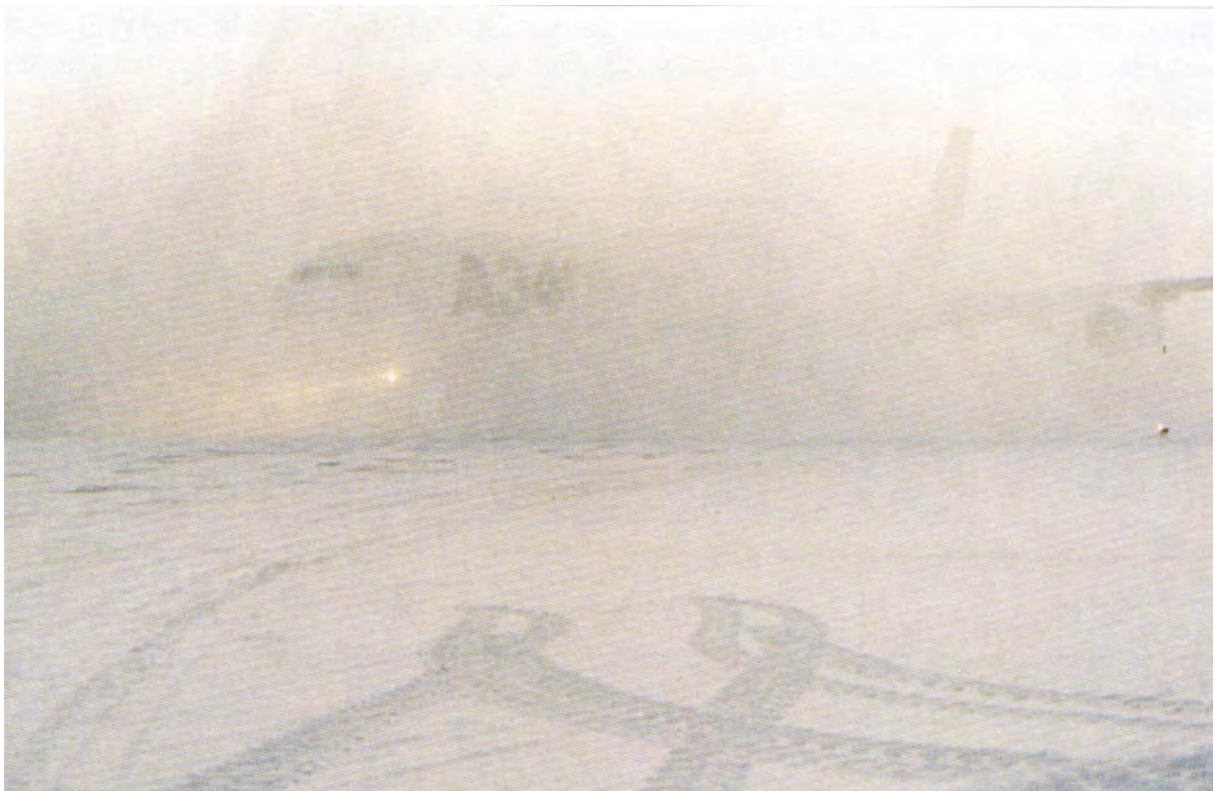


1.2 A BRIEF HISTORY

On 9 January 1969, a Caravelle of AIR INTER became the first aircraft in the history of civil aviation to land in actual Category III A conditions during a commercial flight (Lyon-Paris). The operational approval was obtained from the SGAC (France) only two months before in November 1968. This approval was the direct result of successful flight tests made since 1962 during which an automatic landing system was tested (5 March 1963 at Toulouse: first automatic landing without visibility). Since then, many aircraft were granted approval for Category III A, such as the Trident, the B747 (1971) or the Concorde (1975). In 1974, the A300 was certified for Category III A, followed by the A310 (1983) and also the A300-600 (1984) for CAT III B. Fail-operational automatic landing was first used for these types of operations, but it was found useful to develop fail-passive capability in order to satisfy airline requests. Currently, Airbus Aircraft are certified both with fail-passive (limited to DH=50ft) and fail-operational landing systems.

1.3 ECONOMIC ASPECTS

CAT II / CAT III equipment represent a significant cost for an airline. However, it is the only way to keep in-line services during the whole year without any diversion. Weather conditions mainly depend on the airfield location, nevertheless actual CAT II or CAT III conditions may occur at any airfield during some periods of the year. Diversions are expensive for an airline: directly by passenger compensation costs but also by the resulting bad "image". For these reasons, getting operational approval for CAT II and CAT III approaches may be considered as a necessary step in the evolution of a modern airline.



CHAPTER 2

2. GENERAL CONCEPTS

- 2.1 CATEGORY II**
- 2.2 CATEGORY III**
- 2.3 DECISION HEIGHT AND ALERT HEIGHT**
- 2.4 RUNWAY VISUAL RANGE**
- 2.5 FAIL-PASSIVE AUTOLAND SYSTEM**
- 2.6 FAIL-OPERATIONAL AUTOLAND SYSTEM**
- 2.7 MINIMUM APPROACH BREAK-OFF HEIGHT**
- 2.8 CONCEPT OF MINIMA**

This chapter addresses some essential definitions and concepts for **CAT II or III operations**. The definitions are taken from ICAO, FAA, or JAA documents and are presented in a separate way when necessary.

2.1 CATEGORY II

2.1.1 CAT II DEFINITIONS

The category II is a precision approach corresponding to weather minima as mentioned here below:

ICAO definition

*A category II approach is a precision instrument approach and landing with decision height lower than **60m** (200ft) but not less than **30m** (100ft), and a runway visual range not less than **350m** (1200ft).*

FAA definition

*A category II approach is a precision instrument approach and landing with decision height lower than **200ft** (60m) but not lower than **100ft** (30m), and a runway visual range less than **2400ft** (800m) but not less than **1200ft** (350m).*

JAA definition

*A category II approach is a precision instrument approach and landing with decision height lower than **200ft** (60m) but not lower than **100ft** (30m), and a runway visual range not less than **300m** (1000ft).*

The three definitions refer to the concepts of Decision Height (DH) and Runway Visual Range (RVR), which will be explained later in this chapter.

It is worth noting the difference between Cat II definitions by ICAO and FAA, and the definition by JAA of the minimum runway visual range (not less than 350m for ICAO and FAA but not less 300m for JAA).

2.1.2 CAT II OBJECTIVE

The main objective of CAT II operations is to provide a level of safety equivalent to other operations, but in more adverse weather conditions and lower visibility.

The desired level of safety is achieved through:

- Airborne equipment,
- Non-visual aids (ILS facility),
- Visual aids (runway marks, lighting systems),
- Flight crew training,
- Flight crew procedures,
- ATC procedures,
- Aircraft maintenance,
- Airfield maintenance,
- Criteria for obstacle clearance.

CAT II weather minima has been established to provide sufficient visual references at DH to permit a manual landing (or a missed approach) to be executed (it does not mean that the landing must be made manually).

2.2 CATEGORY III

A CAT III operation is a precision approach at lower than CAT II minima.

CAT III is divided in three sub-categories: CAT III A, CAT III B, and CAT III C, associated with three minima levels (CAT III A is associated with highest minima, and CAT III C with lowest minima).

2.2.1 CAT III A DEFINITIONS

ICAO and FAA definition

*A category III A approach is a precision instrument approach and landing with no decision height or a decision height lower than **100ft** (30m) and a runway visual range not less than **700ft** (200m).*

JAA definition

*A category III A approach is a precision instrument approach and landing with a decision height lower than **100ft** (30m) and a runway visual range not less than **700ft** (200m).*

It is worth noting that the JAA considers that CAT III A is always associated with a decision height (difference with ICAO/FAA).

2.2.2 CAT III B DEFINITIONS

ICAO and FAA definition

*A category III B approach is a precision approach and landing with no decision height or a decision height lower than **50ft** (15m) and a runway visual range less than **700ft** (200m), but not less than **150ft** (50m).*

JAA definition

*A category III B approach is a precision approach and landing with no decision height or a decision height lower than **50ft** (15m) and a runway visual range less than **700ft** (200m), but not less than **250ft** (75m).*

Notes: ICAO/FAA and JAA differ by the minimum RVR associated with CAT III B approaches (50m / 75m).

JAA: Where the DH and the RVR do not fall in the same Category, the RVR will determine in which Category (CAT III A or B) the operation is to be considered.

2.2.3 CAT III C DEFINITION

ICAO and FAA definition

A category III C approach is a precision approach and landing with no decision height and no runway visual range limitation.

CAT III C operations are not currently authorized and the JAA does not mention this sub-category.

Note from ICAO document:

Where the DH and RVR do not fall within the same Category, either the DH or the RVR may determine in which Category the operation is to be considered. The operation will be in the Category with the lower minima.

2.2.4 CAT III OBJECTIVE

The main objective of CAT III operations is to provide a level of safety equivalent to other operations but in the most adverse weather conditions and associated visibility.

In contrast to other operations, CAT III weather minima do not provide sufficient visual references to allow a manual landing to be made. The minima only permit the pilot to decide if the aircraft will land in the touchdown zone (basically CAT III A) and to ensure safety during rollout (basically CAT III B).

Therefore an automatic landing system is mandatory to perform Category III operations. Its reliability must be sufficient to control the aircraft to touchdown in CAT III A operations and through rollout to a safe taxi speed in CAT III B (and CAT III C when authorized).

Note about automatic landing: Automatic landing is not CAT III. An automatic landing system is only equipment providing automatic control of the aircraft during the approach and landing and is not related to particular weather conditions. This system is mandatory for all CAT III operations. However, it is a common practice to perform automatic landing in good visibility but in that case, the ILS performance must be sufficient and ILS signals protected (see Chapter 5).

As for CAT II operations, the desired level of safety is achieved with more stringent requirements.

CAT II / CAT III DEFINITIONS ACCORDING TO ICAO, FAA, and JAA

		ICAO	FAA	JAA
CAT II	DH	100ft ≤ DH < 200ft	100ft ≤ DH < 200ft	100ft ≤ DH < 200ft
	RVR	350m ≤ RVR 1200ft ≤ RVR	350m ≤ RVR < 800m 1200ft ≤ RVR < 2400ft	300m ≤ RVR 1000ft ≤ RVR
CAT III A	DH	No DH or DH < 100ft (1)	No DH or DH < 100ft (1)	DH < 100ft (1)
	RVR	200m ≤ RVR 700ft ≤ RVR	200m ≤ RVR 700ft ≤ RVR	200m ≤ RVR 700ft ≤ RVR
CAT III B	DH	No DH or DH < 50ft	No DH or DH < 50ft	No DH or DH < 50ft
	RVR	50m ≤ RVR < 200m 150ft ≤ RVR < 700ft	50m ≤ RVR < 200m 150ft ≤ RVR < 700ft	75m ≤ RVR < 200m 250ft ≤ RVR < 700ft
CAT III C	DH	No DH	No DH	
	RVR	No RVR limitation	No RVR limitation	

(1) DH ≥ 50ft if fail passive

Acceptable operational correspondance meter/feet (according to ICAO)

15m = 50ft	30m = 100ft	50m = 150ft	75m = 250ft
100m = 300ft	150m = 500ft	175m = 600ft	200m = 700ft
300m = 1000ft	350m = 1200ft	500m = 1600ft	550m = 1800ft
600m = 2000ft	800m = 2400ft	1000m = 3000ft	1200m = 4000ft
1600m = 5000ft			

2.3 DECISION HEIGHT AND ALERT HEIGHT

In CAT II / CAT III regulations, two different heights are defined:

- the Decision Height (DH),
- the Alert Height (AH).

2.3.1 DECISION HEIGHT DEFINITION

Decision height is the wheel height above the runway elevation by which a go-around must be initiated unless adequate visual reference has been established and the aircraft position and approach path have been assessed as satisfactory to continue the approach and landing in safety (JAA).

There are no significant differences in DH definitions according to other regulations.

In this definition, runway elevation means the elevation of the highest point in the touchdown zone. According to the JAA, the DH recognition must be by means of height measured by radio-altimeter. But the FAA leaves the choice for CAT II DH recognition (radio-altimeter, inner markers or barometric altimeter).

Visual references at DH

Because the term of adequate visual reference could be differently interpreted, JAA has defined criteria for CAT II and CAT III for visual reference at DH which are now commonly accepted.

For CAT II and CAT III A, a pilot may not continue the approach below DH unless a visual reference containing not less than a 3 light segment of the centerline of the approach lights or runway centerline or touchdown zone lights or runway edge lights is obtained. For CAT III B the visual reference must contain at least one centerline light.

2.3.2 ALERT HEIGHT DEFINITION

An Alert Height is a height above the runway, based on the characteristics of the aeroplane and its fail-operational automatic landing system, above which a Category III approach would be discontinued and a missed approach initiated if a failure occurred in one of the redundant parts of the automatic landing system, or in the relevant ground equipment (ICAO).

In other AH definitions, it is generally stated that if a failure occurred below the Alert Height, it would be ignored and the approach continued.

2.3.3 DECISION HEIGHT AND ALERT HEIGHT CONCEPT

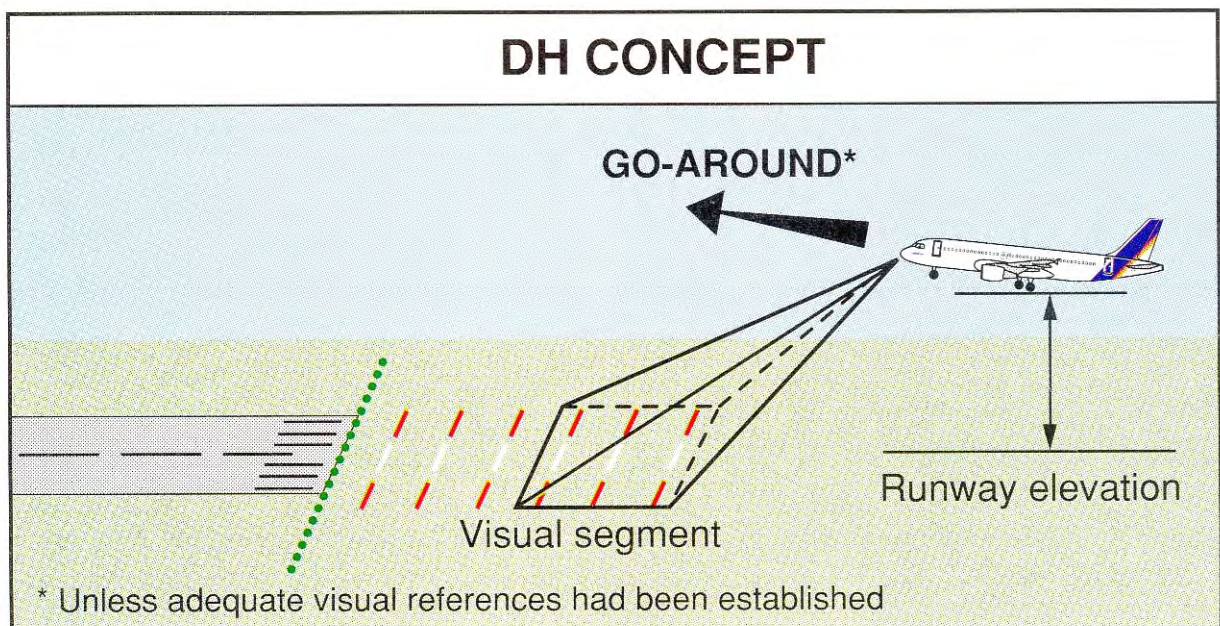
Decision height concept:

Decision height is a specified point in space at which a pilot must make an operational decision. The pilot must decide if the visual references adequate to safely continue the approach have been established.

- If the visual references have not been established, a go-around must be executed.
- If the visual references have been established, the approach can be continued. However, the pilot may always decide to execute a go-around if sudden degradations in the visual references or a sudden flight path deviation occur.

In Category II operations, DH is always limited to 100ft or Obstacle Clearance Height (OCH), whichever is higher. In Category III operations with DH, the DH is lower than 100ft (typically equal to 50ft for a *fail-passive* automatic landing system and 15-20ft for a *fail-operational* automatic landing system).

Figure 2.1



The DH is measured by means of radio-altimeter.

When necessary, the published DH takes into account the terrain profile before runway threshold.

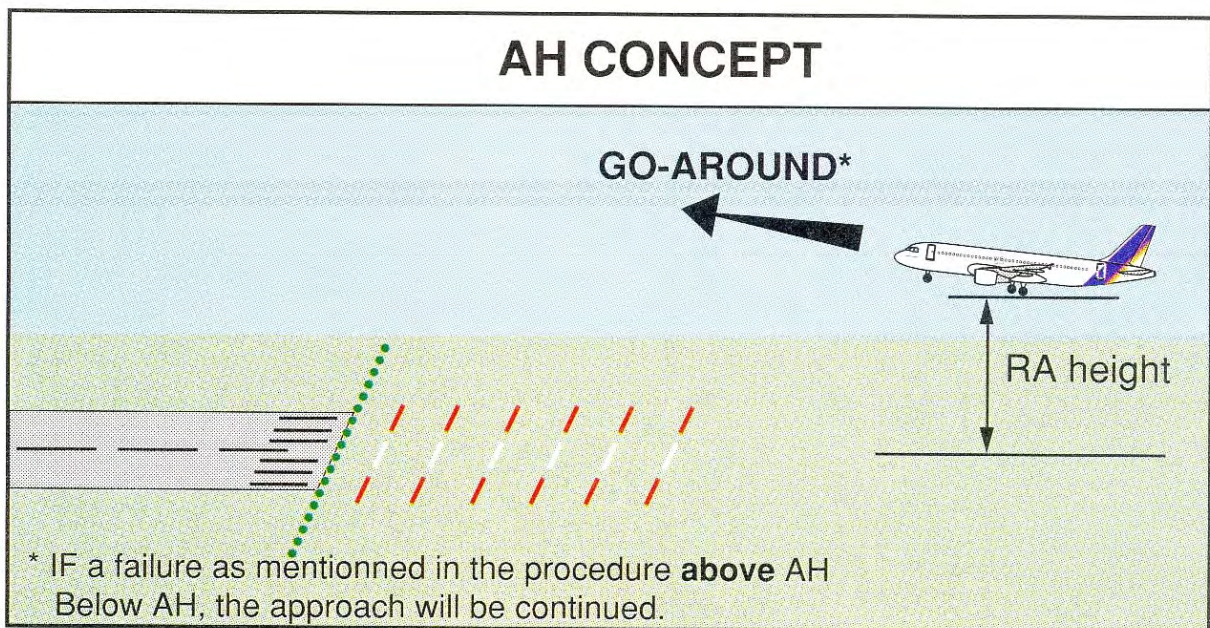
Alert height concept:

Alert height is a height defined for Category III operations with a fail-operational landing system.

- Above AH, a go-around must be initiated if a failure⁽¹⁾ affects the fail-operational landing system.
 - ⁽¹⁾ The list of these failures is mentioned in the AFM.
- Below AH, the approach will be continued (except if AUTOLAND warning is triggered).

The AH is evaluated during aircraft certification; it is set at 100ft for A300, A310, A319, A320, A321 and 200ft for A330, A340.

Figure 2.2



The AH is only linked to the probability of failure(s) of the automatic landing system. Operators are free to select an AH lower than the AH indicated in the AFM but not a higher value. Airbus procedures include both AH and DH concepts for all Fail-operational (see later) Category III operations.

2.4 RUNWAY VISUAL RANGE

2.4.1 RUNWAY VISUAL RANGE DEFINITION

Runway Visual Range (RVR) is the range over which a pilot of an aircraft on the centreline of the runway can see the runway surface markings or the lights delineating the runway or identifying its centreline (ICAO).

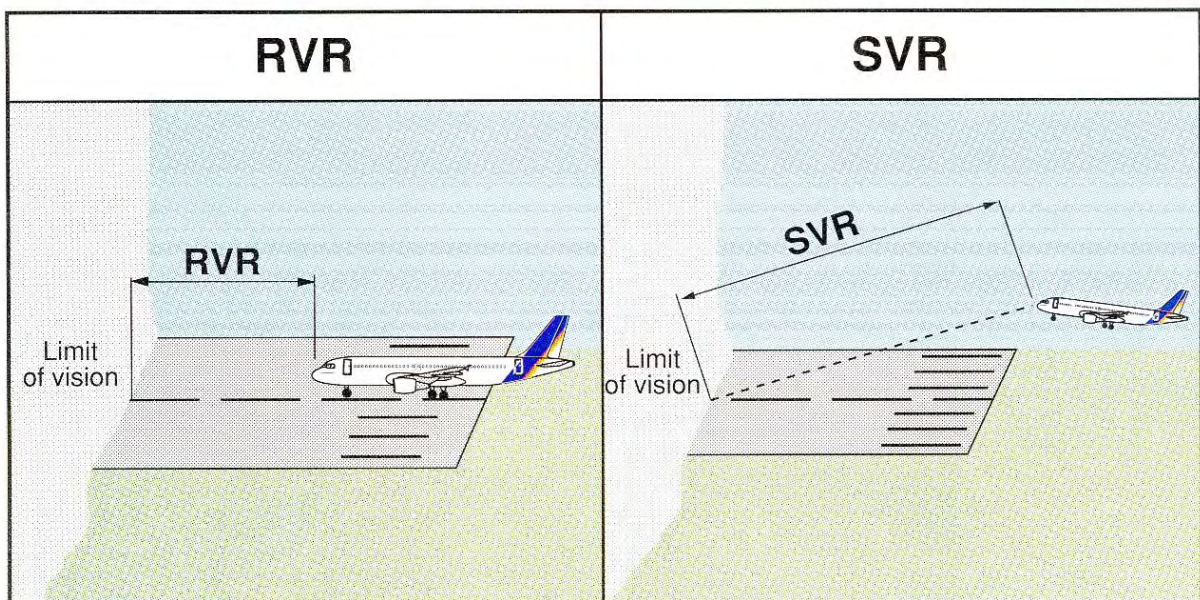
2.4.2 RUNWAY VISUAL RANGE CONCEPT

Categories II and III operations require rapidly updated and reliable reports of the visibility conditions which a pilot may expect to encounter in the touchdown zone and along the runway.

RVR measurements replace the use of Reported Visibility Values (RVV) which is not appropriate for conditions encountered during the final approach and landing in low visibility, because the visibility observations are often several miles away from the touchdown zone of the runway.

Note: RVR is not the Slant Visual Range (SVR). SVR is the range over which a pilot of an aircraft in the final stages of approach or landing can see the markings or the lights as described in RVR definition.

Figure 2.3



2.4.3 RUNWAY VISUAL RANGE MEASUREMENTS

For Category II and Category III operations, the RVR measurements are provided by a system of calibrated transmissometers and account for the effects of ambient background light and the intensity of runway lights (see Chapter 6 for further details).

Transmissometer systems are strategically located to provide RVR measurements associated with three basic portions of a runway:

- the touchdown zone (TDZ),
- the mid-runway portion (MID), and
- the rollout portion or stop end.

For Category II operations the TDZ measurement is required, and for Category III operations the TDZ and MID measurements are mandatory. But for CAT III operations with the lowest weather minima, the three measurements are normally required by FAA.

For CAT III without DH JAR OPS 1 requires only one RVR measuring point on the runway.



2.4.4 ESTABLISHMENT OF RVR MINIMA

In Category II and Category III operations, the minima are expressed in terms of DH and RVR. It is relatively simple to establish the DH. But it is more difficult to establish the RVR to be associated with that DH in order to ensure the required visual reference (three-light segment).

When establishing airfield operating minima, it is recommended to refer to acceptable minima as described in Chapter 3 paragraph 2. The use of those minima has resulted in a high approach success rate.

Theory of RVR minima determination (ECAC document n°17)

The basic principles for the establishment of RVR minima are that the scale of visual reference required by a pilot at and below DH depends on the task that he has to carry out and that the degree to which his vision is obscured depends on the nature of the meteorological phenomena which creates the low visibility conditions.

" ... the task that he has to carry out ... "

Research using flight simulators and flight tests have shown that:

1. *most pilots require visual contact to be established about three seconds above DH though it has been observed that this reduces to about one second when a fail-operational automatic landing system is being used;*
2. *to establish lateral position and cross-track velocity, most pilots require to be able to see not less than a three-light segment of the centreline of the approach lights, or runway centreline, or runway edge lights ;*
3. *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 ;*
4. *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.*

Minimum visual segments at DH have been established for each category. Typical values are 60m for CAT III and 90m for CAT II automatic landing and 225m for CAT II with manual landing.

Note 1: the visual segment is the runway segment that a pilot can see from his position

Correlation between visual segment: SVR ; RVR

A formula can be used to compute the SVR required for the pilot to acquire visually the specified visual segment, at the DH for a particular operation.

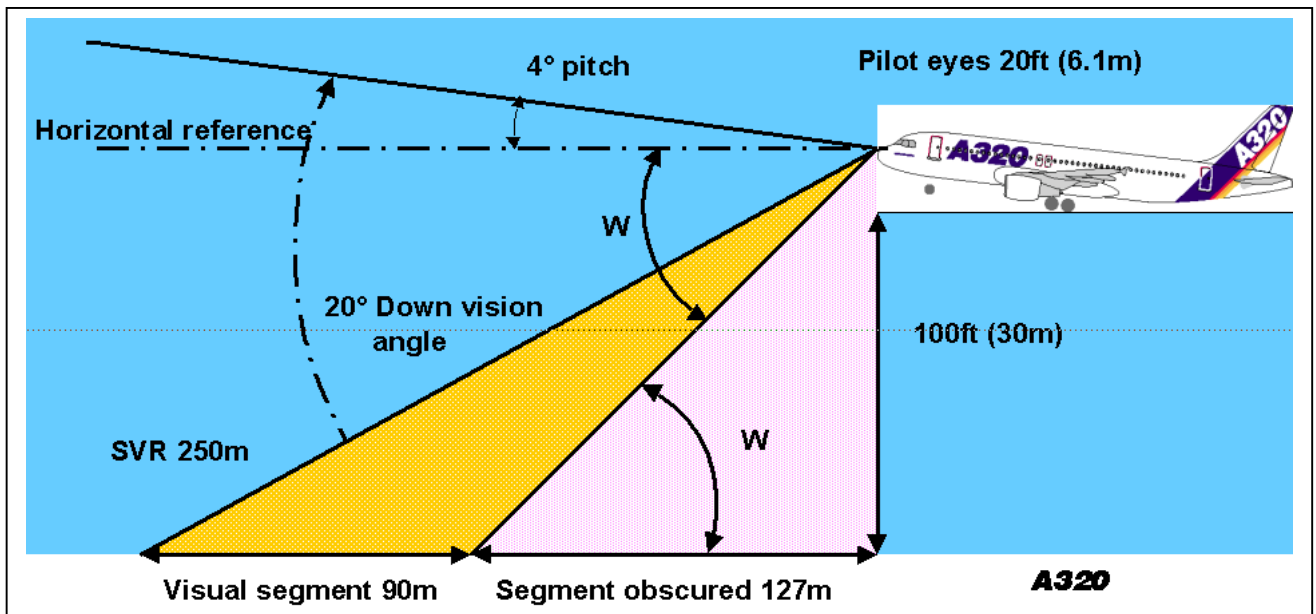
$$SVR = \sqrt{(v + (h * \cotan w))^2 + h^2} \text{ (purely geometrical relation)}$$

v : visual segment (m)

h : pilot's eye height above ground level (m)

w: Cockpit cut-off angle (°) = Down vision angle (°) - pitch angle (°)

Figure 2.4

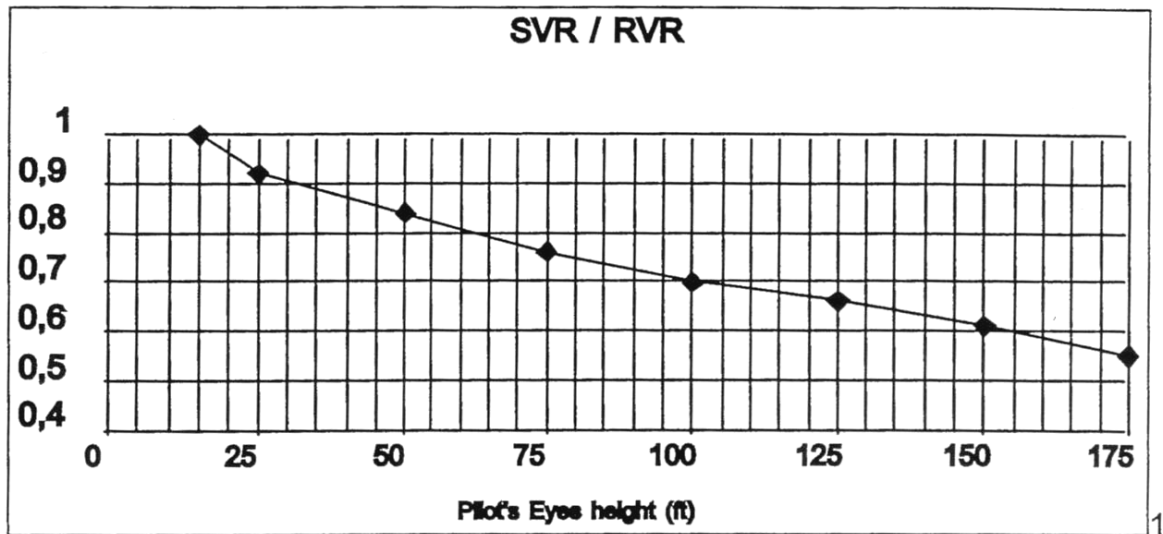


"... nature of the meteorological phenomena..."

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 SVR from eye heights greater than 15ft above the ground will be less than the RVR. There is some evidence in pilots' reports that other low visibility conditions (heavy rain, blowing snow, dust, etc.) could produce a relationship similar to that observed in fog.

So, to convert required SVR into required RVR, the model established in the UK for deep stable fog can be used. Refer to the following graph providing SVR/RVR ratio as a function of eye height. On 90% of occasions, the SVR is expected to be this proportion of RVR or more.

Figure 2.5



Example of establishment of required RVR

For CAT II operations with auto pilot down to DH=100ft and manual control below, the required visual segment is 90m. The required SVR for such operation is 220.7m (using the example as shown in Figure 2.4).

Eye height = DH + 20ft = 120ft = 36.6m

Cut-off angle = 20°

Pitch = 4°,

w = 16°,

Visual segment = 90m

Using above formula we find SVR = 220.7 m

At 120ft above ground level, the SVR/RVR is expected to be 0.68 or more, so we obtain a required RVR equal 324.6m.

$$RVR = SVR \times 1/0.68 = 324.6 \text{ m (for SVR/RVR=0.68)}$$

The same method may also be used to evaluate the visual segment for a given RVR.

Other more or less sophisticated methods, have been used in the past. But with recent experience, 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.

Additional information on pilot's eye position

The pilots must realize the importance of eye position during low visibility approaches and landing. A too-low seat adjustment may greatly reduce the visual segment. When the eye reference position is lower than intended, the already short visual segment is further reduced by the cut-off angle of the glareshield or nose.

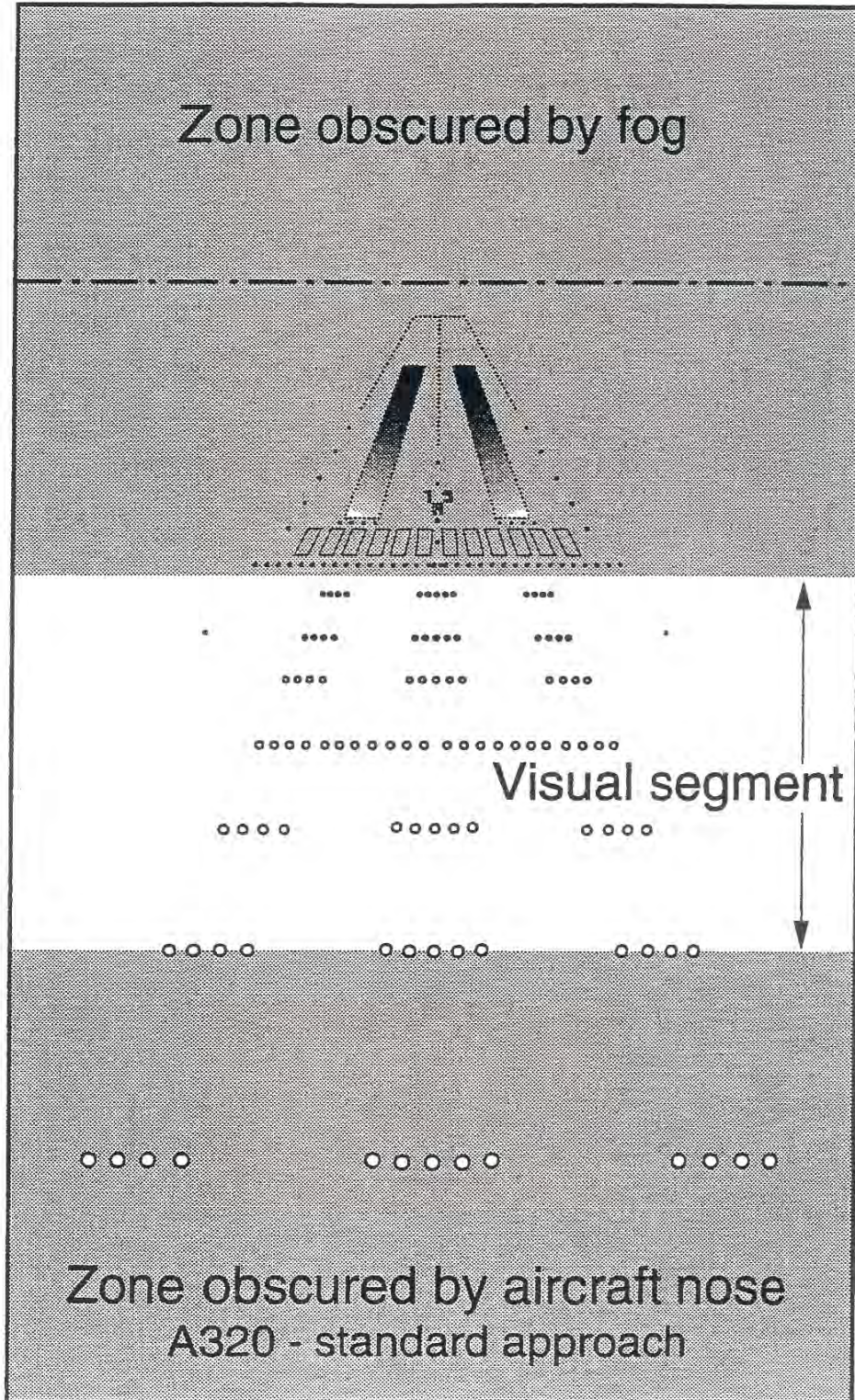
Airbus aircraft are equipped with an eye position indicating device. The optimum eye position is obtained when the pilot sees the red indicator ball covering the white ball.

Additional information on landing lights

Use of landing lights at night in low visibility can be detrimental to the acquisition of visual references. Reflected lights from water droplets or snow may actually reduce visibility. Landing lights would therefore not normally be used in Category III weather conditions.

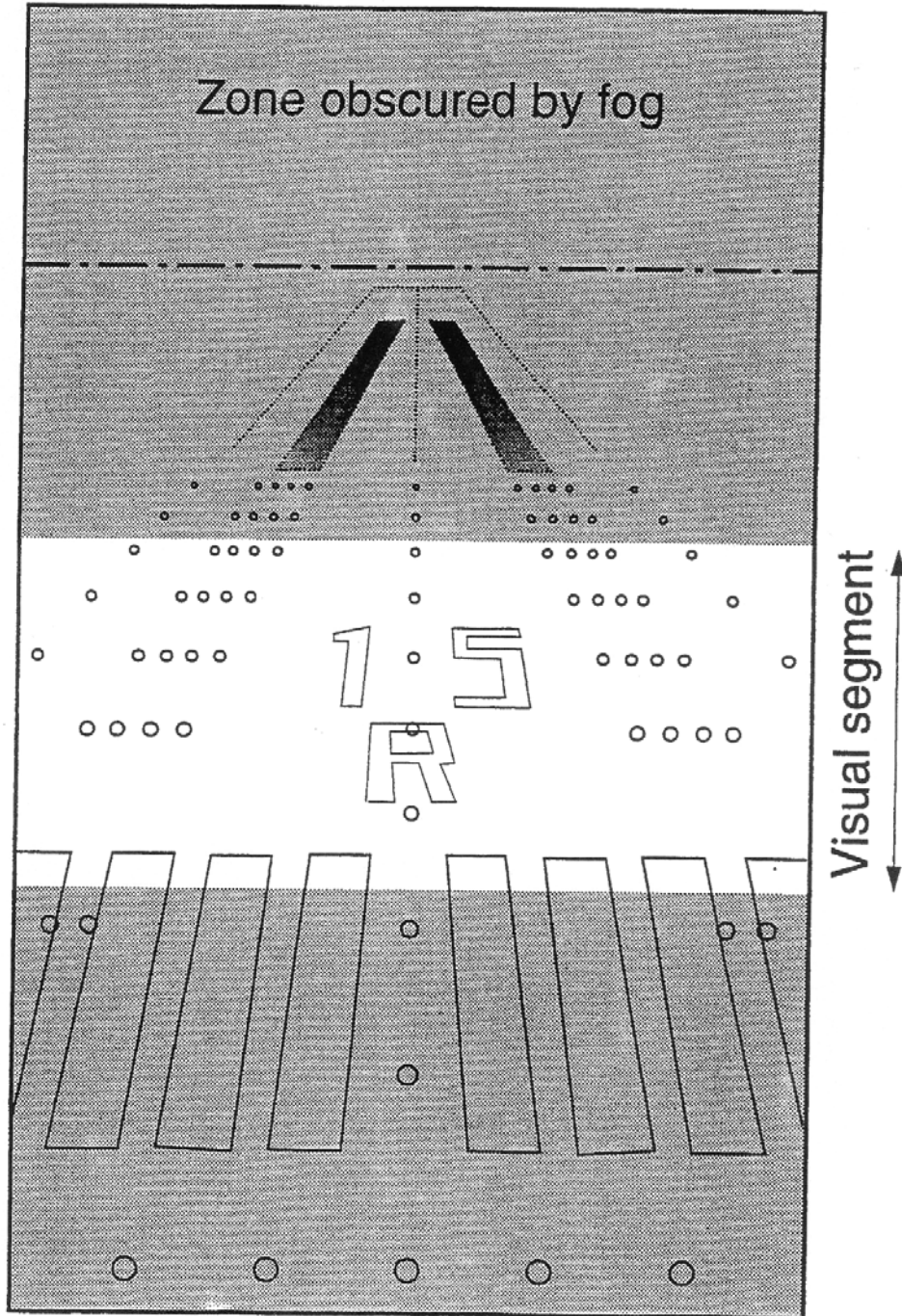
**VISUAL SEGMENT AT DH=100ft
WITH RVR 350m (TYPICAL CAT II)**

Figure 2.6



**VISUAL SEGMENT AT DH=50ft
WITH RVR 200m (TYPICAL CAT III A)**

Figure 2.7



**Zone obscured by aircraft nose
A320 - standard approach**

2.5 FAIL-PASSIVE AUTOMATIC LANDING SYSTEM

An automatic landing system is fail-passive if, in the event of a failure, there is no significant out-of-trim condition or deviation of flight path or attitude but the landing is not completed automatically. For a fail-passive automatic landing system the pilot assumes control of the aircraft after a failure (JAA).

On Airbus aircraft since the A320, fail-passive capability is announced by the display of **CAT 3 SINGLE** on the PFD.

Figure 2.8 PFD on A340

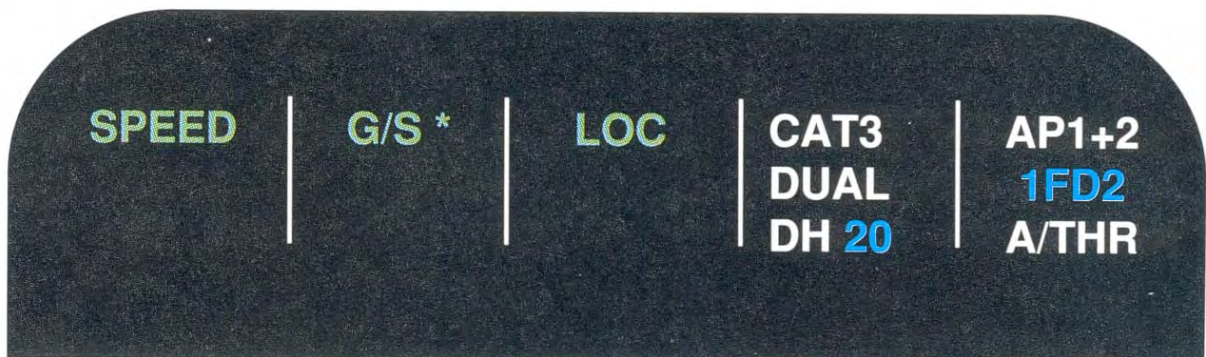


2.6 FAIL-OPERATIONAL AUTOMATIC LANDING SYSTEM

An automatic landing system is fail-operational if, in the event of a failure below alert height, the approach, the flare and landing can be completed by the remaining part of the automatic system. In the event of failure, the automatic landing system will operate as a fail-passive system (JAA).

On Airbus aircraft since the A320, fail operational capability is announced by the display of **CAT 3 DUAL** on the PFD.

Figure 2.9 PFD on A340



2.7 MINIMUM APPROACH BREAK-OFF HEIGHT

The Minimum Approach Break-off Height (MABH) is the lowest height above the ground, measured by radio-altimeter, such that if a missed approach is initiated without external references:

- in normal operation, the aircraft does not touch the ground during the procedure ;*
- with an engine failure during a missed approach, it can be demonstrated that taking this failure probability, an accident is extremely improbable.*

This definition is not considered by the FAA and is abandoned by JAA following the harmonization process of the AWO regulations.

The MABH will remain indicated in some Airbus AFM (except FAA AFM).

For some Airbus type the MABH is replaced by an indication of the minimum DH and for more recent certifications the MABH will be replaced in the procedure section of the AFM by an indication of the altitude loss during automatic go around.

The MABH or the altitude loss during automatic go around can be used by the airlines to determine the minimum DH in CAT III operation.

2.8 CONCEPT OF MINIMA

Regulations often use the term minima. In fact, this term could refer to different concepts:

1. *Airfield operating minima*: established in accordance with the airport authority and published on approach charts.
2. *Operator's minima*: lowest minima that an operator is allowed to use at a specified airfield, following an approval from its operational authority.
3. *Crew minima*: lowest minima that the crew is authorized to operate, depending on the crew qualification.
4. *Aircraft minima*: lowest minima which have been demonstrated during aircraft certification. These minima are indicated in the AFM.

For all CAT II / CAT III operations, these minima consist of a DH and an RVR.

CHAPTER 3

3. HOW TO GET APPROVAL

- 3.1 APPROVAL PROCESS**
- 3.2 OPERATING MINIMA**
- 3.3 FLIGHT CREW PROCEDURES**
- 3.4 FLIGHT CREW TRAINING**
 - ATTACHMENT A: EXAMPLE OF CREW TRAINING**
- 3.5 MAINTENANCE PROGRAMME**
- 3.6 OPERATIONAL DEMONSTRATION**
- 3.7 CONTINUOUS MONITORING**
- 3.8 AUTOLAND IN CAT I OR BETTER WEATHER CONDITIONS**

3.1 APPROVAL PROCESS

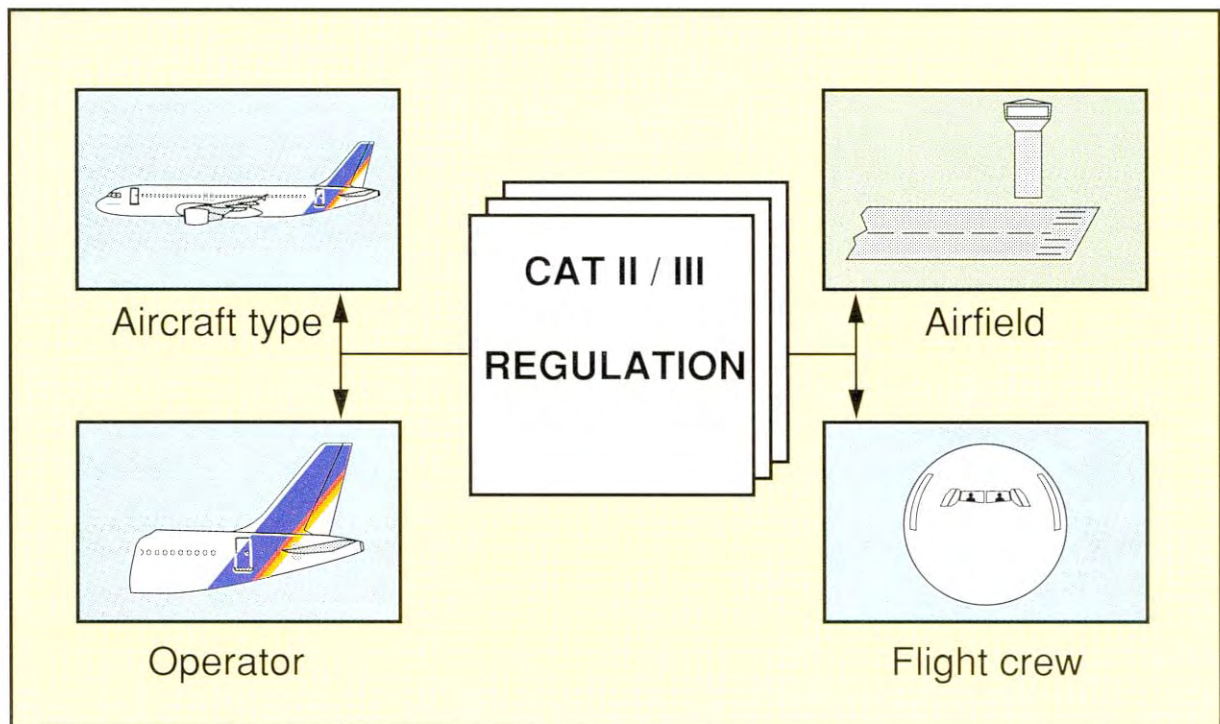
3.1.1 INTRODUCTION

Due to the very low visibility associated with CAT II / III operations, authorities strictly regulate all aspects of this type of operation, in order to maintain the general level of safety in air transportation .

Basically, four elements are strictly regulated (as shown Figure 3.1).

1. The aircraft
2. The airfield
3. The operator
4. The flight crew

Figure 3.1



An operator applying for CAT II or CAT III operations must adhere to the rigid structure of the regulation to get the operational approval from his own authority.

This chapter should be considered as an aid to understand the requirements and as an operator's guide to get the operational approval.

3.1.2 PRINCIPLE OF APPROVAL PROCESS

The approval process may differ according to the various regulations but the general principle follows the same basic sequences set out below.

1. An operator which applies for a Category II or Category III approval must submit a file to his national authority. This file represents the official application. Basically, this file must include the following items.

1.1 **Aircraft type**

Extracts taken from the Flight Manual mainly addressing aircraft certification status, list of required equipment for the intended mode of operations, the limitations, and the procedures following failures.

1.2 **Airfield equipment**

A description of the airfield equipment in accordance with ICAO standards for Category II/III, including visual and non-visual aids, runway characteristics, obstacle clearance area, RVR measurements, ATC procedures, etc.

1.3 **Airfield operating minima**

A proposal for airfield operating minima for each airfield intended to be used by the operator.

1.4 **Flight crew training**

A syllabus for ground training, flight/simulator training in order to get the Category II or III qualification and the requirements for recurrent training.

1.5 **Flight crew procedures**

A description of the operational procedures covering in particular crew task sharing, approach monitoring, decision making, handling of failures and go-around.

1.6 **Maintenance program**

A description of the maintenance program, which is mandatory to ensure the airborne equipment, will remain at the level of performance and reliability demonstrated during the certification.

2. After receiving this file, the authority will meet the operator to review the file and to notify the required operational demonstration.
3. The operator has to establish a simulator training program to qualify both instructors and pilots on the aircraft type.
4. During the operational demonstration, the operator must demonstrate his ability to perform Category II or III with an appropriate approach success rate and level of safety.
5. If the operational demonstration is satisfactory, the operator will obtain the approval for in-fine service with the specified minima.
6. During fine operations, the operator must provide periodic flight reports with all required data to the authority as part of a continuous monitoring process.

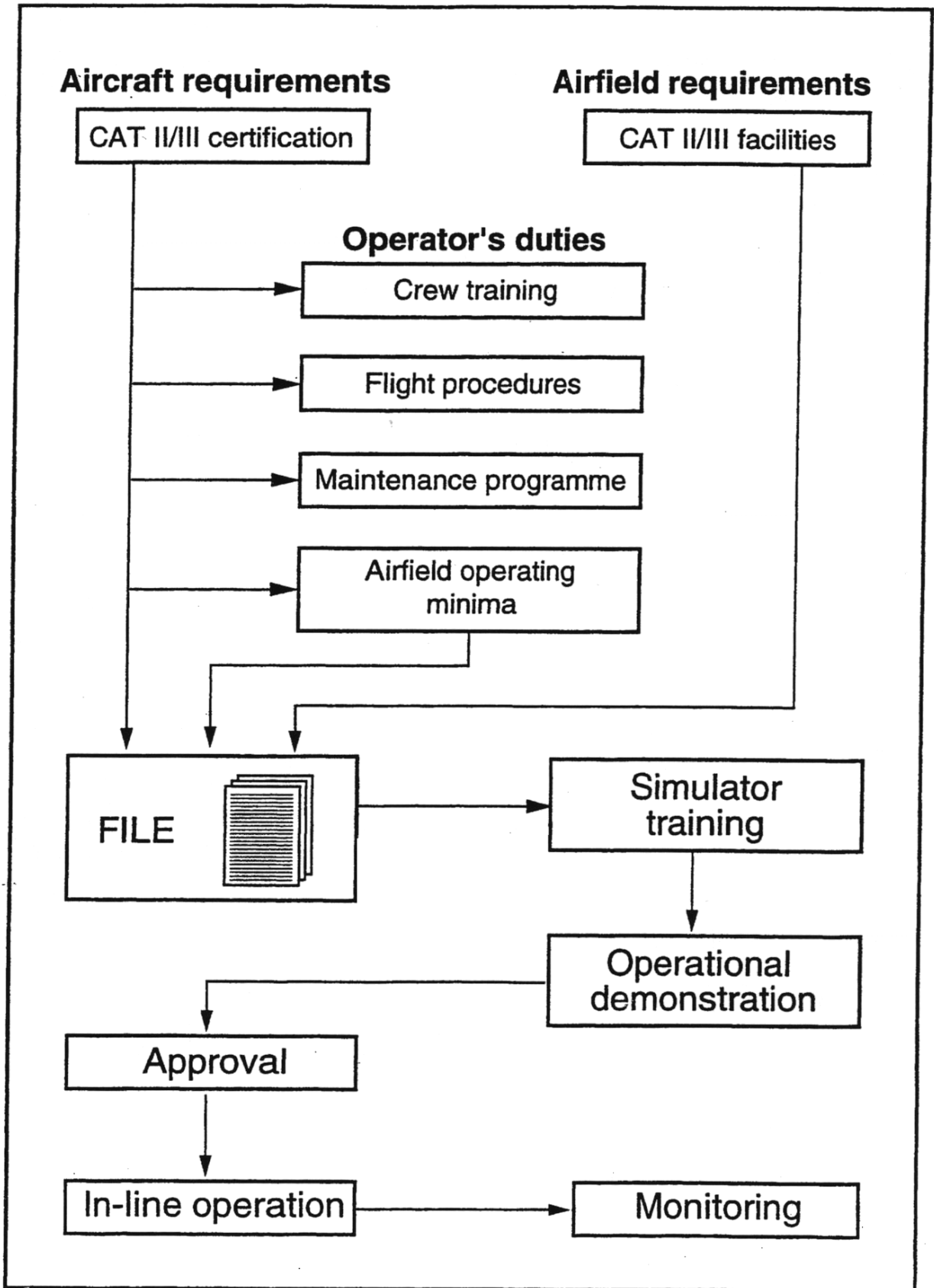
The complete Category II and Category III approval process is illustrated in Figure 3.2.

3.1.3 CREATION OF A FILE FOR THE SUBMISSION

In order to help operators to create an operational approval file, the following is provided.

1. Basis for establishment of the DH and RVR minima, tables of acceptable minima *¶ paragraph 3.2 Operating Aerodrome Minima ¶*
2. Complete FAA/JAA requirements for crew training and qualification and Airbus training program *¶ paragraph 3.4 Crew Training ¶*
3. Requirements for flight crew procedures and examples of Airbus procedures *¶ paragraph 3.3 Flight procedures ¶*
4. Basis for aircraft maintenance *¶ paragraph 3.5 Maintenance ¶*
5. Summary of airworthiness requirements for CAT II / CAT III and autoland certifications *¶ Chapter 4 Aircraft requirements ¶*
6. Standards for an airfield to be CAT II / CAT III approved *¶ Chapter 5 Aerodrome requirements ¶*

Figure 3.2 Illustration of approval process



3.2 OPERATING MINIMA

3.2.1 DEFINITION

In the ICAO document "Manual of All Weather Operations" will be found the following definition of the term 'Aerodrome Operating Minima'.

The limits of usability of an aerodrome for either take-off or landing, usually expressed in terms of visibility or runway visual range, decision altitude (DA/DH) or minimum descent altitude/height (MDA/MDH) and cloud conditions.

For all CAT II / CAT III approaches, Aerodrome Operating Minima are expressed as a minimum **DH** and **RVR**. These Aerodrome Operating Minima must be established by the operator, as specified in the following extract of ICAO Annex 6. For related definitions concerning the Minima, refer also to paragraph 2.8 above.

An operator shall establish aerodrome operating minima for each aerodrome planned to be used. The method of determination of such minima must be approved by his authority. Except specific authorization, these minima shall be higher than any that may be established for such aerodromes by the state in which the aerodrome is located.

An operator must take account of:

- *the type, performance and handling characteristics of the aeroplane.*
- *The composition of the flight crew, their competence and experience.*
- *The dimensions and characteristics of the runway which may be selected for use.*
- *The adequacy and performance of the available visual and non-visual aids.*
- *The equipment available on the aeroplane for the purpose of navigation and/or control of the flight path, as appropriate, during the approach, the flare, the landing and the missed approach.*
- *The obstacles in the approach and missed approach areas and necessary clearance.*
- *The obstacle clearance altitude/height for the instrument approach procedures.*
- *The means to determine and report meteorological conditions.*

Extract of ICAO annex 6

To establish the decision height, the operator must follow the rules explained in the two paragraphs 3.2.2 (DH CAT II) and 3.2.3 (DH CAT III).

To establish the acceptable RVR minima, reference should be made to figures 3.5, 3.6, 3.7 or 3.8 provided here below. However, **each operator must refer to his national authority on this subject.**

3.2.2 DETERMINATION OF THE DH FOR CATEGORY II

To establish a DH for a particular Category II operation, an operator must take into account five parameters as explained in this extract of the JAR-OPS.

An operator must ensure that the decision height for a Category II operation is not lower than:

1. *The minimum decision height specified in the AFM.*
2. *The minimum decision height to which the precision approach aid can be used solely by reference to instruments.*
3. *The OCH for the category of aeroplane.*
4. *The decision height to which the flight crew is authorized to operate.*
5. *100ft (30m).*

Extract of JAR-OPS

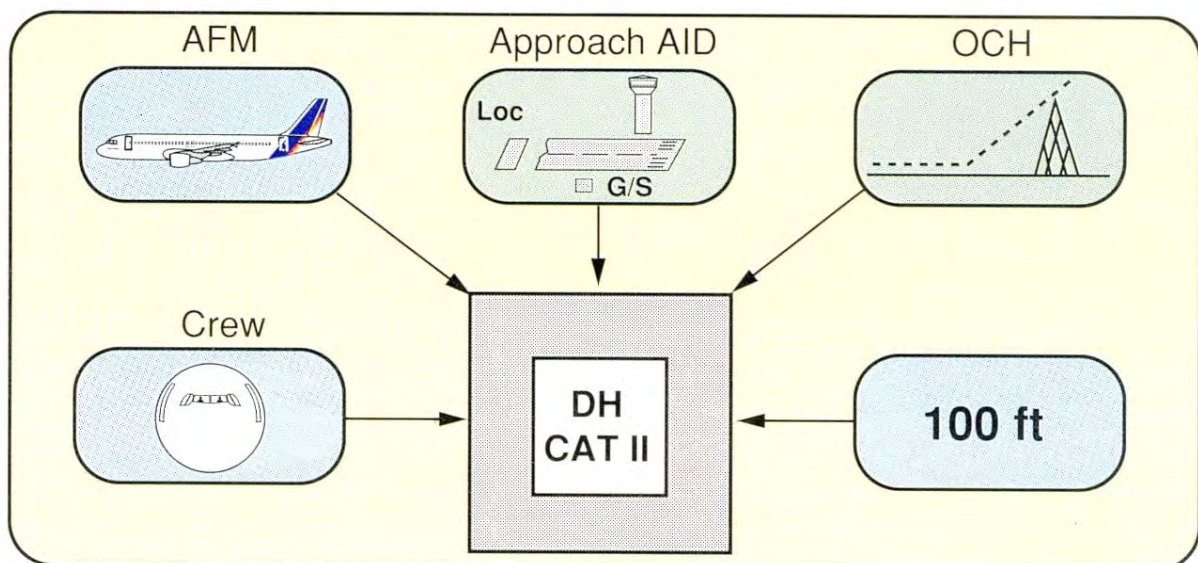
Additional information

In **1** above, for all Airbus aircraft with Category II certification, the minimum DH specified in the AFM is 100ft.

In **2** above, the minimum DH is related to the ILS ground installation performance.

In **3** above, the definition of the OCH can be found in the Chapter 5.6.

Figure 3.3 Category II DH



3.2.3 DETERMINATION OF THE DH FOR CATEGORY III

To establish a DH for a particular Category III operation, an operator must take into account only three parameters as explained in this extract of the JAR-OPS.

An operator must ensure that the decision height for a Category III operation is not lower than:

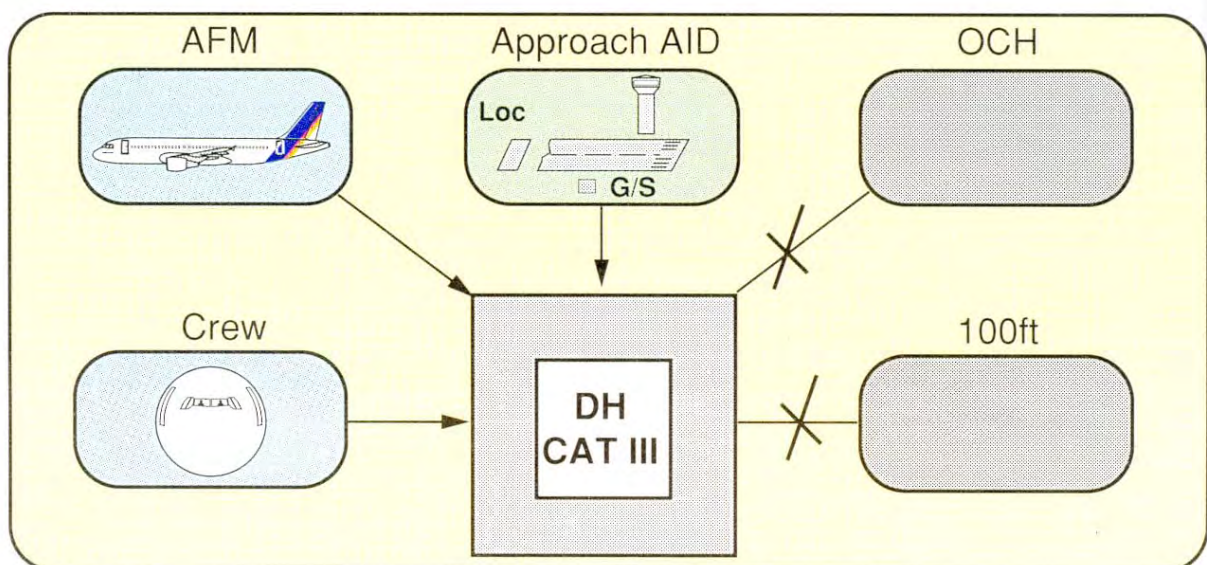
- *The minimum decision height specified in the AFM.*
- *The minimum decision height to which the precision approach aid can be used solely by reference to instruments.*
- *The decision height to which the flight crew is authorized to operate.*

Extract of JAR-OPS

There is no need to take obstacle clearance into account in the determination of the DH. A Category III approach ensures that the aircraft is within the Obstacle Free Zone (see definition of the OFZ in Chapter 5.6) during the approach and go-around.

If the minimum DH is not specified in the AFM, the MABH or the information on the height loss after go around (refer to § 2.7) can be used to determine the minimum DH.

Figure 3.4 Category III DH



3.2.4 DETERMINATION OF RVR FOR CATEGORY II

The table of figure 3.5 provides commonly "acceptable Category II RVR minima" according to ICAO,FAA, and JAA.

The RVR minima according to ICAO are taken from the ICAO document "Manual of All Weather Operations". The RVR minima according to FAA are taken from the AC120.29. The RVR minima according to JAA are taken from the JAR-OPS.

As it is sometimes necessary to increase DH, the RVR minima according to JAA and FAA are a function of the DH.

Figure 3.5 Category II RVR minima

ICAO			FAA		JAA
DH	RVR		DH	RVR	RVR
100ft	350m (1200ft)		100-120ft	1200ft (350m)	350m/300m (1)
			121-140ft	1200ft (350m)	400m
150ft	500m (1600ft)		141-180ft	1600ft (500m)	450m
			181-199ft	1800ft (550m)	450m

Note 1: 300m for aircraft with AP in command down to a height which is not higher than 80% of the applicable DH.

Note 2: The RVR minima 350m according to ICAO is called basic CAT II minima and the RVR minima 500m is called restricted CAT II minima. ICAO recommends use of the restricted CAT II minima for the operational evaluation phases prior to authorization of basic CAT II minima.

3.2.5 DETERMINATION OF RVR FOR CATEGORY III

The table of Figure 3.6 provides commonly "acceptable Category III RVR minima" according to ICAO. This table is taken from "Manual of All Weather Operations".

The table of Figure 3.7 provides commonly "acceptable Category III RVR minima" according to FAA. This table is compiled from information taken from AC120.28C.

The table of Figure 3.8 provides commonly "acceptable Category III RVR minima" according to JAA. This table is taken from the JAR-OPS.

RVR minima for Category III approaches are a function of the aircraft available equipment and automatic landing system capability (fail-operational or fail-passive).

Figure 3.6 Category III RVR minima / ICAO

ICAO

	Category III A		Category III B
	Fail-passive automatic landing system	Fail-operational automatic landing system	
DH	Not less than 15m (50ft)	Less than 15m (50ft) or no DH	Less than 15m (50ft) or no DH
RVR	300m (note 1)	300m	100m

Note 1: For minima between 300m and 200m, RVR are restricted to operations conducted in accordance with specific criteria as specified in ECAC Doc 17 (or JAR-OPS) or AC120.28C.

Figure 3.7

Category III RVR minima / FAA

FAA

		RVR AS A FUNCTION OF AUTOMATIC LANDING SYSTEM STATUS			
		FAIL-PASSIVE SYSTEM	FAIL OPERATIONAL SYSTEM		
			WITHOUT ROLL-OUT SYSTEM	WITH ROLL-OUT SYSTEM	
APPROACH CATEGORY	D H			FAIL-PASSIVE	FAIL-OPERATIONAL
III A	$50\text{ft} \leq \text{DH} < 100\text{ft}$	200m	200m	200m	200m
III A	$\text{DH} \leq 50\text{ft}$	Not authorized	200m	200m	200m
III A	NO DH	Not authorized	200m	200m	200m
III B	$\text{DH} < 50\text{ft}$	Not authorized	Not authorized	100m	50m
III B	NO DH	Not authorized	Not authorized	100m	50m

Refer to AC 120-28C for further details and update.

Figure 3.8

Category III RVR minima / JAA

JAA

		RVR AS A FUNCTION OF AUTOMATIC LANDING SYSTEM STATUS			
		FAIL-PASSIVE	FAIL OPERATIONAL		
			WITHOUT ROLL-OUT SYSTEM	WITH ROLL-OUT SYSTEM	
APPROACH CATEGORY	D H			FAIL-PASSIVE	FAIL-OPERATIONAL
III A	DH < 100ft	200m (note 1)	200m	200m	200m
III A	NO DH				
III B	DH < 50ft	Not applicable	Not authorized	125m	75m
III B	NO DH	Not authorized	Not authorized	Not authorized	75m

Note 1: For operations to approved RVR values less than 300m, a go-around is assumed in the event of an autopilot failure at or below DH.

3.3 FLIGHT CREW PROCEDURES

Operators must develop procedures and operational instructions to be used by flight crews. These procedures and instructions must be published in the Operations Manual. All the instructions must be compatible with the limitations and mandatory procedures contained in the Approved Flight Manual.

3.3.1 ITEMS TO BE COVERED

The procedures and the operational instructions should cover normal and abnormal situations, which can be encountered in actual operations. For this purpose, authorities define items to be covered by these procedures and instructions. For quick reference, we provide a list of items as taken from the JAR OPS. Other regulations are very similar. According to the JAA, the following items must be covered

- a) Checks for the satisfactory functioning of the aircraft equipment, both before departure and in flight.
- b) Effect on minima caused by changes in the status of the ground installations and airborne equipment.
- c) Procedures for approach, flare, rollout and missed approach.
- d) Procedures to be followed in the event of failures, warnings and other abnormal situations.
- e) The minimum visual reference required.
- f) The importance of correct seating and eye position.
- g) Action which may be necessary arising from a deterioration of the visual reference.
- h) Allocation of crew duties in the carrying out of the procedures according to subparagraphs (a) to (d) and (f) above, to allow the pilot in command to devote himself mainly to supervision and decision making.
- i) The requirement for all height calls below 200ft to be based on the RA and for one pilot to continue to monitor the aircraft instruments until the landing is completed.
- j) The requirement for the localizer sensitive area to be protected.

- k) The use of information relating to wind velocity, windshear, turbulence, runway contamination and the use of multiple RVR assessments.
- l) Procedures to be used for practice approaches and landing on runways at which the full CAT II or CAT III airfield procedures are not in force.
- m) Operating limitations resulting from airworthiness certification.
- n) Information on the maximum deviation allowed from the ILS glidepath and/or localizer.

3.3.2 FLIGHT PREPARATION

In addition to normal flight preparation, the following planning and preparation must be performed when CAT II or CAT III approaches are envisaged.

- Review NOTAMS to make sure that the destination airport still meets visual or non-visual CAT II or CAT III requirements:
 - Runway and approach lighting,
 - Radio navaid availability,
 - RVR equipment availability, etc.
- Aircraft status: check that required equipment for CAT II or CAT III approaches are operative. The required equipment list is given in the FCOM and in the AFM.

Although CAT II / CAT III required equipment is not listed in the MMEL, the operator may choose to list them in his own MEL.

When the aircraft log book is available, confirm that no write-up during previous flights affects equipment required for CAT II / CAT III. A maintenance release statement for CAT II / CAT III may be indicated in the log book according to airline policy.

- Crew qualification and currency must be reviewed (both CAPT and F/O must be qualified and current).
- Weather information: check that the weather forecast at destination is within airline and crew operating minima. If the forecast is below CAT I minima, verify that alternate weather forecasts are appropriate to the available approach means and at least equal or better than CAT I minima.
- Fuel planning: additional extra fuel should be considered for possible approach delays.

3.3.3 APPROACH PREPARATION

Aircraft Status

Check on ECAM STATUS page that the required landing capability is available.

Although it is not required to check equipment that is not monitored by the system, if any of this equipment is seen inoperative (flag), the landing capability will be reduced.

For A300/A310, check AUTOLAND WARNING light.

Weather

Check weather conditions at destination and at alternates. Required RVR values must be available for CAT II/III approaches. The selected alternate must have weather conditions equal to or better than CAT I.

Approach ban

Policy regarding an approach ban may differ from country to country. Usually the final approach segment may not be continued beyond the OM or equivalent DME distance if the reported RVR is below the published minima for the required transmissometers. After OM or equivalent, if RVR becomes lower than the minima, the approach may be continued.

ATC calls

Unless LVP are reported active by ATIS, clearance to carry out a CAT II or CAT III approach must be requested from ATC, who will check the status of the ILS and lighting and protect the sensitive areas from incursion by aircraft or vehicles. Such an approach may not be undertaken until the clearance has been received.

Before the outer marker, the required RVR values should be transmitted.

Refer to § 5.10.

Seat position

The correct seat adjustment is essential in order to take full advantage of the visibility over the nose. The seat is correctly adjusted when the pilots eyes are in line with the red and white balls located above the glareshield.

Use of landing lights

At night in low visibility conditions, landing lights can be detrimental to the acquisition of visual references.

Reflected light from water droplets or snow may actually reduce visibility. Landing lights would therefore not normally be used in CAT II or CAT III weather conditions.

CAT II or CAT III crew briefing

The briefing should include the normal items as for any IFR arrival and in addition the following subjects should be covered prior to the first approach:

- destination and alternate weather,
- airfield and runway operational status CAT II / CAT III, etc.
- aircraft systems status and capacity,
- brief review of task sharing,
- review approach procedure (stabilized or decelerated),
- review applicable minima (performance page), go-around procedure, ATC calls,
- brief review of procedure in case of malfunction below 1000ft,
- optimum seat position and reminder to set cockpit lights when appropriate

3.3.4 APPROACH PROCEDURES

The procedures given in FCOM for CAT II and CAT III approaches make the best use of the automatic system of the aircraft. A320/A330/A340 FCOM procedures for CAT II/III indicate task sharing between PF and PNF without specifying the real position of PF. This was intentionally done to give the airlines the possibility to adapt their own policy.

TASK SHARING

CM1 and CM2 task sharing must be clearly defined in the Airline Operations Manual. The task sharing proposed here below is one example of how to conduct a CAT II/III approach. Whatever the Airline policy, the AFM procedures must be observed.

For the Airbus Training Center the recommended task sharing for a CAT II / CAT III approach is that CM1 is PF and CM2 is PNF.

The workload is distributed in such a way that the PF primary tasks are supervising and decision making, and the PNF primary task is monitoring operation of the automatic system.

In summary the tasks are shared as follows:

All
CAT II
and
CAT III
operations

- CM1**
- has hands on controls and thrust levers throughout the approach, landing or go-around;
 - makes FCU selections (if any);
 - takes manual control in the event of AP disconnection ;
 - monitors flight instruments.

Approaching DH:

- starts to look for visual references, progressively increasing external scanning as DH is approached. If no DH procedure is used, the PF will nevertheless look for visual references.

At or before DH (if his decision is to continue):

- calls "LANDING" ;
 - scans mostly head-up to monitor the flight path and flare (in CAT II or CAT III A) or the position on the runway (in CAT IIIB) by visual references;
 - monitors thrust reduction or for A320/A330/A340, at "RETARD" call-out, sets thrust levers to idle ;
 - selects and controls reverse thrust;
 - disengages autopilot when taxi speed is reached.
- CM2**
- monitors flight instruments head-down throughout approach, go-around or landing until rollout is completed;
 - calls any deviation or failure warning ;
 - calls barometric heights as required, and monitors auto call-out or calls radio heights including "100 above" ;
 - monitors FMA and calls mode changes as required.

At DH (identified by aural and visual warning):

- if decision is not announced by CM1, calls "MINIMUM";
- if no response from CM1, initiates a go-around.

CAT III
operations
without
DH

- CM1**
- if no failure by AH, calls "LANDING";
 - monitors flare by flight instruments;
 - monitors lateral guidance during flare by yaw bar on PDF ;
 - monitors automatic ground roll by scanning alternately instruments and external references.

IF DECISION IS TO GO AROUND:

All
CAT II
and
CAT III
operations

- CM1**
- calls "GO-AROUND – FLAPS";
 - initiates go-around by setting thrust levers to TOGA (or triggering GO levers for A300/A310);
 - monitors rotation on PFD;
 - checks positive climb (V/S and RA);
 - commands configuration changes.

- CM2** - Standard Operating Procedures

VISUAL REFERENCES

Operations with DH

It should be stressed that the DH is the lower limit of the decision zone during which, in limiting conditions, the CM1 will be assessing the visual references. CM1 should come to this zone prepared for a go around but with no pre-established judgement. CM1 should make a decision according to the quality of the approach and the way the visual references develop as DH is approached.

a) CAT II Operations

In CAT II operations the conditions required at DH to continue the approach are that the visual references should be adequate to monitor the continued approach and landing, and that the flight path should be acceptable. If both these conditions are not satisfied, it is mandatory to initiate a go around.

The visual references required at DH in CAT II operations to continue the approach may be any of the following:

- a segment of the approach light system,
- the runway threshold,
- the touchdown zone.

b) CAT III Operations

In CAT III operations with DH, the condition required at DH is that there should be visual references, which confirm that the aircraft is over the touchdown zone. Go around is mandatory if the visual references do not confirm this.

CAT III without DH

For this category of operation, the decision to continue does not depend on visual references, even though a minimum RVR is specified (see OPERATING MINIMA). It is nevertheless good airmanship to confirm aircraft position with available visual references. However, the decision depends only on the operational status of the aircraft and ground equipment. If a failure occurs prior to reaching the AH, a go-around will be made. A go around must nevertheless be performed if the autoland warning is triggered below AH.

LOSS OF VISUAL REFERENCES

A. Operations with DH - before touchdown

If the decision to continue has been made and the visual references subsequently become insufficient (for the appropriate category), or the flight path deviates unacceptably, a go-around must be initiated (a go around initiated below the MABH, whether auto or manual, may result in ground contact).

NOTE: If the touchdown occurs after GA is engaged the AP remains engaged in that mode, and ATHR remains in TOGA. Ground spoilers and auto-brake are inhibited.

B. Operations with and without DH - after touchdown

If the visual references are lost after touchdown, a go-around should not be attempted.

The rollout should be continued with AP in ROLLOUT mode down to taxi speed.

FLIGHT PARAMETERS DEVIATION CALLS

PARAMETERS	IF DEVIATION EXCEEDS		CALL REQUIRED
IAS	+ 10kt - 5kt		"SPEED"
RATE OF DESCENT	-1000ft/min		"SINKRATE"
PITCH ATTITUDE	10° nose up 0°(A330/340), - 2.5° (A320/321)		"PITCH"
BANK ANGLE	7°		"BANK"
LOCALIZER	EXCESS DEVIATION WARNING	1/4 DOT (PFD)	"LOCALIZER"
GLIDE SLOPE		1 DOT (PFD)	"GLIDESLOPE"

These calls would normally be made by the PNF and acknowledged by the PF. However, any crewmember that sees a deviation outside the above limits should make the appropriate call.

If any of these limits are exceeded approaching DH, a go-around should be considered.

3.3.5 FAILURES AND ASSOCIATED ACTIONS

GENERAL

In general there are three possible responses to the failure of any system, instrument or element during the approach.

- **CONTINUE** the approach to the planned minima.
- **REVERT to** higher minima and proceed to a new DH (above 1000ft).
- **GO AROUND** and reassess the capability.

The nature of the failure and the point of its occurrence will determine which response is appropriate.

As a general rule, if a failure occurs above 1000ft AGL the approach may be continued reverting to a higher DH, providing the appropriate conditions are met (refer to "DOWNGRADING CONDITION").

Below 1000ft (and down to AH when in CAT III DUAL) the occurrence of any failure implies a go-around, and a reassessment of the system capability. Another approach may then be undertaken to the appropriate minima for the given aircraft status.

It has been considered that below 1000ft, not enough time is available for the crew to perform the necessary switching, to check system configuration and limitations and brief for minima.

In CAT III DUAL, in general, a single failure (for example one AP failure or one engine failure) below AH does not necessitate a go-around. But a go-around is required if the autoland warning is triggered.

ABNORMAL PROCEDURES

The required procedures following failures during CAT II or CAT III approaches are provided in the Approved Flight Manual (AFM). These procedures have been established and approved during the aircraft CAT II / CAT III certification.

It has been found that a simplification of the AFM abnormal procedures was desirable for actual operation. Therefore, these simplified abnormal procedures, which are necessarily more conservative, are published in the FCOM. Operators may always refer to AFM for detailed information if they want to develop their own abnormal procedures.

The abnormal procedures can be classified into two groups

1. Failures leading to a downgrading of capability as displayed on FMA and ECAM with an associated specific audio warning (triple click).
2. Failures that do not trigger a downgrading of capability but are signaled by other effects (Flag, ECAM warning, amber caution and associated audio warnings).

It should be noted that some failures might trigger ECAM warnings, cautions and a downgrading of capability.

The FCOM describes what should be the crew responses to failures in function to the height.

Above 1000ft:

* DOWNGRADING CONDITIONS

- a) Downgrading from CAT 3 to CAT 2 is permitted only if
 - ECAM actions are completed,
 - RVR is at least equal to CAT II minima,
 - Briefing is amended to include CAT II procedure and DH.
 - Decision to downgrade is completed above 1000ft AGL,
- b) Downgrading from CAT 2 to CAT 1 permitted only if
 - ECAM actions are completed,
 - at least one FD is available,
 - RVR is at least equal to CAT I minima,
 - briefing is amended to include CAT 1 procedure and DH.
 - the decision to downgrade is completed above 1000ft AGL,

Note: switching from one AP to another before 1000ft AGL is permitted.

Below 1000ft and above DH (for CAT 2 or CAT 3 SINGLE) or above AH (for CAT 3 DUAL) a go-around must be performed in case of:

- ALPHA FLOOR activation,
- loss of AP (cavalry charge),
- downgrading of capability (triple click),
- amber caution (single chime),
- engine failure.

At 350ft* RA

LAND must be displayed on FMA and runway course must be checked. If runway course is incorrect or LAND does not appear, a go-around must be performed. If conditions permit, and according to airline policy, a CAT II approach with AP disconnection no later than 80ft may be performed.

LAND is displayed if LOC and GS track modes are active and at least one RA is available. These conditions need to be obtained no later than 350ft AGL to allow a satisfactory automatic landing.

* Depending on terrain profile before the runway LAND mode may appear at lower height. This can be acceptable provided it has been demonstrated that automatic landing is satisfactory.

At 200ft RA and below

Any AUTOLAND warning requires an immediate go-around.

If visual references are sufficient and a manual landing is possible, the PF may decide to land manually.

At flare height

If FLARE does not come up on FMA, a go-around must be performed.

If visual references are sufficient and a manual landing is possible, the PF may decide to complete the landing.

After touchdown

In case of anti-skid or nose wheel steering failure, disconnect AP and take manual control.

If automatic rollout control is not satisfactory, disconnect the AP immediately.

3.4 FLIGHT CREW TRAINING AND QUALIFICATION

It is essential that flight crews are trained and qualified in all aspects of All Weather Operations appropriate to the intended operations. This process is divided into two parts:

- Ground instruction in the background and philosophy of all-weather operations.
- Flight training which may be carried out in approved flight simulator and/or during airborne training.

This ground and flight training must be conducted in accordance with the requirements of the operational regulation, which are described in

- ICAO All Weather Document n°9365 AN/910 which represents the basic aeronautical requirements for CAT II and CAT III.
- US/European regulations:
 - * AC 120-28C and D (CAT III) and AC120-29 (CAT II) for airlines under FAA authority.
 - * JAR-OPS for operators under JAA authority.
 - * ECAC Document n°17
 - * CAA CAP 359
 - * DGAC Decision 3437 (2106/1975) etc.

Although the wording and format of these documents are different, the requirements are quite similar. Only two training programs and qualification requirements (FAA and JAA) are described in this chapter. Moreover, to be easily accessible, the different requirements are presented in separate paragraphs:

- 3.4.1 FAA ground training program
- 3.4.2 JAA ground training program
- 3.4.3 FAA flight training program and qualification
- 3.4.4 JAA flight training program and qualification

At the end of this paragraph in the Attachment A, we provide the training syllabi for CAT II and CAT III as established by *the Airbus Training Center*.

3.4.1 FAA GROUND TRAINING PROGRAM

Note: Most of the subjects to be covered during ground training apply to both CAT II and CAT III, therefore the following description does not always specify the items which apply to CAT II or CAT III only. Refer to FAA regulations if a CAT II training only is required.

The ground training program will address the following items:

1. Ground facilities

The operational characteristics, capabilities and limitations as applied to CAT II / CAT III of:

- The instrument landing system and critical area protection,
- The visual approach aids ; i.e. approach lights, touchdown zone and centerline, signs and markings,
- Transmissometer systems,
- Facility status, NOTAMS, or outage reports pertinent to use of CAT II / CAT III minima.

2. The Airborne System

The operational characteristics, capabilities and limitations appropriate to the CAT II / CAT III system(s) utilized such as:

- Automatic landing system,
- Autothrust system,
- Flight director system,
- Instrumentation and display systems,
- Systems and aircraft characteristics which determine the AH or DH as applicable,
- Other systems or devices peculiar to the particular installation, i.e. failure warning systems etc.
- Description of the limits to which acceptable system performance has been demonstrated for wind and windshear.

3. Review of operations specifications applicable to CAT II / CAT III operations

4. Policies and procedures concerning the conduct of CAT II / CAT III operations on icy or snow-covered runways, as well as those runways with braking action reported less than good.

5. Pilot reporting of ILS anomalies, airport lights outage and other discrepancies which may be pertinent to CAT II / CAT III approaches.

3.4.2 JAA GROUND TRAINING PROGRAMME

Note: Most of the subjects to be covered during ground training apply to both CAT II and CAT III, therefore the following description does not always specify the items which apply to CAT II or CAT III only. Refer to JAA regulations if a CAT II training only is required.

The ground training program will address the following items:

1. The characteristics and limitations of the ILS and/or MLS.
2. The characteristics of the visual aids.
3. The characteristics of fog.
4. The operational capabilities and limitations of the particular airborne system.
5. The effects of precipitation, ice accretion, low-level windshear and turbulence.
6. The effects of specific aircraft malfunctions.
7. The use and limitations of RVR assessment system.
8. The principles of obstacle clearance requirement.
9. Recognition of and action to be taken in the event of failure of ground equipment.
10. The procedures and precautions to be followed with regard to surface movement during operations when the RVR is 400m or less.
11. The significance of decision heights based upon radio altimeters and the effect of terrain profile in the approach area on radio altimeter readings and on the automatic approach/landing system.
12. The importance and significance of alert height, when applicable and the action in the event of any failure above and below the alert height.
13. The importance of correct seating and eye position.
14. The qualification requirements for pilots to obtain and retain approval to conduct CAT II and CAT III operations.

3.4.3 FAA FLIGHT TRAINING PROGRAM/QUALIFICATION

FAA SIMULATOR AND/OR FLIGHT TRAINING PROGRAM

The following items are to be covered on both initial training and at least annually during recurrent training/proficiency checks for both pilot in command and second in command (see AC 120-28C or D).

1. Determination of the DH, if a DH applies, including use of radio altimeter.
2. Recognition of and proper reaction to significant failures encountered prior to and after reaching the AH or DH as applicable.
3. Missed approach technique and expected height loss as it relates to manual or automatic go-around and initiation altitude.
4. Runway Visual Range - its use and limitations, including the determination of controlling RVR and required transmissometers.
5. The availability and limitations of visual cues encountered on approach both before and after DH, if applicable. This includes procedures for unexpected deterioration of conditions to less than minimum RVR encountered during approach, flare and roll-out, demonstration of expected visual references with weather at minimum conditions, and the expected sequence of visual cues during an approach in which visibility is at or above landing minima.
6. The effects of vertical and horizontal windshear (not required for recurrent training/proficiency checks).
7. Procedures for transitioning from non-visual to visual flight.
8. Pilot recognition of the limits of acceptable aircraft position and flight path tracking during approach, flare, and, if applicable, rollout.
9. Pilot recognition of and reaction to airborne or ground system faults or abnormalities, particularly after passing AH or DH.

These items should be incorporated into the training program in sufficient detail to show how each one will be accomplished during initial and recurrent training. For instance, the simulator could be frozen at/or below 50ft with varying visibility, wind components, runway lighting, configurations, and offsets from centerline to demonstrate conditions that may be encountered on the line. The above listed items should be accomplished in an approved simulator unless the applicant can show that equivalent training is provided by the use of other training aids and/or devices.

INITIAL TRAINING REQUIREMENTS CATEGORY II

Low approach system	Maneuvers (1)	Initial/Recurrent training
1. Dual flight director	(a) Two ILS approaches to 100ft; from one a landing will be accomplished and from the other a missed approach.	Satisfactorily demonstrate (a) to a company check pilot or an FAA inspector.
2. Flight director and approach coupler (dual flight director CAT II)	(b) Two ILS approaches to 100ft; one using flight director and one using auto coupler; from one a landing will be accomplished and from the other a missed approach.	Satisfactorily demonstrate (b) to a company check pilot or an FAA inspector.
3. Single flight director or approach coupler	(c) One raw data ILS approach to 200ft. (d) One ILS approach to 100ft using flight director or approach coupler. (e) From one of the approaches specified in (c) and (d), a landing will be accomplished; from the other, a missed approach.	Satisfactorily demonstrate (c), (d) and (e) to a company check pilot or an FAA inspector. Applicable to two-engine propeller aircraft only.

- (1) Either an aircraft or an approved visual simulator may be used. When accomplished in an approved visual simulator, the system must simulate the appropriate category of weather, ceiling and visibility, and be equipped with an appropriate lighting system, which depicts the approach and runway lights.
- (2) Seconds in command not expressly prohibited by the operator from conducting CAT II approaches will meet the same initial and recurrent flight training requirements specified for pilots in command. In any case, each second in command will demonstrate to a company check pilot or FAA inspector his ability to perform his assigned function during initial and recurrent training.

For details refer to AC120.29.

RECURRENT TRAINING REQUIREMENTS CAT II

The recurrent training is identical to initial training at least once a year.

INITIAL TRAINING REQUIREMENTS CAT III

Each pilot in command should satisfactorily demonstrate to either a company check pilot or an FAA inspector the following requirements in an approved simulator or in flight with a suitable view limiting device (e.g. variable-density, see-through training hood) in an aircraft configured with the appropriate CAT III system and approved for these maneuvers:

	Simulator Training	Flight Training
Pilot in command	<p>Two ILS approaches using the automatic landing system</p> <ul style="list-style-type: none"> • one automatic landing from one of the approaches • one missed approach starting from very low altitude which may result in an inadvertent touchdown during the go-around maneuver. 	<p>If the initial training is done in an approved simulator, at least:</p> <p>Two actual automatic landings should be conducted in the aircraft prior to conducting CAT III approaches with weather conditions below CAT II minima.</p>
Second pilot in command	<p>Should demonstrate his ability to perform his duties. If not expressly prohibited from performing the duties of pilot in command, should accomplish additional requirement of pilot in command as quoted above.</p>	

Note: For CAT III B operations predicated on the use of a fail-passive rollout control system (not applicable for Airbus aircraft), a manual rollout using visual reference or a combination of visual and instrument references. This maneuver should be initiated by a fail-passive disconnect of the roll-out control system, after main gear touchdown and prior to nose gear touchdown, in conditions representative of the most adverse lateral touchdown displacement and weather conditions anticipated in normal CAT III B operations with a fail-passive roll-out control system.

RECURRENT TRAINING REQUIREMENTS CAT III

Pilot in command/ second pilot: identical training as initial one.

At least once a year.

Additional information

If one of the required redundant operational systems is a manual system based on instrument displays, the pilot will be required at least annually to demonstrate proficiency, in flight or in approved simulator, in the use of such a system. In the case of a pilot in command who is dual aircraft qualified, the proficiency requirements are to be accomplished at least annually for each aircraft type.

* Ground and flight training - aircraft interchange.

When equipment interchange is involved, the pilot in command and the second in command are to receive sufficient ground and flight training to ensure complete familiarity and competence with the particular airborne CAT III system on the interchange aircraft. The amount of training required will depend on the differences in the flight control and display systems, and cockpit configuration.

* Ground and flight training - foreign CAT III airports.

If the operator has authorization for CAT III operations at an airport in a foreign country which imposes procedures or limitations different from those in the United States, both the pilot in command and the second in command should receive sufficient ground and/or flight training to ensure familiarity and competence with these different conditions and requirements.

* CAT III A/B evaluation on line checks.

Operators should give consideration to requiring an approach utilizing CAT III equipment and procedures appropriate to crew qualification and aircraft capability whenever CAT III A/B aircraft are utilized for line evaluations.

3.4.4 JAA FLIGHT TRAINING PROGRAM/QUALIFICATION

JAA SIMULATOR AND/OR FLIGHT TRAINING PROGRAM

1. The training program for CAT II and CAT III must include in flight or in simulator the following items:
 - 1.1 Checks of satisfactory functioning of equipment, both on the ground and in flight.
 - 1.2 Effect on minima caused by changes in the status of ground installations.
 - 1.3 Monitoring of automatic flight control systems and autoland status annunciators with emphasis on the action to be taken in the event of failures of such systems.
 - 1.4 Actions to be taken in the event of failures such as engines, electrical systems, hydraulics of flight control systems.
 - 1.5 The effect of known unserviceabilities and use of minimum equipment lists.
 - 1.6 Operating limitations resulting from airworthiness certification.
 - 1.7 Guidance on the visual cues required at DH together with information on maximum deviation allowed from glidepath or localizer.
 - 1.8 The importance and significance of AH if applicable.
2. The training program must train each flight crewmember to carry out his duties and the co-ordination with either crewmember.
3. The training must be divided into phases covering normal operation with no aircraft or equipment failures, but including all weather conditions which may be encountered and detailed scenarios of aircraft and equipment failure which could affect CAT II or III operations. If the aircraft system involves the use of hybrid or other special systems (such as HUD or enhanced vision equipment) then flight crewmembers must practice the use of these systems in normal and abnormal modes during the simulator phase of training.
4. Incapacitation procedures appropriate to CAT II and III operations shall be practiced.

5. For aircraft with no type specific simulator, operators must ensure that the initial flight-training phase specific to the visual scenarios of CAT II operations is conducted in a simulator approved for that purpose by the authority. The training and procedures that are type specific shall be practiced in the aircraft.
6. The initial CAT II and III training phase will normally be conducted on completion of type conversion training and shall include at least the following exercises:
 - 6.1 Approach using the appropriate flight guidance, autopilot and control systems installed in the aircraft, to the appropriate DH and to include transition to visual flight and landing.
 - 6.2 Approach with all engines operating using the appropriate flight guidance system, autopilot and control systems installed in the aircraft down to the appropriate DH followed by missed approach; all without external visual reference.
 - 6.3 Where appropriate, approaches utilizing automatic flight systems to provide automatic flare, landing and rollout.
 - 6.4 Normal operation of the applicable system both with and without acquisition of visual cues at DH.
7. Subsequent phases of initial training include at least:
 - 7.1 Approaches with engine failure at various stage on the approach.
 - 7.2 Approaches with critical equipment failures (e.g electrical systems, autoflight systems; ground and/or airborne ILS/MLS systems and status monitors).
 - 7.3 Approaches where failures of autoflight equipment at low level require either:
 - Reversion to manual flight to control flare, landing and roll-out or missed approach or
 - Reversion to manual flight or a downgraded automatic mode to control missed approaches from, at or below DH including those which, may result in a touchdown on the runway.

- 7.4 Failures of the systems which, will result in excessive localizer and/or glideslope deviation, both above and below DH, in the minimum visual conditions authorized for the operation. In addition, a continuation to a manual landing must be practiced if a HUD forms a downgraded mode of the automatic system or the HUD display forms the only flare mode.
- 7.5 Failures and procedures specific to aircraft group, type or variant.
- 7.6 The training program must provide practice in handling faults, which require a reversion to higher minima.
- 7.7 The training program is to include the handling of the aircraft when, during a fail-passive CAT III approach, the fault causes the autopilot to disconnect at or below DH when the last reported RVR is 300m or less.

Conversion training requirements to conduct CAT II and III operations

1. Ground training

An operator must ensure that the requirements prescribed above are complied with.

2. Simulator training.

An operator must use an approved simulator specific to the aircraft type to conduct a minimum of eight approaches and/or landings. However, for initial CAT II training only, and where no simulator is available, a minimum of four approaches must be conducted in a simulator approved for the purpose. Aircraft training will then be required with a minimum of three approaches including at least one go-around.

An operator must ensure that if any special equipment is required (e.g HUD, EVS), appropriate additional training must be conducted.

Additional information

Line flying under supervision

An operator must ensure that:

- Where CAT II manual landings are required, a minimum of three such landings from autopilot disconnect must be carried out.

- For CAT III, a minimum of three autolands must be carried out, except that only one autoland is required when the training required in simulator training has been carried out in a full flight simulator usable for zero flight time training.

Type and command experience

The following additional requirements are applicable to commanders who are new to the type:

1. 50 hours as pilot-in-command on the type before performing any CAT II or CAT III operation.
2. Until 100 hours as pilot-in-command on the type has been achieved, 100m must be added to the applicable CAT II or III RVR minimum unless he has previously qualified for CAT II or III operations.

Flight crew qualification

An operator must ensure that a flight crew member has completed a check before conducting CAT II or III operations. Successful completion of the initial simulator and/or flight training will constitute the check. The limiting values of RVR and DH will be approved by the authority.

Recurrent training and checking

An operator must ensure that, in conjunction with the normal training and checking of pilot proficiency, a pilot's knowledge and ability to perform the tasks associated with the particular category of operation for which he is authorized is demonstrated. The required number of approaches to be conducted during such recurrent training is to be a minimum of two, one of which is to be a missed approach.

ATTACHMENT A
EXAMPLE OF CREW TRAINING
BY
AIRBUS
TRAINING AND FLIGHT OPERATIONS
SUPPORT DIVISION

PRECISION APPROACHES

CAT II

VACBI COURSEWARE CONTENT

01. Foreword
02. Definitions
03. Regulations
04. Airport requirements
05. Aircraft requirements
06. Crew requirements
07. Operator approval
08. Crew behavior in abnormal situation
09. Engines
10. EIS failures
11. AFS failures
12. Summary

SYLLABI

01. FFS CAT II Training
02. FFS CAT II Evaluation

CAT II/III APPROVAL PROCESS

AIRBUS INDUSTRIE <small>Training & Flight Operations Support Division</small> A319/A320/A321 FLIGHT CREW TRAINING MANUAL	CAT 2 PRECISION APPROACHES TRAINING SYLLABI	2.18.03 Page 4 E F18 REV 21 MAY 98
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MALFUNC REF.	- TRAINING FFS - (2:00 session per crew)	-	+
	INIT T/O		
130 FT	■ 1 - COCKPIT PREPARED BY INSTRUCTOR		
200 M	ENGINES RUNNING, FUEL FREEZE		
	■ 2 - TAKE-OFF FOG PATCHES - FOLLOW YAW BAR		
	■ 3 - RADAR VECTORS - CAT II BRIEFING		
170 FT	■ 4 - APPROACH - 2 AP		
500 M	FREEZE AT 150 FT - REVIEW VISUAL SEGMENT - RELEASE		
130 FT	■ 5 - FREEZE AT 100 FT - REVIEW VISUAL SEGMENT - RELEASE		
400 M	AUTOLAND		
	INIT T/O FUEL FREEZE		
130 FT	■ 6 - TAKE-OFF - FOG PATCHES		
200 M	REJECTED TAKE-OFF (ONE ENGINE FAIL ABOVE 100 KT) - Restore		
	■ 7 - TAKE-OFF - ENG FAIL AFTER V1 (BETWEEN V1 AND V2)		
	INIT T/O FUEL FREEZE		
130 FT	■ 8 - TAKE-OFF - RADAR VECTORS DOWNWIND		
400 M	STANDBY HORIZON FLAG - RESET (ABOVE 1000 FT)		
	■ 9 - APPROACH 2 AP - DH 100 FT		
	LOSS OF LOC TRANSMITTER AT 200 FT - AUTOLAND WARNING - GO AROUND - Restore		
130 FT	■ 10 - APPROACH 2 AP - DH 100 FT - 1 ATHR ONLY		
0 M	REMAINING ATHR FAILS AT 500 FT		
	CONTINUE TO DH - NO VISUAL - GO AROUND- Restore ATHR		
130 FT	■ 11 - APPROACH - 2 AP - DH 100 FT - ENGINE FAILURE BELOW 100 FT		
400 M	LAND		
130 FT	■ 12 - APPROACH 2 AP - DH 100 FT - CHECK ATT WARNING AT 200 FT (OR 2 RAD ALT FAILURE)		
400 M	MANUAL GO AROUND (USING STDBY HORIZON IF NECESSARY)		
130 FT	■ 13 - APPROACH 2 AP - DH 100 FT		
400 M	CM1 INCAPACITATION ABOVE DH - GO AROUND		
130 FT	■ 14 - APPROACH - 2 AP - DH 100 FT		
400 M	ENG FAIL ABOVE 100 FT		
	GO AROUND - CLEAN UP		
0 FT	15 - RELIGHT - APPROACH - 2 AP - DH 100 FT		
0 FT	NO VISUAL CONTACT - GO AROUND		
130 FT	■ 16 - APPROACH - 1 AP - DH 100 FT		
400 M	AUTOPILOT DISCONNECT AT 80 FT - MANUAL LANDING		

PRECISION APPROACHES

CAT III


VACBI COURSEWARE CONTENT

01. Foreword
02. Definitions
03. Regulations
04. Airport requirements
05. Aircraft requirements
06. Crew requirements
07. Crew behavior in abnormal situation

SYLLABI

01. FFS CAT III Training
02. FFS CAT III Evaluation

CAT II/III APPROVAL PROCESS

 A319/A320/A321 FLIGHT CREW TRAINING MANUAL	CAT 3 PRECISION APPROACHES TRAINING SYLLABI	2.19.03 Page 4 E F19
		REV 21 MAY 98

MALFUNC REF.	- TRAINING FFS - (2:00 session per crew)			-	+
		INIT T/O	FUEL FREEZE		
		■	1 - COCKPIT PREPARED BY INSTRUCTOR - CAT III T/O BRIEFING ENGINES RUNNING		
RVR 150		■	2 - TAKE-OFF		
		■	3 - HOLDING CAT III BRIEFING		
RVR 200			4 - APPROACH CAT III DUAL		
RVR 125			REVIEW VISUAL SEGMENT		
60 FT			DH 50 FT - FREEZE AT 50 FT - RVR 200 M		
30 FT			DH 20 FT - FREEZE AT 20 FT - RVR 125 M		
			AUTOLAND		
RVR 150			5 - TAKE-OFF - FOG PATCHES FOLLOW YAW BAR		
30 FT			6 - APPROACH ABOVE 1000 FT		
RVR 125			REVIEW LOSS OF ILS TRANSMITTER		
			REVIEW LOSS OF ILS RECEIVERS		
			REVIEW LOSS OF RADIO ALTIMETER		
			REVIEW LOSS OF STANDBY HORIZON		
			REVIEW INSTRUMENT FAILURES		
			7 - AUTOLAND		
30 FT		■	8 - TAKE-OFF FOG PATCHES		
RVR 1			ENGINE FAILURE ABOVE 100 KT		
			REJECTED TAKE-OFF		
		■	9 - TAKE-OFF - ENG FAIL AFTER V1 (BETWEEN V1 AND V2)		
			INIT APP		
RVR 150			10 - TAKE-OFF		
30 FT			11 - APPROACH CAT III DUAL DH 20 FT		
RVR 125			LOSS OF LOC TRANSMITTER AT 200 - AUTOLAND WARNING		
			GO AROUND - Restore		
30 FT			12 - APPROACH CAT III DUAL DH 20 FT		
RVR 125			CHECK ATT WARNING AT 100		
			GO AROUND USING STANDBY HORIZON		
30 FT		■	13 - APPROACH CAT III DUAL - ILS PERFORMANCE II		
RVR 125			ENG FAIL AT 200 FT - GO AROUND - CLEAN UP		
60 FT			14 - APPROACH CAT III SINGLE DH 50 FT		
150 M			AUTOPILOT DISCONNECT AT 50 FT - GO AROUND		
150 M			15 - APPROACH CAT III DUAL - CM1 INCAPACITATION - CM2 GO AROUND		
150 M			16 - APPROACH CAT III DUAL DH 50 FT		
150 M			BOTH RADIO ALTIMETER FAIL AT 100 FT - GO AROUND		
30 FT			17 - APPROACH CAT III DUAL DH 20 FT - ENG FAIL BELOW 100 FT		
125 M			AUTOLAND		

3.5 MAINTENANCE PROGRAMME

3.5.1 MAINTENANCE ASPECTS

Summary

On all Airbus aircraft CAT II / CAT III are inherent functions of the basic design standard of the aircraft. Therefore, related tasks are covered by the respective maintenance program (by ATA chapter) without special recommendations for scheduled maintenance tanks. However, operators should comply with supplemental national requirements when applicable. It should be noted that Airbus aircraft do not require scheduled periodic use, confidence tests or functional checks to assure CAT II / CAT II certification.

The program/data hereafter given is therefore only for information and should be completed according to authorities requests.

The data contained herein after are general; the purpose of this information is to give guidelines to the operator, if needed.

3.5.2 MAINTENANCE PROGRAM

The maintenance program to be established will mainly concern the equipment which is required to be operational for precision approaches as detailed in the following pages (§ 3.5.4).

Any unscheduled maintenance task required due to operational, maintenance and/or being called up by the authorities should follow the procedure and test laid down in the relevant chapter of the AMM (or as specified to maintain system integrity).

A reliability program should be developed/extended to monitor, track and control the CAT III operational status of the aircraft and to achieve at least 95% successful CAT III landings in real and/or simulated conditions.

3.5.3 MAINTENANCE PROCEDURE

A specific procedure should be established to govern the capability of the aircraft to conduct CAT III operations in the following conditions:

- Operational:

- Impossible to obtain (or loss of) CAT 3 capability (AMM 22 13 00),
- Missed approach (illumination of the red AUTOLAND warning light) .

- Maintenance

- Confirmed defect with corrective action carried out,
- Unconfirmed defect but with corrective action,
- Aircraft dispatch under MEL conditions,
- Unable to correct defect and not under MEL conditions,
- Unable to perform the required test.

Therefore, upgrading/downgrading procedure must be defined so as to assist the dispatch of the aircraft to assure maximum autoland capacity.

The dispatch policy should be based on the minimum equipment list (MEL) as it governs the basic criteria for operation.

Dispatch criteria and status of aircraft must be recorded in the Technical Log Book with reference to the MEL (if any); if the defect has been rectified it should be cleared accordingly and revalidation of the aircraft status performed.

A prominent placard should be displayed on the aircraft and in the maintenance control room to inform Flight Operations of the current aircraft status.

In general, aircraft which perform Cat III operation regularly under real or simulated conditions do not need to perform system checks except if specified in AMM.

After an adjustment or a repair is made on the equipment, a revalidation of the aircraft should be made by the corresponding AMM ground test.

A periodic check may be requested by national authorities on an aircraft, which has not performed CAT III operations for a specific period of time (to be agreed with national authorities).

3.5.4 LIST OF REQUIRED EQUIPMENT

The table below gives the reference of the tests, which verify the CAT III availability in each system. Refer to the AFM for the official list of required equipment.

A300 B2-B4		
AFM REQUIRED EQUIPMENT FOR CAT III DUAL		Equi. validity tested by
"AUTOLAND" light	2	MPD 331500-0303-1
ADC	2	AMM 221000 P501
AP/FD	2 AP ENGAGED	AMM 221000 P501
ATTITUDE INDICATION	n°1+n°2+STBY	AMM 221000 P501
AUTOTHRUST	1	AMM 221000 P501
BEAM EXCESSIVE DEVIATION	1	AMM 343601 P300
COMPASS COUPLER	2	AMM 221000 P501
DH INDICATION	2	AMM 344200 P500
ELECTRICAL POWER SUPPLY	SPLIT	NONE
MASTER WARNING CONTROLLER	2	AMM 221000 P501
HAS/ISS	3	AMM 221000 P501
HYDRAULIC GENERATION	G + B + Y	AMM 221000 P501
ILS RECEIVER	2	AMM 221000 P501
REDUNDANCY of Pitch Trim	YES	AMM 221000 P501
RADIO ALTIMETER	2	AMM 221000 P501
REDUNDANCY of Yaw Damper	YES	AMM 221000 P501

CAT II/III APPROVAL PROCESS

A310/A300-600		
AFM REQUIRED EQUIPMENT FOR CAT III DUAL		Equi. validity tested by
"AP OFF" warning	2	AMM 315100 P501 R/I
"AUTOLAND" light	1	AMM 224000 P501
ADC	2	AMM 224000 P501
AFS FLIGHT MODE ANNUNCIATOR	2	AMM 224000 P501
ANTI SKID	1	AMM 324200 P501 R/I
AP disconnect P/B	2	AMM 224000 P501
AP/FD	2 AP ENGAGED	AMM 224000 P501
AT disconnect P/B	NO	AMM 224000 P501
ATTITUDE INDICATION	n°1+n°2+STBY	AMM 347100 P501 R/I
AUTO CALL OUT RADIO ALTIMETER	1	AMM 315100 P501 R/I
AUTOTHRUST	1	AMM 224000 P501
BEAM EXCESSIVE DEVIATION	2	AMM 347100 P501 R/I
DH INDICATION	1	AMM 347100 P501 R/I
EFIS screen	4	AMM 224000 P501
ELECTRICAL POWER SUPPLY	SPLIT	AMM 243100 P500 R/I
FLIGHT WARNING COMPUTER	2	AMM 224000 P501
ILS RECEIVER	2	AMM 224000 P501
REDUNDANCY of Pitch Trim	YES	AMM 224000 P501
RADIO ALTIMETER	2	AMM 224000 P501
REDUNDANCY of Yaw Damper	YES	AMM 224000 P501
WINDOW HEAT	1	AMM 304200 P501 R/I
Windshield wipers or rain repellent	1	AMM 304500 P501 R/I

CAT II/III APPROVAL PROCESS

A319 / A320 / A321		
AFM REQUIRED EQUIPMENT FOR CAT III DUAL		Equi. validity tested by
"A/THR" warning	1	AMM 315000 P501
"AP OFF" warning	2	AMM 315000 P501
"AUTOLAND" light	1	AMM 229700 P501
ADR	3	AMM 229700 P501
AFS FLIGHT MODE ANNUNCIATOR	2	AMM 229700 P501
ANTI SKID	1	TST LDG extension
AP disconnect P/B	2	AMM 229700 P501
AP/FD	2 AP ENGAGED	AMM 229700 P501
AT disconnect P/B	NO	AMM 229700 P501
ATTITUDE INDICATION	n°1+n°2+STBY	AMM 316000 P501
AUTO CALL OUT RADIO ALTIMETER	1	AMM 315000 P501
AUTOTHRUST	1	AMM 229700 P501
BEAM EXCESSIVE DEVIATION	2	AMM 316000 P501
DH INDICATION	1	AMM 316000 P501
2 ELAC giving AP engagement authorization	YES	AMM 229700 P501 (C/M/OWN/OPP)
ELECTRICAL POWER SUPPLY	SPLIT	CAT 3 DUAL indicated
FLIGHT WARNING COMPUTER	2	AMM 229700 P501
ILS RECEIVER	2	AMM 229700 P501
NOSEWHEEL STEERING	1	AMM 229700 P501 (BSCU valid)
PFD/ND CRT's	2	AMM 229700 P501
RADIO ALTIMETER	2	AMM 229700 P501
RUDDER TRAVEL LIMIT SYSTEM	1	
RUDDER TRIM 1+2	YES	AMM 229700 P501
WINDOW HEAT	1	AMM 304200 P501
windshield wipers or rain repellent	1	AMM 304500 P501/601
YAW DAMPER 1+2	YES	AMM 229700 P501

CAT II/III APPROVAL PROCESS

A330 / A340		
AFM REQUIRED EQUIPMENT FOR CAT III DUAL		Equi. validity tested by
"AP OFF" warning	2	AMM 315000 P501
"AUTOLAND" light	1	AMM 229700 P501
2 FCPCs giving AP engagement authorization	YES	AMM 229700 P501
ADR	3	AMM 229700 P501
AFS FLIGHT MODE ANNUNCIATOR	2	AMM 229700 P501
ANTI SKID	1	AT EACH LDG EXTEN.
AP disconnect P/B	2	AMM 229700 P501
AP/FD	2 AP ENGAGED	AMM 229700 P501
AT disconnect P/B	NO	AMM 229700 P501
ATTITUDE INDICATION	n°1+n°2+STBY	AMM 316000 P501
AUTO CALL OUT RADIO ALTIMETER	1	AMM 315000 P501
AUTOTHRUST	1	AMM 229700 P501
DH INDICATION	1	AMM 316000 P501
ELECTRICAL POWER SUPPLY	SPLIT	CAT3 dual indicated
FLIGHT WARNING COMPUTER	2	AMM 229700 P501
ILS RECEIVER	2	AMM 229700 P501
Magnetic references selected	YES	AMM 229700 P501
NOSEWHEEL STEERING	1	AMM 229700 P501 (BSCU valid)
PFD/ND CRT's	2	AMM 229700 P501
RADIO ALTIMETER	2	AMM 229700 P501
REDUNDANCY of Yaw Damper	YES	AMM 229700 P501
REDUNDANCY of Rudder Trim	YES	AMM 229700 P501
REDUNDANCY of THS and elevator	YES	AMM 229700 P501
WINDOW HEAT	1	AMM 304200 P501
Windshield wipers or rain repellent	1	AMM 304500 P501/601

3.6 OPERATIONAL DEMONSTRATION

An operator must prove that he can perform CAT II or CAT III operations with the appropriate success rate and level of safety. For this purpose, he must carry out a proving program called "operational demonstration" or "in-service proving" to demonstrate that, in line service, the performance and the reliability of the aircraft and its systems meet the airworthiness certification criteria. Particular attention will also be given to the flight procedures as established by the operator and to the way the operator uses pilots' reports and applies his maintenance procedures.

The aim of this paragraph is to present the operational demonstration process and to assist the operator to plan an initial proving program.

3.6.1 SUCCESSFUL APPROACH AND LANDING

The authority will take into account flight reports or recordings and the resulting approach/landing success rate. It is necessary to know the applicable definition of a successful approach or landing.

The following definitions of a successful approach and landing has been established, making use of JAR OPS 1 and JAR AWO.

Definition of a successful approach

An approach is considered to be successful if:

** from 500ft to start of flare*

- speed is maintained within ± 5 kt disregarding rapid fluctuations due to turbulence*
- no relevant system failure occurs*

** from 300ft to DH*

- no excessive deviation occurs*
- no centralized warning gives a go-around order*

Definition of a successful landing

An automatic landing is considered to be successful if:

- no system failure occurs*
- no flare failure occurs*
- no decrab failure occurs*
- mainwheel touchdown occurs between 150m (500ft) and 750m (2500ft) from runway threshold, assuming a normal GS antenna location*
- nosewheel touchdown occurs within 8m (27ft) of runway centerline*
- touchdown vertical speed does not exceed 360ft/min*
- bank angle at touchdown does not exceed 7 degrees*
- pitch angle does not exceed to maximum value for a safe tail clearance*
- rollout lateral deviation does not exceed 8m (27ft)*
- no rollout failure occurs.*

The specified speed limits, sink rate limit and bank angle limit can be found in JAR-AWO 131,231 & ACJ AWO 231.

For other national applicable definitions, the operator will refer to his own regulation, if any, or refer to the following documents: AC120.29 (FAA), French Decision of 2 June 1975 (DGAC), or ECAC Doc n°17.

Note: Generally, unsuccessful approaches due to particular ATC factors, ground facility difficulties, or some other specific reasons may be excluded from the data alter analysis if sufficient proofs are provided.

A non-exhaustive list of those factors is provided here-below .

ATC factors

- The flight is vectored too close in for adequate localizer and glide slope capture
- Lack of protection of ILS critical areas.
- ATC request to abandon the approach or
- Other reasons.

Ground facility difficulties:

- ILS beam irregularities caused by other aircraft taxiing
- ILS beam irregularities caused by other aircraft overflying the antenna
- Other reasons.

3.6.2 DATA COLLECTION

The operator must provide crew flight reports or automatic flight recordings during all the operational demonstration. According to the JAA, automatic flight recordings must be provided in addition to crew reports for operations with DH below 50ft (15m). Each authority provides the list of data to be recorded. The following list of the JAR-OPS can be used as reference. In addition, to assist the operator when developing his own crew report form, one form developed and used by one major airline is given in the next page. An extract of an automatic recording is also given hereinafter.

CREW REPORTS (all modes of operation)

According to the JAR OPS, the data to be reported is:

- Airfield and runway used,
- Weather conditions,
- Time,
- Adequacy of speed control,
- Any out-of-trim condition at time of automatic flight control system disengagement,
- Compatibility of automatic flight control systems, flight director and raw data,
- Indication of the position of the aircraft relative to the ILS centerline when descending through 100ft (30m),
- Touchdown position,
- Reason for failure leading to aborted approach.

AUTOMATIC FLIGHT RECORDINGS (for DH < 50ft or no DH only)

According to the JAR OPS, the data to be recorded automatically is:

- Deviation from localizer at touchdown,
- Flare time,
- Date of descent at touchdown,
- Pitch and bank angles at touchdown,
- Speed loss in flare,
- Maximum deviation during ground roll-out (for aircraft with automatic ground roll control or guidance intended for operations with no DH).

To obtain the list of data required by the FAA, please refer to AC120.29 (FAA does not require automatic flight recordings).

Figure 3.10 Example of form for crew reports

Auto-Approach and Auto-Land Performance

Aircraft Type _____

SECTION I. Complete All Items					
A/C #	Captain	Employee #		Fit #	Date
Airport	Runway	Conditions CAT I+ <input type="checkbox"/> CAT II <input type="checkbox"/> CAT III <input type="checkbox"/>	Wind Dir/Spd	ATC Runway Protection Provided <input type="checkbox"/> Unknown or None <input type="checkbox"/> CAT II	
The Auto-Approach Auto-Land was: <input type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory If unsatisfactory you must complete SECTION II					
Auto-Land Touchdown Zone is 900 feet to 2400 feet down the runway, and within 27 feet of centerline. Record Area of Touchdown with an X on Runway Depiction ----->					
SECTION II. Complete ONLY if Auto-Approach or Auto-Land was UNSATISFACTORY					
If the Approach was discontinued, it was due to: <input type="checkbox"/> Airborne Equipment Failures <input type="checkbox"/> Ground Facility Difficulties <input type="checkbox"/> ATC Instructions <input type="checkbox"/> Other (specify)					
LOCALIZER (L/R) GLIDE SLOPE (H/L)					
OUTER		MIDDLE		INNER	
<input type="checkbox"/> L	<input type="checkbox"/> H	<input type="checkbox"/> L	<input type="checkbox"/> H	<input type="checkbox"/> L	<input type="checkbox"/> H
R <input type="checkbox"/>	L <input type="checkbox"/>	R <input type="checkbox"/>	L <input type="checkbox"/>	R <input type="checkbox"/>	L <input type="checkbox"/>
If the autopilot was disconnected the altitude was _____ ft MSL					
Other Comments: _____ _____ _____ _____					

2500 Feet

2000 Feet

1500 Feet

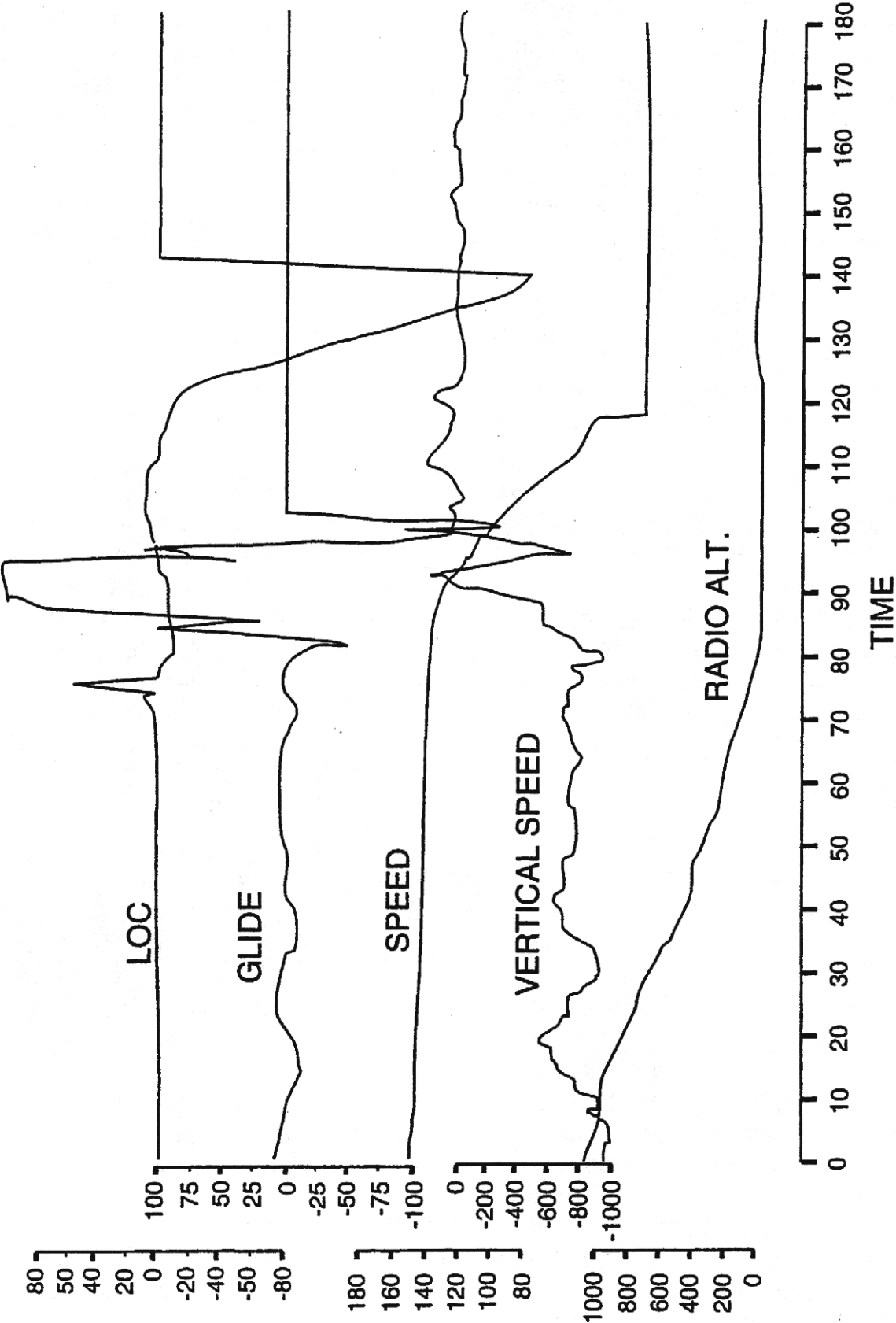
1000 Feet

500 Feet

Threshld Marker

Figure 3.11

Example of automatic recorded parameters



3.6.3 FULL OPERATIONAL DEMONSTRATION

A complete demonstration is required when an operator introduces a new aircraft new into service for CAT II or CAT III (refer to the paragraph 3.6.4 for cases which apply for reduced demonstration). This operational demonstration process often follows the same basic sequences, even if national variants exist. It consists of a progressive introduction to lower minima with periodic reports of the approaches made during actual in-line service.

For information, a description of a typical operational demonstration process is in line with JAR OPS 1 is shown below.

JAA OPERATIONAL DEMONSTRATION PROCESS

1) Decision height 200 - 50ft

The aircraft type should be operated for a period of at least **6 months** with DH of 200ft or more, using the operating and maintenance procedures, which are intended to be used, when the DH is lowered. During this period a pilot report should be obtained for each approach with the data described in paragraph 3.6.2. These reports should be analyzed and a summary report issued to the authority. This report should show that, to a 90% confidence level, **95%** of approaches made using the lower DH would be successful. In the absence of any failures this could be demonstrated with typically **30** approaches.

2) Decision height below 50ft or no decision height

For a period which should not normally be less than **6 months** the aircraft type should be operated with DH of 50ft or more, using the system operating and maintenance procedures, which are intended to be used, when a DH below 50ft is used or there is no DH.

The data should cover typically **100** landings, which should be supported by data recorder information (in addition to crew reports).

These reports should be analyzed and a summary report issued to the authority.

This report should show, to a 90% confidence level, that the mean and standard deviations of the automatically recorded parameters are not, worse than those recorded during the certification simulation program. These distributions should be consistent with the flight test results upon which airworthiness certification is based.

The sources of data gathered during the operational demonstration should be distributed as evenly as possible across the fleet of the operator, using different airfield and ILS installations as required by the authority.

When automatic landing is anticipated at an airport with a particular terrain profile before the runway threshold or known to have particular characteristics, the automatic system performance should be confirmed in CAT I or better weather conditions prior to starting CAT II or CAT III operations.

3.6.4 REDUCED OPERATIONAL DEMONSTRATION

The operational demonstration as described above is not fully required in the cases listed below

- The operator has previous experience in CAT II or III operations with a variant of the same type of aircraft utilizing the same basic flight control and display systems.
- The aircraft type has already been approved for CAT II or III operations for another operator by any other JAA state.

When an operator has been approved in one country for CAT II or III, he is generally not required to accomplish complementary demonstration if he applies for Category II or III operations in another JAA country. With his application the operator may have to enclose proof of initial approval by his national authorities and a copy of the approval file.

3.6.5 ASPECTS OF FAA PROCESS

The FAA process differs from the process described in the JAR-OPS (Refer to AC120.29 and AC120.28D for more details).

CAT II: An operator is first given approval to operate to a DH of 150ft and a minimum RVR of 1600ft (500m) with no prior in-service proving. The results of the first six months of operations to these minima are analyzed and, if satisfactory, approval is given to use a DH of 100ft and a minimum RVR of 1200ft (350m).

For aircraft with an automatic landing system approved in accordance with App 1 of AC 120-29, no operational demonstration is required but the 6 months period of in service proving still applies to obtain 1200ft (350m) RVR.

CAT III: Following the issue to an operator of operations specifications authorizing CAT III A or III B minima the FAA requires a program of data collection in line service for a period of at least six months. During this period normally of 100 successful landings, including training flights, are required to demonstrate reliability and performance in line operations.

3.7 CONTINUOUS MONITORING

This paragraph applies to operators already authorized for CAT II or CAT III operations. After obtaining the authorization, the operator must continue to provide reports of in-line service.

These reports must include the following information:

- The total number of approaches, by aircraft type, where the airborne CAT II or III equipment was utilized to make satisfactory, actual or practice, approaches to the applicable CAT II or III minima.
- The total number of unsatisfactory approaches by airfield and aircraft registration in the following categories.
 - (a) Airborne equipment faults
 - (b) Ground facility difficulties
 - (c) Missed approaches because of ATC instructions
 - (d) Other reasons

The continuous monitoring should permit the detection of any decrease in the level of safety before it becomes hazardous. The operator must continue to check his results and to take adequate actions by modifying the operating or maintenance procedures if necessary. The monitoring may also permit problems to be detected on a specified airfield (ILS , ATC procedures, etc.).

The data must be retained for a period of 12 months.

3.8 AUTOLAND IN CAT I OR BETTER WEATHER CONDITIONS

3.8.1 GENERAL

Some operators may wish to perform automatic landings in CAT I or better weather conditions for training purpose or to record data for an operational demonstration or even at crew discretion.

Some guidelines are given below on the conditions, which must be considered by the airline before authorizing its crews to perform automatic landings.

3.8.2 AIRPORT REQUIREMENTS

The Automatic Landing System performance has been demonstrated during type certification with CAT II or CAT III ILS qualify beam, nevertheless automatic landing on CAT I ILS quality beam is possible provided the Airline has checked that the guidance below 200ft is satisfactory.

Operators should interrogate the airport authorities on ILS ground equipment quality and on experience with other operators. They should check with the authorities that specific restrictions do not apply at airports with CAT I only capability.

Terrain profile before the runway threshold has also to be considered since it may significantly affect the automatic landing system performance.

It is generally accepted that automatic landings in CAT I or better weather conditions are performed without activation of the low visibility procedures.

In particular, ILS-sensitive areas will not be protected which means that ILS fluctuations may be encountered due to the presence of an aircraft or a vehicle taxiing in the sensitive areas. On that same aspect, airport authorities should be interrogated and in some cases it may be necessary to protect the ILS sensitive areas before an automatic landing is performed.

3.8.3 CREW AUTHORIZATION

The airline must establish its own standards to authorize pilots for automatic landings. Only pilots authorized by the airline can perform automatic landings.

3.8.4 CREW PROCEDURES

An automatic landing may only be performed on runways listed in the airline's operations manual.

The operator must establish procedures and techniques similar to CAT II / CAT III operations (refer to FCOM).

Visual cues must be obtained at the applicable DA (baro) (CAT I) or a go-around must be performed.

The crew should be warned that fluctuations of the LOC or GS may occur and that the PF should be prepared to immediately disconnect the AP and take the appropriate action should unsatisfactory automatic landing performance occur.

The flight crew is reminded to be vigilant for ILS disturbances when conducting automatic landing on any ILS quality beam in CAT I or better weather conditions when the critical area protection is not assured by ATC.

Being in visual contact with the runway, the crew will decide to continue the automatic landing or to take over manually or to go around. Flare, landing and roll-out must be closely monitored as the crew must be ready to take over in these flight phases as well.

3.8.5 LIMITATIONS

Automatic landing must be approved in the AFM.

At least CAT 2 capability must be displayed on FMA.

AFM limitations must be observed including:

- Glide slope angle,
- Airport elevation,
- Flap configuration,
- Wind limits,
- Required equipment for CAT II must be operative.

CHAPTER 4

4. AIRCRAFT REQUIREMENTS

4.1 INTRODUCTION

4.2 AIRCRAFT EQUIPMENT

4.3 AUTOMATIC LANDING CERTIFICATION

4.4 CATEGORY II/III CERTIFICATION

**ATTACHMENT B: AIRBUS AIRCRAFT CAT II/III
CERT. STATUS**

4.1 INTRODUCTION

An operator cannot perform CAT II or CAT III approaches or auto-landings unless:

- the aircraft type is approved for this type of operation (refer to attachment B for the mod/SB status required for those operations) ;
- the operator has received from his national authorities the operational approval to perform these types of operations. These requirements are reviewed in the preceding Chapter 3.

The aircraft capability to perform these operations is a necessary pre-requisite to obtain this operational approval (refer to AFM).

The airworthiness requirements for CAT II / CAT III approach and automatic landing applied to Airbus aircraft are in compliance with the following:

- JAR AWO section 1 (auto-land), section 2 (CAT II) and section 3 (CAT III) or its previous regulations applicable at the time of certification.
- FAA AC 20-57A (auto-land), AC 120-29 (CAT II) and AC 120-28D (CAT III).

The methodology described in the following only demonstrates compliance with the JAR requirements.

FAA airworthiness approval was obtained by performing additional tests and assessments to comply with above FAA regulations.

It should be noted, however, that the above-listed requirements may be modified in the near future to reflect the JAR/FAR AWO harmonization process, and that the JAR AWO regulations only cover automatic approach and landing using an ILS as precision approach aid.

4.2 AIRCRAFT EQUIPMENT

In order to perform a CAT II or CAT III approach and automatic landing as explained above, the equipment listed in the AFM is required to be operative.

If one of these equipments / systems is listed in the airline MEL with associated dispatch conditions, the MEL must clearly indicate that CAT II or CAT III operations are not authorized.

4.3 AUTOMATIC LANDING CERTIFICATION

The objective of this section is to provide a short description of the main requirements to be complied with in order to obtain airworthiness approval of the automatic landing function of the Automatic Flight System (AFS).

4.3.1 REQUIREMENTS

The automatic landing function of the AFS provides automatic guidance and control of the aircraft during approach, landing and roll-out.

This is a mandatory function for all CAT III operations, but it may also be used in weather conditions better than CAT III weather conditions (see § 3.8 above).

The airworthiness requirements applied to Airbus aircraft are in compliance with the following:

- JAR AWO Subpart 1 or previous regulation applicable at the time of certification, and
- FAA AC 20-57A.

The methods used to show compliance with the airworthiness requirements have to be agreed by the airworthiness authorities in the certification plan and comprise mainly:

- simulation to assess the performance of the autoland,
- a System Safety Assessment (SSA) to assess the impact of the automatic landing function on possible failure conditions (AFS and its sensors), and their probabilities in accordance with the agreed methodology of JAR/FAR 25.1309 and its AMJ/AC,
- failure cases assessment on the simulator to verify the above, in particular the worst case failures during automatic landing.
- aircraft flight tests are performed to confirm the simulation results or assumptions of the SSA for selected failure cases.

in the following, selected major JAR AWO requirements are described.

4.3.2 TOUCHDOWN PERFORMANCE

JAR AWO 1.3.1 and its ACJ requires that:

- a simulation by statistical analysis be performed to demonstrate that the exceedance of any of the limits of table 4.1 for the average and limit risk be improbable (for detailed explanation see AWO 131 (c) (1) to (6),
- flight tests be performed to confirm the results obtained by simulation (100 is a typical number of tests performed for a new, non-derived aircraft).

Table 4.1

	Average	Limit
Longitudinal touchdown earlier than a point on the runway 60 m (200ft) from the threshold.	10^{-6}	10^{-5}
Longitudinal touchdown beyond the end of the touchdown zone lighting, 900 m (3000 ft) from the threshold.	10^{-6}	10^{-5}
Lateral touchdown with the outboard landing gear greater than 21 m (70ft) from the runway centerline, assuming a 45m (150ft) runway.	10^{-6}	10^{-5}
Sink rate for structural limit load.	10^{-6}	10^{-5}
Bank angle such that wing tip touches ground before wheels.	10^{-6}	10^{-7}
Lateral velocity or slip angle for structural limit load.	10^{-6}	10^{-5}

*one variable is held at its most adverse value

4.3.3 ROLL-OUT PERFORMANCE

Automatic roll-out is only necessary for specific CAT III operations. The requirement is detailed in JAR-AWO 338: Automatic ground roll control.

The automatic roll-out performance is demonstrated with the same method as touchdown performance, but is measured only by one parameter, i.e, maximum lateral deviation of the aircraft center from the runway center line.

- When automatic ground roll control or head-up ground roll guidance is being used, the probability that the aircraft will deviate more than 8.2m (27ft) from the runway centerline is less than 5%.
- Additionally, when the operation is predicated on the provision of fail-operational ground roll control, the probability must be less than 10^{-6} that the outboard landing gear will deviate to a point more than 21.3m (70 ft) from the runway centerline while the speed is greater than 40 knots.

4.3.4 AUTOMATIC LANDING DISTANCE

The landing distances using auto-land have been established for the aircraft type. When they exceed the comparable values for the required manual landing distances (actual distance x 1.67), they are shown in the approved flight manual (see JAR-AWO 142).

Calculation of the automatic landing distance

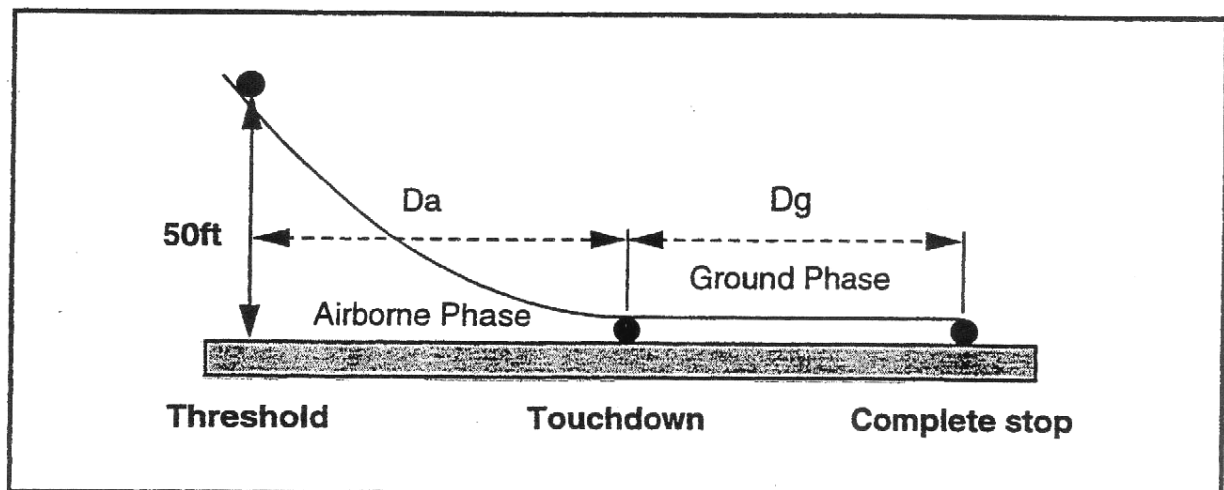
The **required** automatic landing distance is the distance of the airborne phase plus the distance of the ground phase (see figure 4.1), multiplied by the factor 1.15.

$$D = (D_a + D_g) \times 1.15$$

D_a is the distance of the airborne phase.

D_g is the distance of the ground phase.

Figure 4.1

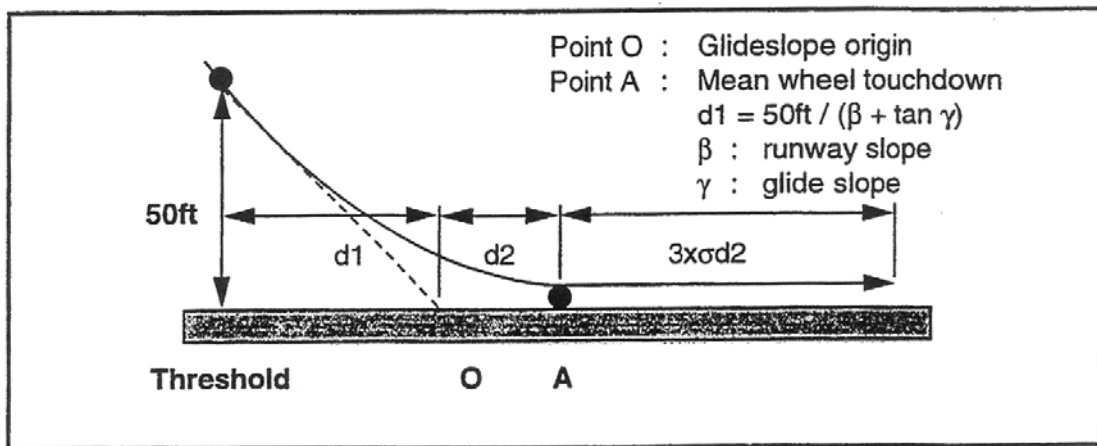


Airborne phase

The distance of the airborne phase is the distance from the runway threshold up to the glide slope origin (noted d1 in figure 4.2) plus the mean distance from the glide slope origin up to the touchdown (noted d2 in Figure 4.2), plus the 3x standard deviation of the distance from the glide slope origin to the touchdown ($\sigma d2$).

$$D = d1 + d2 + 3 \times \sigma d2$$

Figure 4.2



The mean distance from glide slope origin to the touchdown (d2) and the multiples of standard deviation of this distance ($\sigma d2$) have been established through the results of more than one thousand simulated automatic landings.

Ground phase

The distance of the ground phase for an automatic landing is established using the same method as for a manual landing, **assuming** a touchdown speed equal to the mean touchdown speed plus the 3x standard deviation of this speed (based on more than one thousand simulated automatic landings).

4.3.5 CONFIGURATIONS AND CONDITIONS TO BE CONSIDERED

The compliance demonstration for the automatic landing system must take into account all essential variables influencing the performance (see JAR-AWO 131 (a) and 132).

A typical example for the set of variables for Airbus aircraft is:

- slat/flap setting,
- aircraft weight and center of gravity,
- engine status (e.g. one engine inoperative),
- wind characteristics,
- ILS characteristics,
- autothrust speed control mode,
- runway characteristics.

The wind characteristics are longitudinal and lateral component, nominal wind shear and turbulence.

The runway characteristics are elevation, slope, length, ambient temperature and status (dry or wet). Auto-land is generally approved by JAA only up to 2500 ft runway elevation, unless a runway higher than that is included in the flight tests - the so-called high-altitude auto-land approval.

Note from JAR-AWO subpart 1:

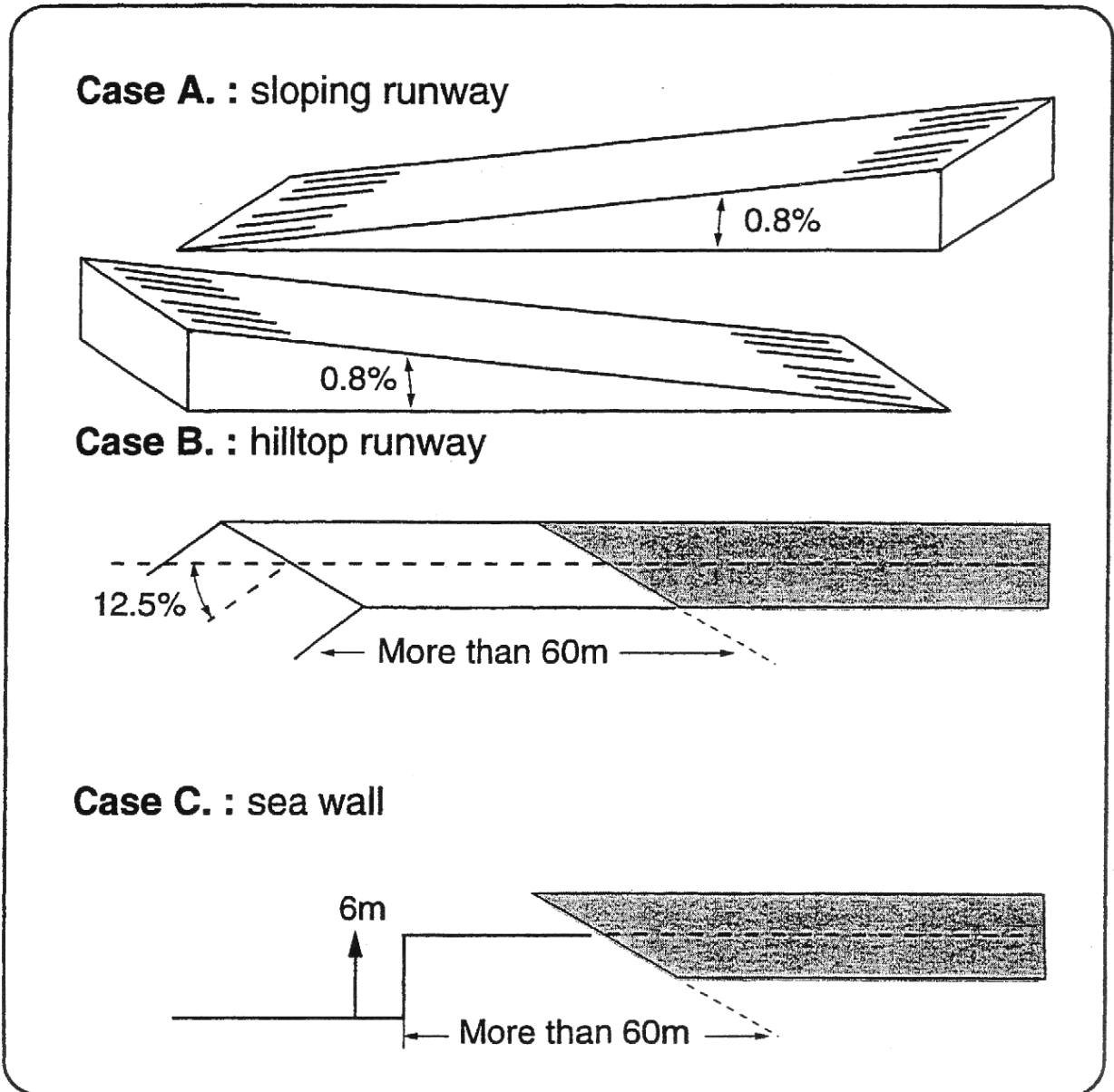
The information on characteristics of aerodromes is contained in ICAO Annex 14. Examination of a number of airports used for automatic landing has shows that the following features may be encountered:

Case A. Sloping runway - slopes of 0.8%

Case B. Hilltop runway - 12.5 % slope up to a point 60m prior to the threshold ; or

Case C. Sea wall - 6m (20ft) step up to threshold elevation at a point 60m prior to the threshold.

Figures 4.3



4.4 CATEGORY II/III CERTIFICATION

This section describes the specific requirements for CAT II and CAT III airworthiness certification. It is assumed that the aircraft has a basic airworthiness approval for IFR operations.

4.4.1 REQUIREMENTS

Subpart 2 of JAR-AWO contains the supplementary airworthiness requirements for CAT II operations i.e. to perform ILS precision approaches with decision heights below 60 m (200 ft) down to 30 m (100 ft).

Subpart 3 of JAR-AWO contains the supplementary airworthiness requirements for CAT III operations i.e. to perform ILS precision approaches with decision heights below 30 m (100 ft) or no decision height. Subpart 3 provides a further division of the criteria into:

- decision heights below 15m (50 ft) and
- no decision height.

The latter two cases require the landing system installed in the aircraft to be fail operational ; if the ground roll control is not fail-operational, a minimum Runway Visual Range (RVR) is necessary, a typical value for Airbus aircraft is 75m (JAA).

All values of aircraft airworthiness certification have to be considered as limits, the operational approval may introduce margins to ensure operational safety for every specific case, e.g. operation to a specific airport.

4.4.2 RATE OF MISSED APPROACH

The rate of missed approach or go-around rate below 150m (500ft) may not exceed a prescribed limit of 5% due to performance deficiencies or reliability of the airborne equipment (see JAR-AWO 202 for CAT II and 302 for CAT III).

The go-around rate is demonstrated by simulation.

Definition of a successful approach can be found in JAR-AWO Subpart 2. It reads as follows:

An approach is successful if:

- a) *The approach from 150m is completed without a system failure.*
- b) *Between 150m and the start of flare, the speed is maintained within ± 5 knots of the approach speed (disregarding rapid airspeed fluctuations associated with turbulence) under all intended flight conditions ;*

Note: when making an approach using an autothrottle system, the approach speed may be selected manually or automatically.

- c) *The position of the aeroplane is such that, between 90m and the DH the deviation with regard to the reference ILS beam, does not exceed the values of Glide Path or Localizer deviation for the excess-deviation alerts.*

ATTACHMENT B
AIRBUS AIRCRAFT
CAT II / CAT III CERTIFICATION STATUS

A300 B2/B4 CERTIFICATION STATUS

DGAC/FAA

Category	Min. DH	AH	Min RVR	Remarks
CAT II	100 ft		see AC120-29	APPR 2 or LAND 2 or LAND 3
CAT III A fail- operational with DH	15 ft	100 ft	see AC120.28A	LAND 3
CAT III A fail- operational without DH		100 ft	see AC 120.28A	LAND 3

Modifications

CAT II A300 B2/B4 basic including A300 FFCC

CAT IIIA Aircraft with mod 1510 or 2599
A300 FFCC is not CAT III approved

A310 CAT II/III CERTIFICATION STATUS

DGAC

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III fail-passive with DH ⁽¹⁾	15 ft			No RVR specified	Certified capability CAT 3
CAT III fail-operational without DH	15 ft	15 ft	100 ft	No RVR specified	Certified capability CAT 3
CAT III fail-operational without DH			100 ft	125 m	Roll-out mode operative Certified capability CAT 3
CAT III fail-operational without DH			100 ft	75m	Certified capability CAT 3

Modifications:

CAT II Basic aircraft

⁽¹⁾ CAT III Aircraft with mod 4747 = NO LONGER APPLICABLE
4747: CAT III fail-passive annunciation

CAT III DH = 15 ft: Aircraft with mod. 4941
4941: Achieve CAT III fail-operational

CAT III without DH and RVR = 125m: Aircraft with mod. 4941
4941: Achieve CAT III fail-operational

CAT III without DH and RVR = 75m: With mod (4941+5502+5429+5528+5757)
4941: Achieve CAT III fail operational
5429: Upgrade autothrottle
5502: Autopilot: Modify FAC, FCC, FCU supply bus bar
5528: AFS: Update FAC CAT III certification standard
5757: AFS: Update FCC, MTP CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A310 CAT II/III CERTIFICATION STATUS

LBA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III fail-operational with DH			100 ft	200m	Certified capability CAT 3
CAT III fail-operational without DH			100 ft	75m	Certified capability CAT 3

Note: For CAT III, the required runway length is the greater of:

- determined runway length + 1000ft
- determined runway length x 1.15
(x 1.3 if thrust reversers are inoperative)

For auto-land braking, the assumed touchdown point should be 2300ft beyond the threshold.

Modifications:

CAT II Basic aircraft

CAT III A without DH: Aircraft with mod. (4941 and 5429)
 4941: Achieve CAT III fail-operational
 5429: Upgrade autothrottle

CAT III B without DH: Aircraft with mod (4941+5502+5429+5528+5757)
 4941: Achieve CAT III fail operational
 5429: Upgrade autothrottle
 5502: Autopilot: Modify FAC,FCC, FCU supply bus bar
 5528: AFS: Update FAC CAT III certification standard
 5757: AFS: Update FCC, MTP CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A310 CAT II/III CERTIFICATION STATUS

CAA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III fail-passive with DH ⁽¹⁾	50 ft			No RVR specified	Certified capability CAT 3
CAT III fail-operational with DH	15 ft	15 ft	100 ft	100 m	Certified capability CAT 3 (indicated at 100ft) ILS CAT 3 mandatory
CAT III fail-operational without DH			100 ft		Airport in accordance with CAP359 or acceptable alternative

Modifications:

CAT II Basic aircraft

⁽¹⁾ CAT III fail-passive: With mod. 4747 (NO LONGER APPLICABLE)

CAT III fail-operational: With mod. (4941+5502+5429+5528+5757)
 4941: Achieve CAT III fail operational
 5429: Upgrade autothrottle
 5502: Autopilot: Modify FAC, FCC, FCU supply bus bar
 5528: AFS: Update FA C CAT III certification standard
 5757: AFS: Update FCC, MTP CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A310 CAT II/III CERTIFICATION STATUS

RLD

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III B fail-operational without DH			100 ft	75m	Certified capability CAT 3

Note: For CAT III, the required runway length is the greater of:

- determined runway length + 1000ft
- determined runway length x 1.15

Modifications:

CAT II Basic aircraft

CAT III Aircraft with mod. (4941+5502+5429+5528+5757)
 4941: Achieve CAT III fail-operational
 5429: Upgrade autothrottle
 5502: Autopilot: Modify FAC, FCC, FCU supply bus bar
 5528: AFS: Update FAC CAT III certification standard
 5757: AFS: update FCC, MTP CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A310 CAT II/III CERTIFICATION STATUS

FAA

Category	Min. DH	AH	Min. RVR	Remarks
CAT II	100 ft		see AC120-29	Certified capability CAT 2, CAT 3
CAT III fail-operational with DH	15 ft	100 ft	see AC120- 28C Appendix 1	Certified capability CAT 3
CAT III B fail-operational without DH		100 ft	see AC120-28C Appendix 1 and 3	Certified capability CAT 3

Modifications:

CAT II Basic aircraft

CAT III with DH: Aircraft with mod. (4941+5757)
 4941: Achieve CAT III fail-operational
 5757: AFS: Update FCC, MTP CAT III certification standard

CAT III in compliance: Aircraft with mod. (4941+5502+5429+5528+5757)
 with
 AC 120-28C
 Appendix 2
 4941: Achieve CAT III fail-operational
 5429: Upgrade autothrottle
 5502: Autopilot: Modify FAC, FCC,FCU supply bus bar
 5528: AFS: Update FAC CAT III certification standard
 5757: AFS: Update FCC, MTP CAT III certification standard

CAT III with RVR= 50m: Aircraft with mod (4941+5502+5429+5528+5757+5953)
 with
 AC120-28C
 Appendix 3
 4941: Achieve CAT III fail-operational
 5429: Upgrade autothrottle
 5502: Autopilot: Modify FAC, FCC, FCU supply bus bar
 5528: AFS: Update FAC CAT III certification standard
 5757: AFS: Update FCC, MTP CAT III certification standard
 5953: AP loss probability: Replace FCC

For specific AFCS limitations, refer to Flight Manuals.

A310 CAT II/III CERTIFICATION STATUS

DOT

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III B fail-operational without DH			100 ft	75m	Certified capability CAT 3

Note: For CAT III, the required runway length is the greater of:

- determined runway length + 1000ft
- determined runway length x 1.15
(x 1.3 if thrust reversers inoperative)

Modifications:

CAT II Basic aircraft

CAT III B without DH: Aircraft with mod. (4941+5502+5429+5528+5727)

4941: Achieve CAT III fail operational

5429: upgrade autothrottle

5502: Autopilot: Modify FAC, FCC, FCU supply bus bar

5528: AFS: Update FAC CAT III certification standard

5757: AFS: Update FCC, MTP CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A300-600 CAT II/III CERTIFICATION STATUS

DGAC

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III fail-operational with DH	15 ft	15 ft	100 ft	No RVR specified	Certified capability CAT 3
CAT III fail-operational without DH			100 ft	75m	Certified capability CAT 3

Modifications:

CAT II Basic aircraft

CAT III Aircraft with mod. 5686
 5686: AFS update CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A300-600 CAT II/III CERTIFICATION STATUS

LBA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	Certified capability CAT 2, CAT 3
CAT III B fail-operational without DH			100 ft	75m	Certified capability CAT 3

Note: For CAT III, the required runway length is the greater of:

- determined runway length + 1000ft
- determined runway length x 1.15
(x 1.3 if thrust reversers are inoperative)

For auto-land braking, the assumed touchdown point should be 2300ft beyond the threshold.

Modifications:

CAT II Basic aircraft

CAT III Aircraft with mod. 5686
5686: AFS update CAT III certification standard

For specific AFCS limitations, refer to Flight Manuals.

A300-600 CAT II/III CERTIFICATION STATUS

CAA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft (1)			No RVR specified	Certified capability CAT 2, CAT 3
CAT III fail-operational with DH	15 ft	15 ft	100 ft	100m	Certified capability CAT 3 (indicated at 100 ft)
CAT III fail-operational without DH			100 ft		Airport in accordance with CAP359 or acceptable alternative

Modifications:

CAT II

Basic aircraft

CAT III with DH or without DH:

Aircraft with mod. 5686

5686: AFS update CAT 3 certification standard

For specific AFCS limitations, refer to Flight Manuals.

- (1) Note: decision height: determine by radio altimeter, not less than OCH/A (obstacle clearance height/altitude).
When OCH/A is not promulgated the decision height may be determined by an alternative method acceptable to CAA.

A300-600 CAT II/III CERTIFICATION STATUS

FAA

Category	Min. DH	AH	Min. RVR	Remarks
CAT II	100 ft		See AC120.29	Certified capability CAT 2, CAT 3
CAT III fail-operational with DH	15 ft	100 ft	See AC120.28C Appendix 1	Certified capability CAT 3
CAT III fail-operational without DH		100 ft	See AC120.28C Appendix 1 and 3	Certified capability CAT 3

Modifications:

CAT II Basic aircraft

CAT III Aircraft with mod. 5686
 5686: AFS update CAT II certification standard

For specific AFCS limitations, refer to Flight Manuals.

A320 CAT II/III CERTIFICATION STATUS

JAA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	CAT 2, CAT 3 SINGLE or CAT 3 DUAL capability displayed
CAT III fail-passive	50 ft			No RVR specified	CAT 3 SINGLE or CAT 3 DUAL capability displayed
CAT III fail-operational with DH		15 ft* or 17 ft*, 20 ft*, 25 ft*	100 ft	No RVR specified	CAT 3 DUAL capability displayed
CAT III fail-operational without DH			100 ft	75m	CAT 3 DUAL capability displayed
				125 m** Autoland CONF 3 not permitted**	

* 15ft for A320 IAE
 17ft for A320 CFM
 20ft for A320 CFM with mod. 25199 or 25314
 25ft for A320 IAE with mod. 24066 or 24067

** Aircraft without mod 23132 or 24348 or 24348 or 24511

For specific AFCS limitations, refer to Flight Manuals.

A321 CAT II/III CERTIFICATION STATUS

JAA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	CAT 2, CAT 3 SINGLE or CAT III DUAL capability displayed
CAT III fail-passive with DH	50 ft			No RVR specified	CAT 3 SINGLE, or CAT 3 DUAL capability displayed
CAT III fail-operational with DH		18 ft* 22 ft*	100 ft	No RVR specified	CAT 3 DUAL capability displayed
CAT III fail-operational without DH			100 ft	75m	CAT 3 DUAL capability displayed

* 18 ft for A321 with CFM
22 ft for A321 with IAE

Modifications:

CAT III fail-operational: aircraft without mod 25199 (CFM) or 25200 (IAE)

Minimum DH 50ft

Roll out not permitted

For specific AFCS limitations, refer to Flight Manuals.

A319 CAT II/III CERTIFICATION STATUS

JAA

Category	Min. DH	AH	Min. RVR	Remarks
CAT II	100 ft		No RVR specified	CAT 2, CAT 3 SINGLE or CAT III DUAL capability displayed
CAT III fail-passive with DH	50 ft		No RVR specified	CAT 3 SINGLE or CAT 3 DUAL capability displayed
CAT III fail-operational with DH		100 ft	No RVR specified	CAT 3 DUAL capability displayed
CAT III fail-operational without DH		100 ft	75m	CAT 3 DUAL capability displayed

A320, A321, A319 CAT II/III CERTIFICATION STATUS

FAA

Category	Min. DH	AH	Min. RVR	Remarks
CAT II	100 ft		See AC120-29	CAT 2, CAT 3 SINGLE or CAT 3 DUAL capability displayed
CAT III fail-passive	50 ft		See AC120-28C Appendix 1	CAT 3 SINGLE, or CAT 3 DUAL capability displayed
CAT III fail-operational		100 ft	See AC120-28C Appendix 1 and 3	CAT 3 DUAL capability displayed
With or without DH				125 m, auto-land conf. 3 not permitted*

* A320 without mod. 23132 or 24348 or 24511

CAT III fail-operational: Basic aircraft

For specific AFCS limitations, refer to Flight Manuals.

A330 CAT II/III CERTIFICATION STATUS

JAA

Category	Min. DH	MABH **	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	CAT 2, CAT 3 SINGLE or CAT 3 DUAL capability displayed
CAT III fail-passive	50 ft			No RVR specified	CAT 3 SINGLE, or CAT 3 DUAL capability displayed
CAT III fail-operational with DH		20 ft 23 ft* 22 ft*	200 ft	No RVR specified	CAT 3 DUAL capability displayed
CAT III fail-operational without DH			200 ft	75m	CAT 3 DUAL capability displayed

* A330-300 GE : 20ft
 A330-300 PW : 23ft
 A330-300 RR : 22ft

** A330-200 : No MABH specified.

For specific AFCS limitations, refer to Flight Manuals.

A340 CAT II/III CERTIFICATION STATUS

JAA

Category	Min. DH	MABH	AH	Min. RVR	Remarks
CAT II	100 ft			No RVR specified	CAT 2, CAT 3 SINGLE or CAT 3 DUAL capability displayed
CAT III fail-passive	50 ft			No RVR specified	CAT 3 SINGLE, or CAT 3 DUAL capability displayed
CAT III fail-operational with DH	20 FT	19 ft* 22 ft**	200 ft	No RVR specified	CAT 3 DUAL capability displayed
CAT III fail-operational without DH			200 ft	75m	CAT 3 DUAL capability displayed

* with A340-213

** with A340-313

Modifications:

CAT II Basic aircraft
Autopilot must be disengaged at 80ft at the latest

Cat III With mod. 42100 or 42875

For specific AFCS limitations, refer to Flight Manuals

CHAPTER 5

5. AIRFIELD REQUIREMENTS

- 5.1 INTRODUCTION**
- 5.2 RUNWAY CHARACTERISTICS**
- 5.3 VISUAL AIDS – RUNWAY MARKS**
- 5.4 VISUAL AIDS – RUNWAY LIGHTS**
- 5.5 VISUAL AIDS – APPROACH LIGHT SYSTEM**
- 5.6 OBSTACLE CLEARANCE**
- 5.7 ILS FACILITY**
- 5.8 RVR**
- 5.9 AERODROME MAINTENANCE**
- 5.10 ATC PROCEDURES**

5.1 INTRODUCTION

An operator shall not use an airfield for CAT II or CAT III operations unless it is approved for such operations by the state in which the airfield is located.

Airfield requirements are contained in the ICAO document "All-Weather Operations Manual" which refers to standards and recommendations from ICAO Annex 10 first volume (ILS) and ICAO annex 14 (Aerodrome). ICAO standards are internationally accepted but additional requirements or variants may be found in national regulations (AC120.29 and AC120.28C for FAA for instance) or in the ECAC document n°17.

The present chapter addresses the following subjects:

- runway characteristics,
- visual aids,
- non-Visual aids (ILS),
- RVR measurements,
- obstacle clearance area,
- ATC procedure,
- maintenance procedure.

The aim of this chapter is to present a summary view of the typical CAT II or CAT III airfield requirements.

5.2 RUNWAY CHARACTERISTICS

5.2.1 RUNWAY LENGTH

There is no specific requirement concerning runway length for an aerodrome to be CAT II or III approved. The runway length is only an operational limitation.

5.2.2 RUNWAY WIDTH

The runway width should be normally not less than **45m**.

5.2.3 RUNWAY SLOPE

For CAT II or CAT III, disregarding normal standards, it is recommended that for the first and the last quarter of the length of the runway the slope does not exceed **0.8%**.

To permit the use of the automatic landing system, ICAO also recommends that slope changes must be avoided or, when it is not possible, kept to a maximum of **2% per 30m** (i.e. a minimum radius of curvature of 1500m) in the area located just before the threshold (60m wide, 200m long). This limitation is due to the fact that automatic landing systems use radio altimeter and a rapid slope change could disturb the landing.

During airworthiness certification, it must be demonstrated that the automatic landing system works on a particular runway profile (see aircraft requirements).

5.2.4 OBJECTS ON RUNWAY STRIPS

It is recommended that for runways intended for use for CAT II or CAT III approaches, no fixed object (other than frangible visual aids) are installed on a runway strip within **60m** of the centerline. During landing, no mobile objects are permitted in the same area.

5.2.5 TAXI-HOLDING POSITION

A taxi-holding position is established at each intersection of a taxiway and the runway. The distance between the holding position and the centerline of the runway is not less than **90m** (greater if the runway elevation exceeds 700m).

5.3 VISUAL AIDS-RUNWAY MARKS

5.3.1 RUNWAY CENTRELINE MARKS

For CAT II or CAT III operations, the runway centerline marks, as shown in Figure 5.2, must have a width not less than **0.90m** (or not less than 0.45m for CAT I).

5.3.2 TOUCHDOWN ZONE MARKS

Touchdown zone marks, as shown in Figure 5.2, are required for all precision approaches, unless the authority declares that they are unnecessary.

They are painted in the touchdown zone (the zone beginning at the threshold and extending to a distance of 900m).

5.3.3 TAXIWAY MARKS

Taxiway marks are not a specific CAT II or CAT III requirement, but experience has shown that they are an efficient means of guiding aircraft in low visibility conditions during the day.

5.3.4 TAXI-HOLDING POSITION MARKINGS

The taxi-holding positions must be as shown in pattern A for the closest marks to the runway and pattern B for the other markings (see Figure 5.3). Either CAT II or CAT III is written on the surface when the area exceeds 60m width. CAT II or CAT III signs are also placed on either edge of the taxiway at the holding-position and the sign CAT III must be accompanied with flashing lights. These markings or signs are an efficient means to avoid aircraft intruding into the obstacle-free zone or in the critical/sensitive area.

Figure 5.1

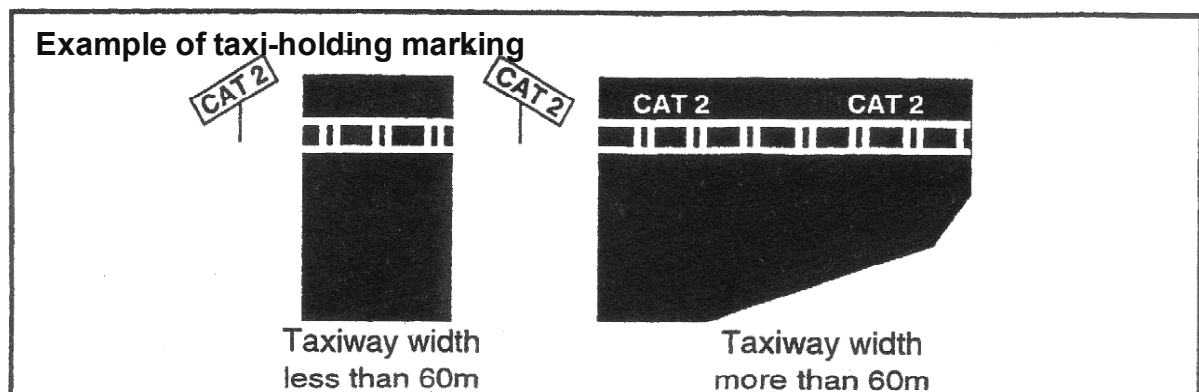
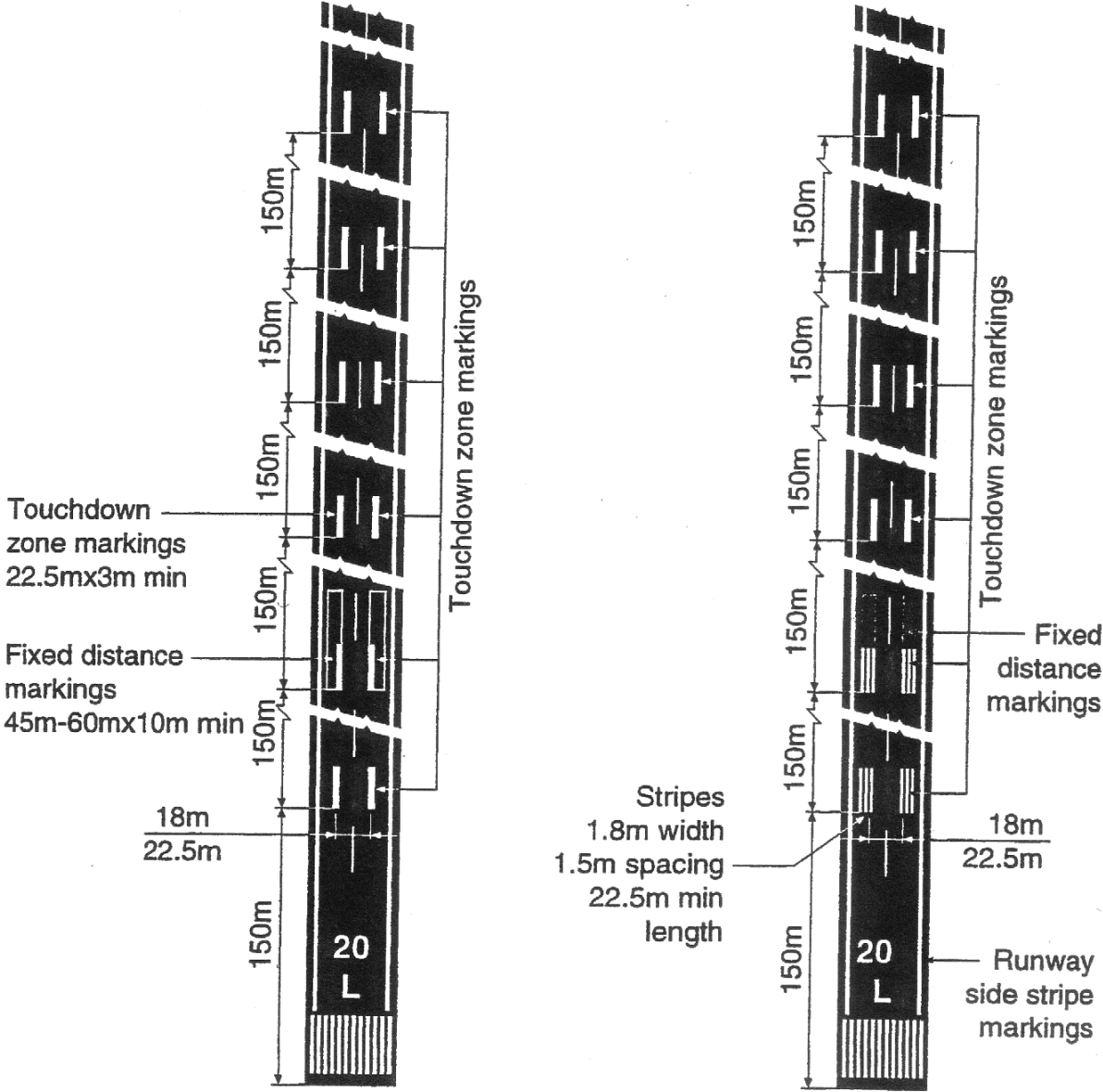


Figure 5.2 Runway marks



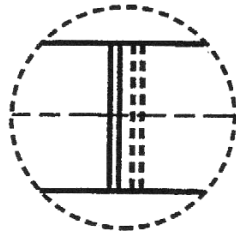
Basic pattern

With distance coding

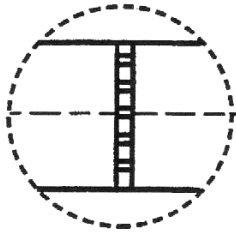
Figure 5.3

Taxi-holding position marking

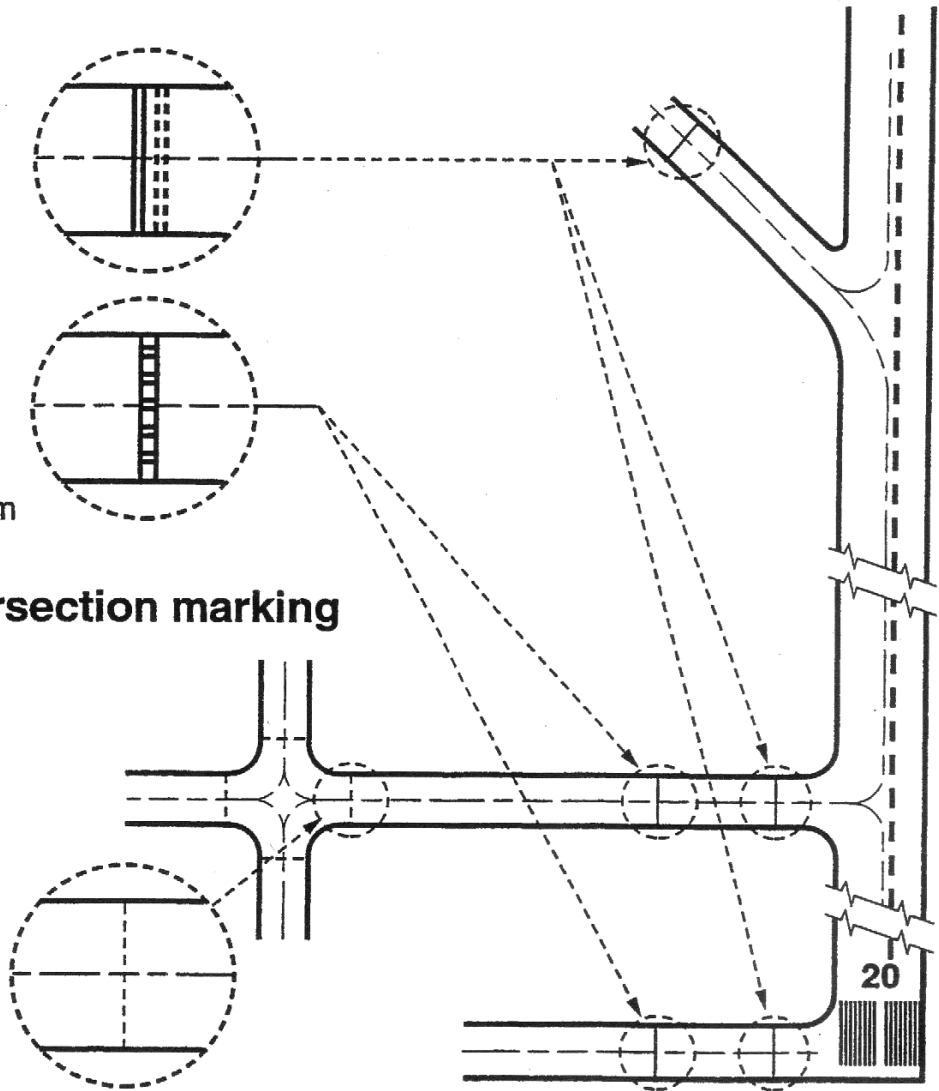
Pattern A :
4 lines and
3 spaces at
0.15m each



Pattern B :
2 lines and
0.3m each
1 space at 0.6m



Taxiway intersection marking



5.4 VISUAL AIDS-RUNWAY LIGHTS

Runway lights on runways intended for use by CAT II or CAT III operations consist of high intensity threshold lights, runway end lights, runway touchdown zone lights, runway edge lights, and runway centerline lights. The basic pattern of runway lights is shown in Figure 5.4. This paragraph also includes requirements for taxiway lights as shown in Figure 5.5.

5.4.1 RUNWAY EDGE LIGHTS

Runway edge lights are placed along the full length of the runway in two parallel rows equidistant from the centerline, with a distance of no more than **3m** to the runway edge. These lights are uniformly spaced at intervals of no more than 60m and may be omitted at the intersections. The lights are fixed lights showing **variable white**.

5.4.2 THRESHOLD LIGHTS

Threshold lights are placed in a row at right angles to the runway axis, outside the runway with a distance of no more than **3m** to the threshold.

The lights are fixed unidirectional lights showing **green**, uniformly spaced at intervals of no more than **3m**.

5.4.3 RUNWAY END LIGHTS

Runway end lights are placed in a row at right angles to the runway axis, outside the runway with a distance of no more than **3m** to the runway end.

The lights are fixed unidirectional lights showing **red**, with a minimum number of **6** lights. ICAO also recommends a spacing between the lights of no more than **6m** for runways intended for use by CAT III approaches.

5.4.4 RUNWAY CENTERLINE LIGHTS

Runway centerline lights are a specific requirement for CAT II or CAT III approaches. They are located along the centerline of the runway, with a longitudinal spacing of approximately 7.5m, 15m or 30m for CAT II and only 7.5m or 15m for CAT III.

These lights are fixed lights showing:

- **Variable white** from the threshold to the point 900m from the runway end.
- **Alternate red and variable white** from the point 900m to the point 300m from the runway end (pairs of red lights followed by pairs of variable white lights if the spacing is only 7.5m)
- **Red** from the point 300m to the runway end.
(If the runway length is less than 1800m, the alternate red and variable white lights are extended from the mid-point of the runway to 300m from the runway end).

5.4.5 TOUCHDOWN ZONE LIGHTS

Runway touchdown zone lights are a specific requirement for CAT II or CAT III approaches. They extend from the threshold for a longitudinal distance of **900m** (full touchdown zone) but do not extend beyond the mid-point if runway length is less than 1800m.

The pattern is formed by **pairs of barrettes** containing at least **three lights**. The lights inside each barrette are fixed unidirectional lights showing variable white, spaced at an interval of no more than **1.5m**. Each barrette must be not less than **3m** and no more than **4.5m** in length. The lateral spacing (or gauge) between the lights is not less than **18m** and no more than **22.5m** with a preference of 18m. The longitudinal spacing between pairs of barrettes is **60m** or **30m**, but it is recommended to have a spacing of 30m for low minima.

5.4.6 TAXIWAY EDGE LIGHTS

Taxiway edge lights are not a specific CAT II or CAT III requirement, but provide efficient visual aid during low-visibility operations. The lights are fixed lights showing blue.

5.4.7 TAXIWAY CENTERLINE LIGHTS

Taxiway centerline lights have to be installed on airfields intended for use by operations with an **RVR 400m** or less (400m is the mean value for CAT II approach). The lateral spacing between lights must not exceed **15m** but the proximity of a curve must be indicated by a spacing equal to, or less than, **7.5m**. The lights are fixed lights showing **green**, but from the beginning of the taxiway to the perimeter of the ILS critical area/sensitive area or the lower edge of the inner transitional surface, the lights are alternately showing **green and yellow**.

5.4.8 STOP BARS

Stop bars are placed at each taxi-holding position when the runway is intended for use at an **RVR less than 400m** and are specially required for all CAT III approaches. The lights of the stop bars show **red** and are spaced at intervals of **3m**. These stop bars are an efficient means to avoid aircraft intrusion into the obstacle-free zone (OFZ) or into the critical/sensitive area during approaches in very low visibility conditions.

Figure 5.4 Runways lights / Approach light system

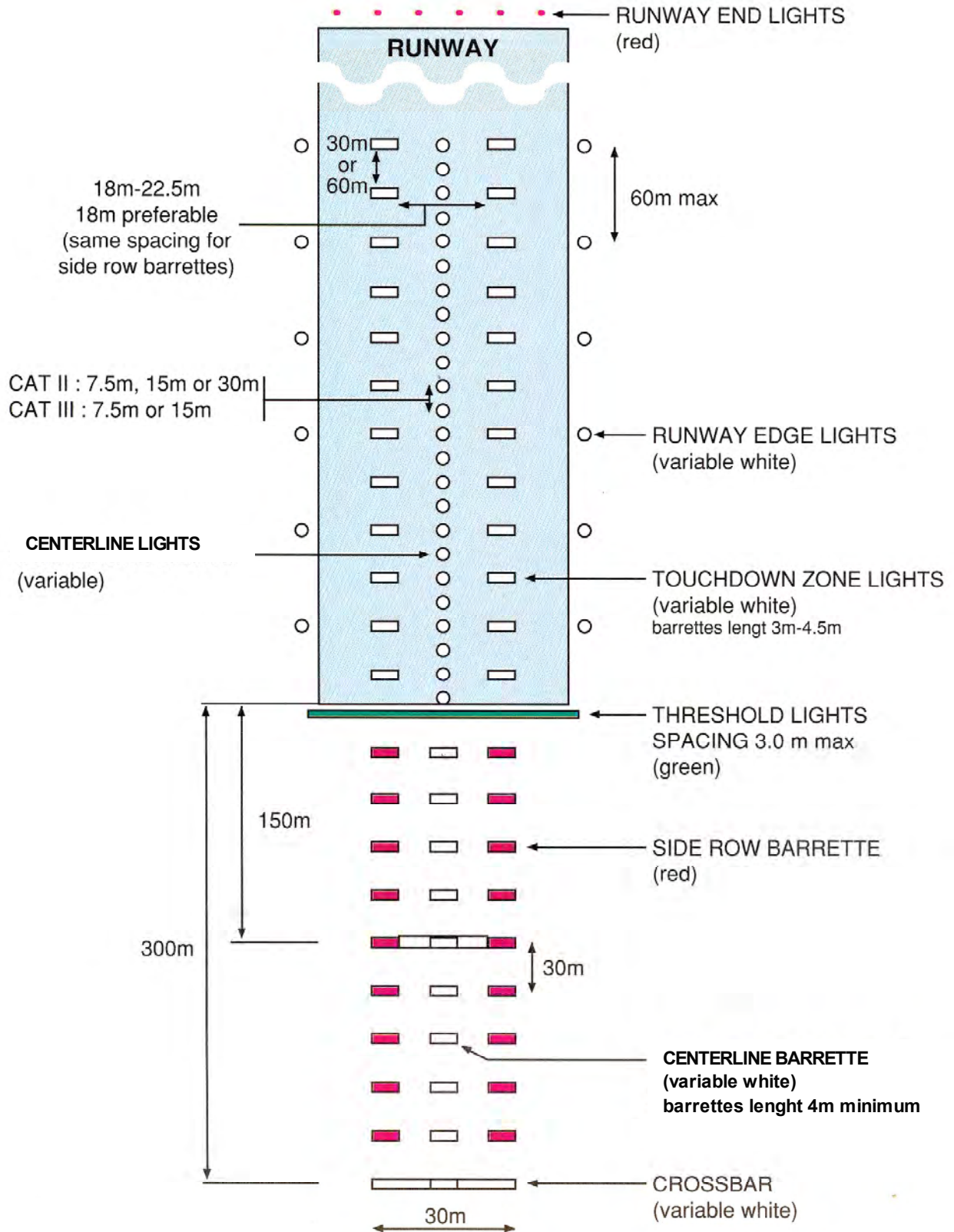
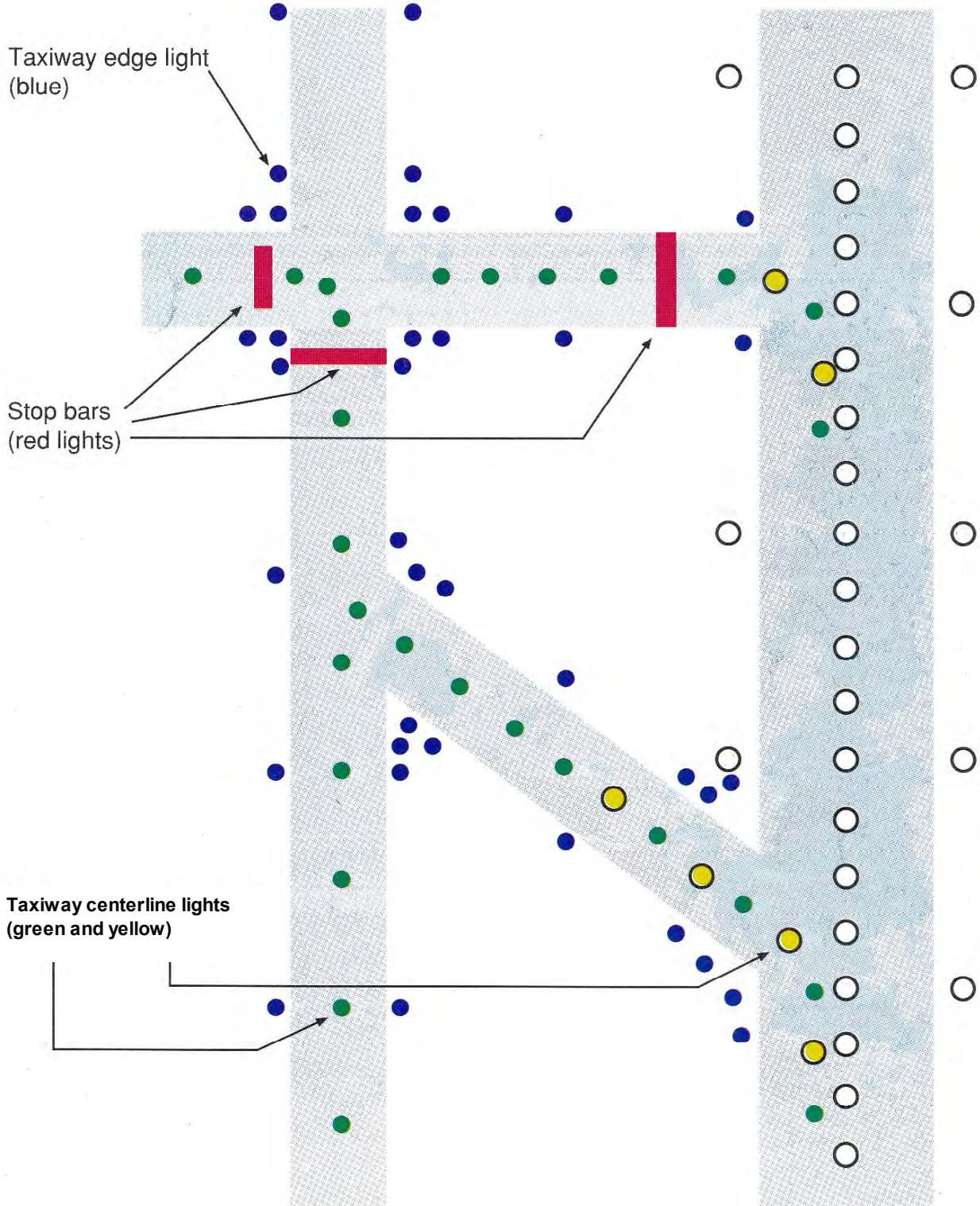
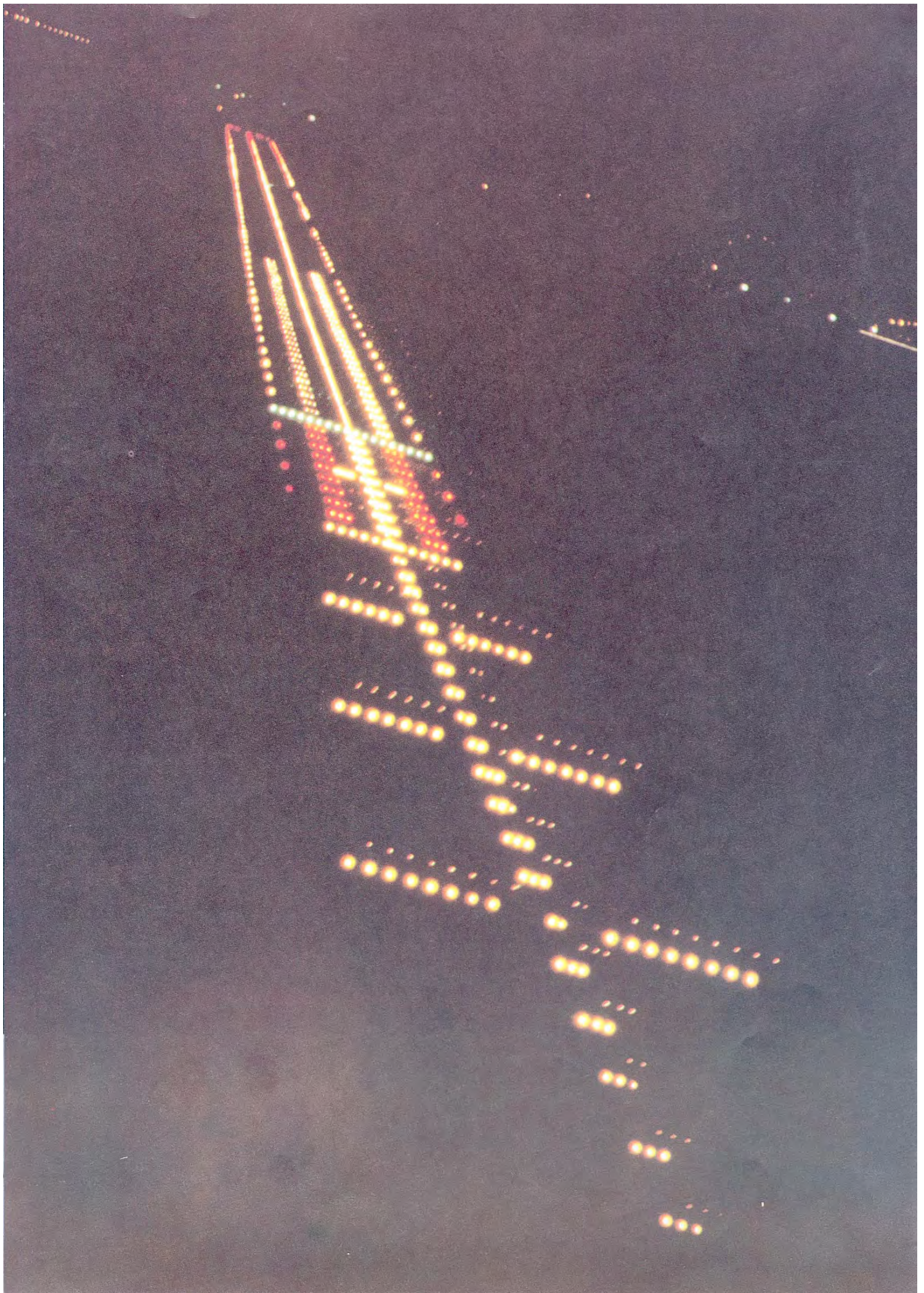


Figure 5.5 Taxiway lights





5.5 VISUAL AIDS-APPROACH LIGHT SYSTEM

The approach light system is mandatory for CAT II operations, and only optional for CAT III operations. It consists of **a row of lights** on the extended centreline of the runway, extending over a distance of **300m** from the threshold (over 900m for CAT I).

In addition, the system has **two side rows of lights**, extending **270m** from the threshold, and **two crossbars**, one at **150m** and one at **300m** from the threshold as shown in Figure 5.5.

It is specified by the ECAC that sequenced strobe lighting is considered to be incompatible with CAT II and III operations. When installed for other operation, it should be switched off when CAT II or CAT III approaches are in progress.

5.5.1 EXTENDED CENTERLINE LIGHTS

The lights forming the centerline are placed at longitudinal intervals of **30m**, with the first one located 30m from the threshold.

These lights consist of barrettes showing **variable white**. Each barrette is at least **4m** in length. When a barrette is composed of point sources, the lights are uniformly spaced at intervals of no more than **1.5m**.

5.5.2 SIDE ROW LIGHTS

The lights forming the side rows are placed on each side of the centerline, at a longitudinal spacing equal to that of the extended centerline lights (30m), with the first ones located 30m from the threshold. The lateral spacing (or gauge) between the lights is not less than **18m** and no more than **22.5m**, with a preference for 18m. In any case, the lateral spacing shall be equal to that of the touchdown zone lights (see 5.4.5).

These lights consist of barrettes showing **red**. The length of a side row barrette and the longitudinal spacing of its lights shall be equal to those of the touchdown lights barrettes.

5.5.3 CROSSBAR LIGHTS

The crossbar provided at **150m** from the threshold fills in the gap between the centerline and the side row lights. The crossbar provided at **300m** is extended on both sides of the centerline lights to a distance of 15m from the centerline. The lights forming the two crossbars are fixed lights showing variable **white**.

5.6 OBSTACLE CLEARANCE AREA

5.6.1 INTRODUCTION

Due to the very low visibility in CAT II and CAT III operations, each airfield must meet stringent criteria concerning obstacle clearance to avoid any aircraft on approach, landing or go-around touching obstacles on the ground. The basis of those criteria are fully included in ICAO Annex 14 and PANS-OPS Doc 8168 and in other national documents. In CAT II and III operations, two important concepts are often mentioned in the regulations.

- the Obstacle Free Zone (OFZ),
- the Obstacle Clearance Height (OCH).

5.6.2 DEFINITIONS

Provided below are the definitions of the OCH and OFZ as defined in ICAO.

OCA/OCH: *The lowest altitude (OCA), or alternatively the lowest height above the elevation of the relevant runway threshold or above the aerodrome elevation as applicable (OCH), used in establishing compliance with appropriate obstacle clearance criteria.*

Sometimes, the term OCL (obstacle clearance limit) can be found in the documentation, but this term is being phased out.

When an operator establishes his operating aerodrome minima, he must take into account the OCH only for CAT II. The minimum DH for CAT II is always equal to or higher than any OCH mentioned in the aerodrome chart. This OCH is a function of the category of aircraft (A to E).

OFZ: *The airspace above the inner approach surface, inner transitional surfaces, and balked landing surfaces and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted and required for air transportation purposes.*

5.7 ILS FACILITY

5.7.1 DESCRIPTION

Nowadays, all CAT II and III approaches are based on ILS facilities. The ILS installation must conform to the appropriate specifications contained in ICAO Annex 10, Volume 1, Part 1, Chapters 2 and 3, and be designed and operated in accordance with the guidance material contained in attachments C to part 1 of Annex 10.

There are three categories of ILS, providing guidance down to a height higher or equal to

- 60m(200ft) for CAT I,
- 15m(50ft) for CAT II,
- runway surface and along the runway for CAT III.

Generally, the authority requires a CAT II ILS facility for the performance of CAT II approaches, and a CAT III ILS facility for the performance of CAT III approaches. However, it is acceptable to use a category II ILS facility for the performance of CAT III approaches with the highest minima (for example CAT III A or CAT III with DH not less than 50ft). Generally, a special agreement from the authority should be obtained. Mainly, the authority will take account of the continuity of service objective and the integrity objective of those installations.

5.7.2 ILS PROTECTION

In CAT II and III approaches, the ILS beams must be protected from unacceptable disturbance. For this purpose, two kinds of protection area are defined

- the critical area,
- the sensitive area.

ILS critical area: *An area of defined dimensions about the localizer and glide path antennas where vehicles, including aircraft, are excluded during all ILS operations. The critical area is protected because the presence of vehicles and/or aircraft inside the boundaries will cause unacceptable disturbance to the ILS signal-in-space.*

ILS sensitive area: *An area extending beyond the critical area where the parking and/or movement of vehicles, including aircraft, is controlled to prevent the possibility of unacceptable interference to the ILS signal during ILS operations. The sensitive area is protected to provide protection against interference caused by large moving objects outside the critical area but still normally within the airfield boundary.*

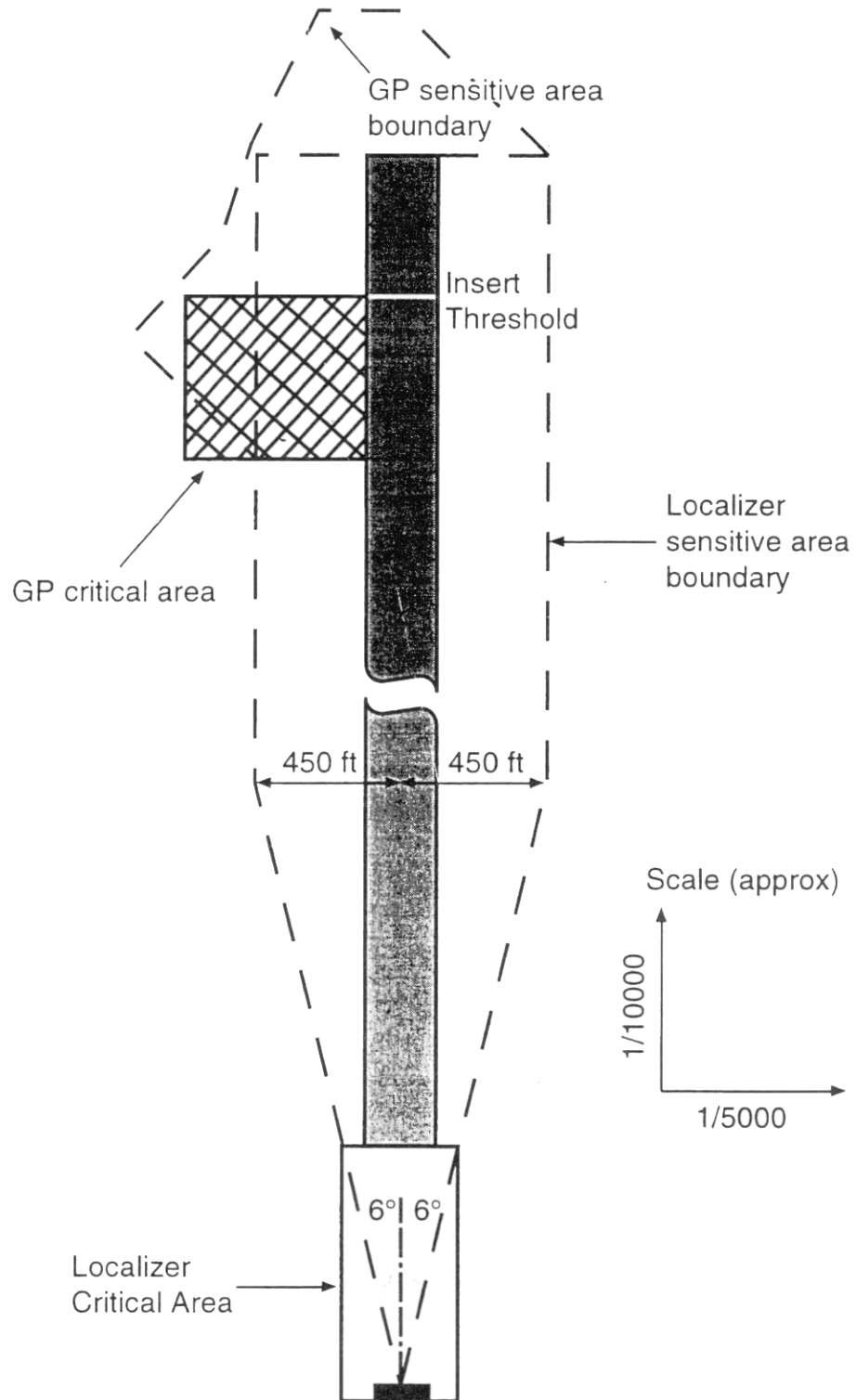
The dimensions of the critical area are contained in ICAO Annex 10, but there is no specification for the dimensions of the sensitive area. An example of both critical and sensitive areas, taken from ECAC doc n° 17, is given in Figure 5.6. Some states do not define the sensitive area but increase the critical area.

The ILS beam is also protected by longitudinal separation between aircraft on landing or take-off.

ILS protection is mandatory when low visibility procedures are in force.



Figure 5.6 Critical and sensitive areas (Edinburgh runway 25)



5.8 RVR

5.8.1 RVR MEASUREMENTS

The RVR measurements are provided by a system of calibrated transmissometers and take account of the effects of ambient background light and the intensity of runway lights.

Description of RVR measurement system

RVR measurement system includes:

- One or more transmissometer(s): A transmissometer is a system providing the value of the opaqueness of the atmosphere on a reference distance through the ratio between the transmitted light flux and the received light flux.

There are two types of transmissometer commonly used as shown Figure 5.8.

5.8.2 LOCATION OF THE TRANSMISSOMETERS

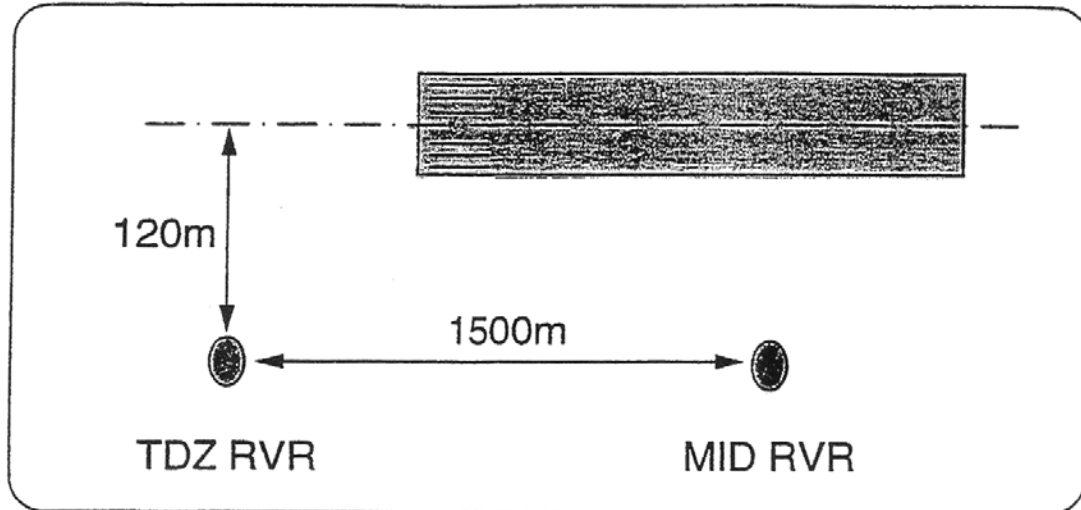
The RVR measurements are basically provided for three parts of the runway.

- the touch-down zone (TDZ),
- the mid runway portion (MID),
- the roll-out portion or stop-end.

The required number of measurements depends on the type of operations.

Transmissometers should be placed at each zone in which they are intended to provide an RVR measurement. The location is supervised by the technical services of the authority. The transmissometer must be close enough to the runway to provide an acceptable value, but at the same time must be a non-hazardous obstacle for the aircraft. Generally, each transmissometer is at a distance of between 110m and 150m from the runway centerline. Moreover, to be representative of the vision of a pilot on the runway (see RVR definition paragraph 2.4.1), the transmissometer is installed at a height of between 5m and 10m above the ground. An example of the locations of two transmissometers (TDZ,MID) are shown in Figure 5.7.

Figure 5.7

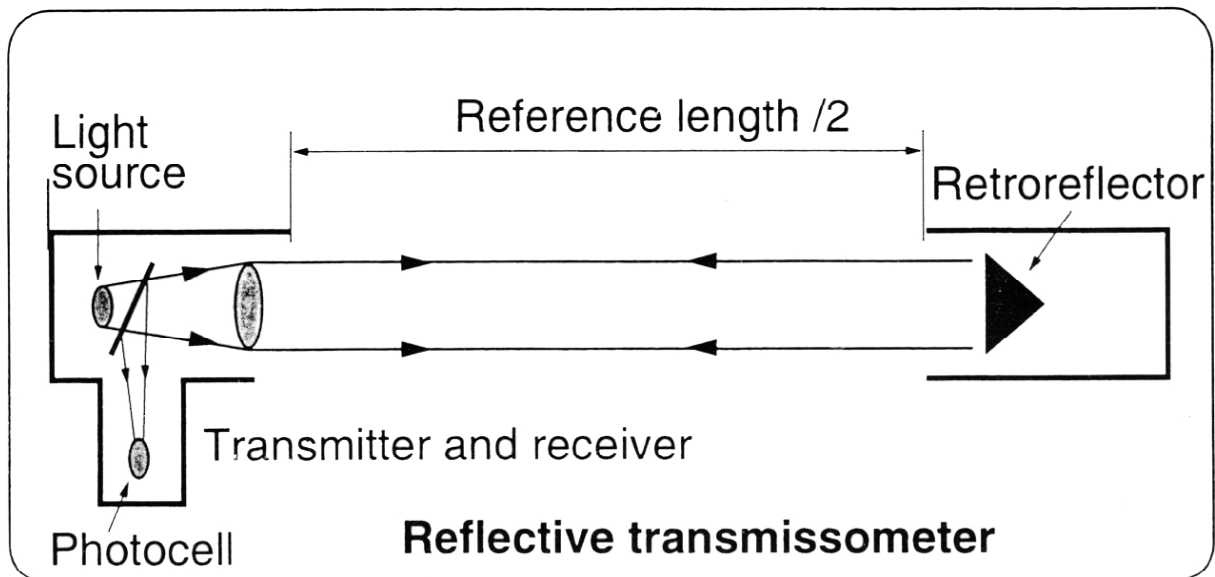
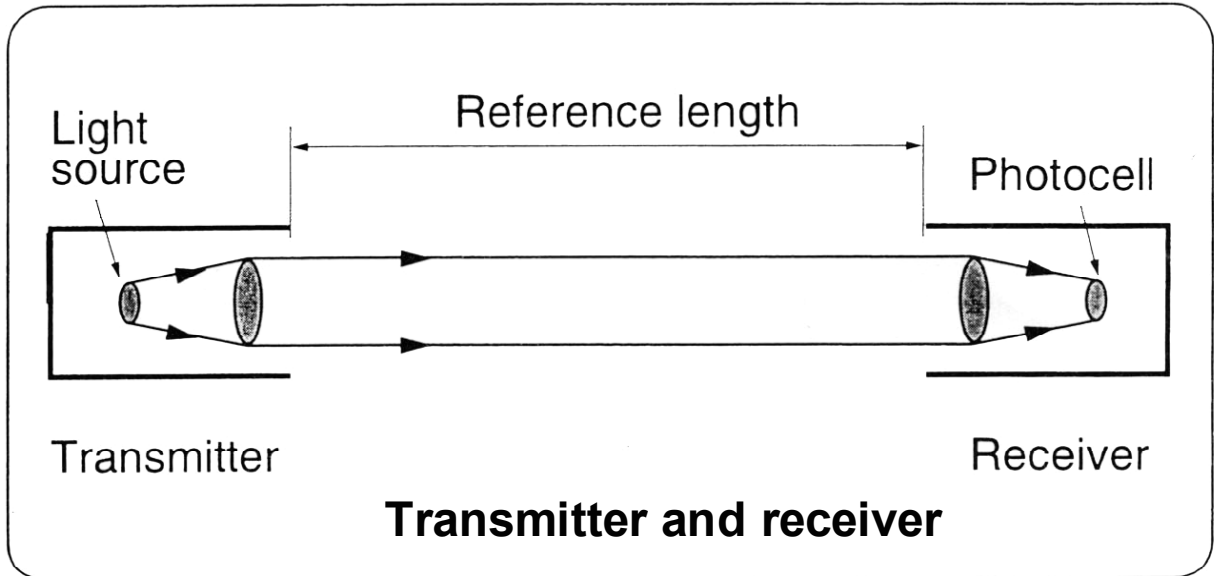


5.8.3 RVR MEASUREMENT REPORTS

ICAO recommends that RVR reports are given with 50m increments when the RVR is less than 800m and 25m increments when the RVR is less than 150m. In any case, any change of the RVR value must be known by the ATC as soon as possible and in less than 15 seconds.

During operations, the pilot must know the RVR value related to the touch-down. Generally, it is not necessary to give the other values (MID, stop-end) unless these values are lower than the TDZ report or there is special mention in the ATC procedures.

Figure 5.8 Two types of transmissometer





5.9 AERODROME MAINTENANCE

5.9.1 INTRODUCTION

A system of maintenance for visual aids must be established at an aerodrome to ensure both lighting and marking system reliability. A system of maintenance for ILS installations must also be established with regular ground and flight checks as mentioned in the ICAO Annex 10.

5.9.2 LIGHTING SYSTEM CONDITION

As it is difficult to have at any moment in time zero failures in the lighting system, ICAO recommends that in any event, the percentage of unserviceable lights during a CAT II or CAT III approach should not exceed the values shown in the table of figure 5.9.

Figure 5.9

5%	in the approach lighting system from the threshold to 450m before the threshold
5%	in the runway centerline lights
5%	in the runway threshold lights
5%	in the runway edge lights
10%	in the touchdown zone lights
15%	in the approach lighting system from the point 450m before the threshold and beyond
25%	in the runway end lights

However, to preserve the pattern of the lighting system, it is also recommended to ensure that two unserviceable lights are never adjacent (except in the same crossbar or barrette where two adjacent unserviceable lights are permitted).

To check the pattern of the lighting system aerodrome maintenance services can either use a photograph of the complete system, taken at night or use automatic lighting system reports.

5.9.3 SECONDARY POWER SUPPLY FOR VISUAL AIDS

A secondary power supply for visual aids is required with maximum switch-over time as indicated in ICAO Annex 14 and shown in the table of figure 5.10.

Figure 5.10

Maximum switch-over time	
1 second	15 seconds
<ul style="list-style-type: none"> * Approach lighting system * Runway threshold * Runway end * Runway centerline * Runway touchdown zone * Stop bars at taxi-holding positions (CAT II) * All stop bars (CAT III) 	<ul style="list-style-type: none"> * Runway edge * Essential taxiway including stop bars other than those at taxi-holding positions (CAT II)

5.9.4 ILS MAINTENANCE

ILS installations must be ground- and flight-checked at regular intervals in accordance with the requirements of ICAO Annex 10. Moreover, users must be advised as soon as possible, and according the ATC procedures, of any degradations in ILS performance.

5.10 ATC PROCEDURES

5.10.1 GENERAL

CAT II and CAT III operations require special procedures for the ATC and all services on the aerodrome (maintenance, security). They are often referred to under the generic name of Low Visibility Procedures. Each aerodrome authority develops its own procedures with the ICAO All-Weather Document or ECAC n°17 as a possible aid. It is very difficult to provide in this paragraph a complete view of all those procedures. To be perfectly informed of all aspects it is preferable to refer to the two documents mentioned above.

Mainly, the procedures to be established are:

- procedures for ATC to be quickly informed of all degradations in ILS performance and to inform the pilot if necessary,
- procedures for ATC to be quickly informed of all degradations in visual aids and to inform the pilot if necessary,
- procedures for the protection of the OFZ by the control of ground movements,
- procedures for the protection of the ILS critical area and the ILS sensitive area by control of ground movements and adequate separation between two aircraft on approach or one aircraft on approach and another taking-off,
- procedures for meteorological services,
- procedures for maintenance,
- procedures for security.

All procedures at Heathrow airport in London, taken from ECAC Doc n°17, are given in Attachment C.

5.10.2 ATC CLEARANCE

Clearance to carry out a CAT II or III approach must be requested from ATC, who will activate the Low Visibility Procedures, i.e. prepare the airfield and assure appropriate aircraft separation. Such an approach may not be undertaken until the clearance has been received. It is also recommended that ATC be informed when an automatic landing is intended to be performed, to ensure, whenever possible, the same protection even in CAT 1 or better conditions.

ATTACHMENT C
ATC PROCEDURES
HEATHROW (LONDON)

**EXTRACT FROM MANUAL OF AIR TRAFFIC SERVICES
FOR LONDON HEATHROW**

(FOR INFORMATION ONLY - NOT TO BE USED)

ATC LOW VISIBILITY PROCEDURES

1. INTRODUCTION

The procedures have been devised to simplify the differing requirements of CAT 2 and CAT 3 operations. To achieve this, during the relevant weather conditions (see 2 below), the Localiser Sensitive Area is to be guarded. This ensures the protection of the Localiser signal and at the same time effectively meets the Obstacle Free Zone (OFZ) requirements.

2. GENERAL

Runways - 28L/10R and 28R/10L are equipped for CAT 2/3 operations (Low Visibility Operations).

ATC Low Visibility Procedures become effective when :

- a) The IRVR (or meteorological visibility if the IRVR system is unserviceable) is less than 600 metres. The IRVR to be used to determine the commencement of these procedures is to be the touchdown reading but if this position is unserviceable the midpoint reading is to be used instead.
- b) The cloud ceiling is 200 feet or less,

irrespective of the serviceability state of the ILS, lighting, standby power, etc.

Localiser Sensitive Area (LSA) (See Diagram on Page 1-26A)

Effectively, for ATC purposes, the LSA is a rectangular area contained within parallel lines 137 metres either side of the runway centreline and between the localiser aerial and the beginning of the runway.

No vehicle or aircraft is to be permitted to infringe the LSA from the time when:

- a) An Arriving aircraft is 1 nm from touchdown until it has completed its landing run.
- b) A departing aircraft has commenced its take-off run until it is airborne.

NOTE : This means that landing or take-off clearance must not be issued if the LSA is known to be infringed.

3. RESPONSIBILITIES

It is the responsibility of :

- ATC - to advise Tels and the Airport Authority when Low Visibility Procedures are to commence.
- Tels - to immediately notify ATC whenever the ILS Category differs from that promulgated. Tels will take the appropriate Notam action.
- BAA - to immediately advise ATC of any significant unserviceability in the aerodrome lighting and/or stand-by power supplies, and to ensure that all necessary ground safeguarding action is taken and advise ATC accordingly. BAA will take the appropriate NOTAM action.

Information relative to the above is to be recorded in the Watch Log.

4. APPROACH CONTROL PROCEDURES

Action by Approach Supervisor

In order that the necessary arrangements are in force in sufficient time the following action is to be taken when the Touchdown - IRVR or Cloud Ceiling is decreasing, and is expected to fall below 600 metres/200 feet.

- i Notify Tels and confirm the status of ILS.
- ii Notify the LATCC Supervisor.

The APC Supervisor is responsible for notifying the above agencies when Low Visibility Operations cease.

The APC Supervisor is also to ensure that :

- i The following message is broadcast on Heathrow ATIS or passed to arriving aircraft by RTF, as appropriate :

"ATC Low Visibility Procedures in operation"
- ii All relevant information concerning the status of the ILS, lighting unserviceabilities etc., is passed to the appropriate controllers (including the ADC Supervisor) for onward transmission on to aircraft; this notification to pilots is to indicate any lower status of the facility whether or not it has already been promulgated by NOTAM.
- iii Details of any unserviceabilities of equipment relevant to CAT 2/3 operations are included in the ATIS message.

Information to Pilots

In addition to the information normally transmitted by Approach Control, the following information must be passed by the appropriate controller to the pilot of every arriving aircraft :

- i the current IRVR readings for the landing runway (or the reported meteorological visibility if the IRVR system is unserviceable).

MATS Part 1 refers

- ii Unserviceability of any component parts of the CAT 2/3 facilities not previously broadcast on the Arrival ATIS.

Separation on Final Approach

The N° 2 DIR will decide on a suitable final approach spacing in coordination with the Air Controller, taking account of the prevailing weather conditions. The aim should be to ensure that arriving aircraft can be given a landing clearance at 2 nm from touchdown. Controllers should be aware that during Low Visibility Operations aircraft may require considerable time to clear the runway. Experience has shown that final approach spacings in excess of 10 miles may be necessary.

In low visibility conditions aircraft require to establish on the localiser at an early stage. Therefore, whenever ATC Low Visibility Procedures are in operation aircraft must be vectored to intercept the localiser at not less than 10 nm from touchdown.

CDAs

During Low Visibility Operations the range information and intermediate approach speed associated with CDAs are to be given whenever practicable. However, controllers should be aware that pilots may wish to use final approach speeds which do not conform with those specified in the CDA.

5. AERODROME CONTROL PROCEDURES

Action by Aerodrome Supervisor

On being notified by the Approach Supervisor that Low Visibility Procedures are to commence the ADC Supervisor will inform :

BAA Control Engineer (Ext 7672)

AFS

MASU to institute their Ground Safeguarding Procedures and obtain confirmation that the runway has been safeguarded.

The ADC Supervisor is also responsible for notifying the above agencies when Low Visibility Operations cease.

NOTE : Every effort should be made to notify MASU in sufficient time to enable Ground Safeguarding Procedures to be completed before Low Visibility Operations commence. However, the start of Low Visibility Operations is not to be delayed awaiting the receipt of confirmation from MASU.

If the IRVR falls to 350 metres or less, or cloud ceiling 100 feet or less before confirmation is obtained from MASU, Supervisors are to ensure that any pilot wishing to make an approach, or take-off, is notified that Ground Safeguarding Procedures have not been completed.

Action by Air Controller

- a) Landing clearance should be given no later than 2 nm from touchdown. If this is not possible then the pilot must be warned to "expect late landing clearance". A landing clearance or overshoot instruction must be issued before the aircraft reaches 1 nm from touchdown.
- b) A landed aircraft, or traffic which has crossed the runway, should be given an unimpeded route to allow it to clear the LSA towards, or onto the outer taxiway. ASMI should be used to monitor the progress of aircraft and crossing traffic and no ATC instruction is to be issued which could prejudice this routing.

NOTES : 1 If ASMI is not available then landing aircraft and crossing traffic must clear the runway at those exits where white flashing lights are provided. In the event landing aircraft or crossing traffic leave the runway at an exit where there are not white flashing lights then pilot/driver reports must be obtained to ascertain that the LSA has been cleared, and this may entail the use of an appropriate stop bar if block number reports are not available.

2 If DFTI performance does not allow satisfactory assessment of the 1 nm point, the aircraft must be given landing clearance or overshoot instructions at 2 nms from touchdown.

- c) During single runway operations, the approach spacing should be arranged so as to ensure that a departing aircraft passes overhead the localiser before the next landing aircraft reaches 2 nms from touchdown. Experience has shown that the departing aircraft must commence its take-off roll before the inbound aircraft reaches 6 nms from touchdown in order to achieve this.

White Flashing Lights

These are provided at certain runway exits and mark the lateral boundaries of the LSA. Pilots clearing at these exits will delay their "runway clear" reports until passing these lights.

Action by Lighting Operator

The GMC Lighting Assistant is to monitor, in liaison with BAA Airport Duty Engineer, the fault indicator lights for the lighting services ; establish the nature and expected duration of any faults and inform the Aerodrome Control Supervisor immediately any fault indications appear.

Information to Departing Aircraft

When Low Visibility Procedures are in force the following is to be added to the Departure ATIS or passed to aircraft on RTF as appropriate :

"ATC Low Visibility Procedures in operation : use Category 3 Holding Points"

Holding Points

To comply with the safeguarding requirements, aircraft awaiting take-off must hold at the CAT 3 holding positions which are well defined by illuminated notice boards and taxiway markings. The notified CAT 3 Holding Points are as follows :

- 28L - Block 75, Block 94 and 95
- 28R - Block 92
- 10L - Block 115
- 10R - Block 98

With reference to Runway 28L/A0R, as there is no CAT 3 notified holding point north of Block 79, aircraft wishing to depart from Block 79 on 10R are to be held at the 65-89 stop bar. This restriction applies equally to crossing traffic.

GMC Controller - Procedures

Runway Crossing Routes

It should be clearly understood that in Low Visibility Operations appropriate notified holding points should be used not only for departing aircraft but also for aircraft, vehicles etc. wishing to cross a runway, or enter for purposes other than departure.

If aircraft vehicles etc. wish to cross or enter at a position where a notified holding point is not available, they must be held at a stop bar which is outside the LSA as shown on the diagram on Page 1-26A.

Taxiway Route Restrictions

The following route restrictions are to be applied during Low Visibility Operations :

1. Landings on Runway 10R. No aircraft, taxiing or towing, to route via Blocks 85-72(0)-77(0).

NOTE : This routing restriction is applicable in the direction stated, and applies equally to landing aircraft.

2. Landings on Runway 28R. No aircraft, taxiing or towing, to route via Blocks 101-27-40. It is permitted to hold at the 40/27 stop bar in a north-easterly direction awaiting clearance to enter Runway 28R.
3. 10L - No B747SP aircraft are to proceed westward beyond the 35/36 stop bar whilst approaches are being carried out to 10L.
4. 10R - No B747SP aircraft are to proceed westward beyond the 107/106 stop bar whilst approaches are being carried out to 10R.

6. ROUTES

Most routes on the airfield, are fitted with High Intensity taxiing lighting. Special paint markings have been provided in some locations on the taxiway to warn of the proximity and direction of the curves.

During Low Visibility Operations the GMC/Air Dep Controller is to pass to aircraft approaching the holding point essential traffic information in respect of aircraft already holding.

British Airways' aircraft, some of which are equipped with a Ground Roll Monitor (GRM) may request specific preferred routes to the holding points. These preferred routes are shown on the diagram on Page 1-26B.

During the taxiing phase from the stand, ATC may be requested to illuminate the stop bar at the exit from the cul-de-sac, or at 24(I)/24(O) as appropriate, before bringing up the green route to the runway holding point. This is to provide a zero reference point for the GRM.

CHAPTER 6

6. OPERATIONAL APPROVAL FILE

- 6.1 INTRODUCTION**
- 6.2 AIRCRAFT REQUIREMENTS**
- 6.3 OPERATIONS**
- 6.4 AERODROME REQUIREMENTS**
- 6.5 OPERATING MINIMA**

This chapter is an example of an operational approval file for a first application to the national authorities of the operator. All figures and the aircraft type (A320-211) are used only as an example ; appropriate data should be specified by the airline at the time of making an application.

Appropriate appendices should as well be added to this file.

6.1 INTRODUCTION

This file is presented to the authorities in support of the airline's application to obtain operational approval to conduct CAT II and CAT III operations with the Airbus A320-211 on the aerodromes listed in Appendix to this file. This application is the airline initial application to perform CAT II and CAT III operations.

The project will be conducted in steps, starting from CAT II to full CAT III B operations.

6.2 AIRCRAFT REQUIREMENTS

6.2.1 CERTIFICATION STATUS

The A320-211 in the airline fleet are certified for the intended operations in compliance with:

- JAR AWO 1 and AC 20-57 A for automatic landing,
- JAR AWO 2 and AC 120-29 for CAT II,
- JAR AWO 3 and AC 120-28 C for CAT III.

Automatic approach with DH below 200ft but not less than 100 ft

The A320-211 is certified to conduct CAT II approaches provided that:

- at least one AP is coupled down to DH,
- CAT 2, CAT 3 SINGLE or CAT 3 DUAL is displayed on FMA.

The CAT II approach capability has been demonstrated on CAT II or CAT III ILS quality beam.

A CAT II automatic approach can be followed, if visual references are sufficient, by a manual or an automatic landing.

Automatic approach with DH below 100ft but not less than 50ft

The A320-211 is certified to conduct fail passive CAT III approaches provided that:

- at least one AP is coupled for approach and automatic landing,
- CAT 3 SINGLE or CAT 3 DUAL is displayed on FMA.

The CAT III approach capability has been demonstrated for CAT II and CAT III ILS quality beam.

Automatic approach with DH below 50ft but not less than the MABH or NO DH

The A320-211 is certified to conduct fail operational CAT III approaches provided:

- both AP are coupled for approach, automatic landing and roll-out;
- CAT 3 DUAL is displayed on FMA,
- a DH is established based on the MABH of 17ft or if NO DH is used the minimum RVR is not less than 75m.

The CAT III approach capability has been demonstrated for CAT II and CAT III ILS quality beam.

In addition, for both CAT II and CAT III operation, the relevant AFM limitations, normal procedures and abnormal procedures will be observed. AFM extracts are given in appendix to this file.

6.2.2 REQUIRED AIRCRAFT EQUIPMENT

The CAT II or CAT III capability is available provided the equipment listed in the relevant AFM list of equipment is operative.

AFM extracts are given in appendix to this file.

If the aircraft is dispatched with equipment inoperative, the MEL may preclude CAT II or CAT III operations as appropriate.

6.2.3 MAINTENANCE REQUIREMENTS

On all Airbus aircraft, CAT II / CAT III capabilities are inherent functions of the basic design standard. Therefore, related tasks are covered by the Airbus Maintenance Program. There is no special recommendation for scheduled maintenance tasks or functional checks to assure CAT II / CAT III capabilities.

A program for unscheduled maintenance is established based on the Airbus Maintenance Manual to advise corrective actions / procedures necessary after an automatic landing failure or associated component failure.

A reliability program for the required equipment has been established to monitor the system operational status.

The aircraft status is primarily governed by status messages displayed on ECAM STATUS page and FMA display of capability. However, crew entry in the Technical Log Book will take precedence.

A log entry will be made if full (CAT 3 DUAL) capacity is not available. A downgrading / upgrading procedure has been established and is used.

6.3 OPERATIONS

6.3.1 OPERATING PROCEDURES

The Airline Operations Manual has been revised to include procedures appropriate for CAT II and CAT III operations.

Extracts of FCOM and Operation Manual are given in appendix to this file.

These procedures have been developed to comply with JAR-OPS 1455 and associated Appendix 1 taking into consideration requirements of the A320-211 AFM and the recommended procedures of the Airbus FCOM.

In particular, the Airline policy is for CAT II / CAT III approaches that the captain in the left seat is the pilot flying who takes the decision to land or to carry out a go-around at DH, the F/O has the task of monitoring the approach and to make the appropriate call-out.

For all CAT II and CAT III approaches the recommended procedure is to engage both APs and to disconnect APs at taxi speed on the runway. However, depending on aircraft status or airport conditions:

- in CAT II conditions with RVR > 300m, the AP may be disconnected at 80ft,
- in CAT III A conditions with RVR > 200m, the AP may be disconnected at touchdown,
- CAT III SINGLE may be performed with 50ft DH and RVR > 200m if one AP is inoperative.

CAT III operations will be conducted with a DH of 17ft (or no DH).

6.3.2 FLIGHT CREW TRAINING

The flight crew Training program complies with the provisions of JAR OPS-1450 and associated Appendix 1. The program consists of:

- Ground courses in accordance with JAR-OPS 1450 Appendix 1(b).
- Simulator training in accordance with JAR-OPS 1450 Appendix 1(c) and (d)
 - 1 simulator session of 2 h + 1 h evaluation for CAT II or CAT III

The program of the simulator sessions is given in appendix to this file.

- Line training in accordance JAR OPS 1450 Appendix 1(d)(4).

For CAT II approach:

- one automatic approach and automatic landing and if option with manual landing is envisaged, 3 automatic approaches with AP disconnection at 80ft followed by a manual landing.

For CAT III approaches:

- three automatic approaches in CAT II or better weather conditions followed by automatic landing

The prerequisite experience on the type to perform CAT II or CAT III operation as pilot-in-command is 100 FH or 40 sectors.

The recurrent training for CAT II and CAT III operations has been integrated in the standard recurrent training and checking for captain and F/O.

A simulator check consisting of at least two automatic approaches will be conducted every six months, one of which includes a go-around. In a period of two years all failure cases will be covered.

In addition to the recurrent simulator training, the flight crew will have performed at least one approach and automatic landing using CAT II or CAT III procedures within the last six months.

One of these approaches will be conducted on aircraft.

6.3.3 OPERATIONAL DEMONSTRATION

The operational demonstration is made to comply with JAR OPS 1.440(f) for aircraft types already approved by JAA for CAT II and CAT III operations.

During the operational evaluation period a reporting system is established to monitor CAT II / CAT III success rate and to review unsuccessful approaches. The demonstration is divided into two steps:

1. The operational demonstration consists of at least 30 automatic approaches and automatic landings using CAT II/III procedures in CAT I or better weather conditions.

If a success rate of 95 % or better is established at the end of this operational demonstration, the CAT II approach with 100ft DH will be requested.

After 6 months of CAT II operations, CAT III A approval with 50ft DH will be requested.

2. The additional operational demonstration will consist of performing at least 70 automatic approaches and automatic landings using CAT III procedures in CAT III A or better weather conditions.
If a success rate of 95% or better is established, and after not less than 6 months of CAT II or CAT III A operations, the CAT III B approval will be requested.

6.3.4 CONTINUOUS MONITORING

Data and statistics to monitor the automatic approach and landing success rate will be established. PIREPS of any unsatisfactory approach and automatic landing or aircraft system malfunction will be retained for a period of twelve months. All the data will be available to the authorities.

6.4 AERODROME REQUIREMENTS

6.4.1 GENERAL

CAT II / CATIII operations are envisaged for a number of airports which fully comply with CAT II / CAT III standards and are approved for such operations by the airport national authorities.

During the operational demonstration period or before conducting approaches and automatic landings in CAT II / CAT III weather conditions at any airport and, the suitability of the ILS installation and terrain before the runway should be verified by a minimum number of automatic approaches and automatic landings.

Before conducting an automatic approach and automatic landing in CAT II / CAT III weather conditions, the crew must verify that Low Visibility Procedures are enforced.

Requirements of AMC to JAR OPS 1.430(b)(4) for airport equipment failure will be used as reference.

6.4.2 RUNWAY CHARACTERISTICS

Required runway length will be verified to comply with automatic landing distance given in the AFM, if this distance is greater than the normal required runway length. Runway width is not to be less than 45m for CAT II / CAT III operations.

6.4.3 OBSTACLE CLEARANCE

For CAT II approach the selected DH must not be lower than the published OCH.

6.4.4 RVR MEASUREMENTS

Touchdown or mid-runway RVR measurement must be available for CAT II and CAT III A operations.

Touchdown and mid-runway RVR measurements must be available for CAT III B operations. Roll-out RVR is advisory.

6.4.5 AUTOMATIC LANDINGS IN CAT I OR BETTER WEATHER CONDITIONS

During the operational demonstration period or for training, automatic landings can be performed on runways not promulgated for CAT II / CAT III operation or without enforcing Low Visibility Procedures. This can be done on a selected number of runways in addition to those qualified for CAT II / CAT III operations.

The airline has checked the suitability of these selected runways for automatic landings.

Criteria to qualify crews for automatic landings in CAT I or better weather conditions have been established.

Special procedures have been developed for this kind of operation and are published in the operation manual.

6.5 OPERATING MINIMA

6.5.1 CAT II AUTOMATIC APPROACH

The DH is determined as the higher of:

- the published OCH,
- the minimum DH applicable to the flight crew,
- 100ft.

The minimum RVR is a function of the DH and is indicated in the table below.

DH	RVR
100-120ft	300m
120-140ft	400m
140 ft and above	450m

Touchdown transmissiometer must indicate a RVR above the listed minimum.

The visual segment associated with DH = 100ft and RVR 300m has been evaluated to be 170m.

6.5.2 CAT III AUTOMATIC APPROACH AND LANDING

CAT III A WITH 50ft DU

For CAT III A operations, the minima are:

- minimum DH 50ft
- minimum RVR 200m

Touchdown transmissiometer must indicate a RVR above listed minimum.

The visual segment associated with DH=50ft and RVR 200m has been evaluated to be 120m.

Procedures recommend the use of both APs, but if one is not operative, CAT III SINGLE can be performed with the same minima.

If roll-out cannot be used or is inoperative, CAT III A automatic approach and landings can still be conducted provided that the AP is disconnected at touch down.

CAT III B automatic approach and landing

For CAT III B operations the minima are:

The minimum DH is 17 ft.

The minimum RVR is 100 m.

For CAT III operations the RVR indicated by both touchdown and mid- runway transmissometers must be above the applicable minima.

The visual segment associated with DH=17ft and RVR 100m has been evaluated to be 60m.

CHAPTER 7

7. LOW VISIBILITY TAKEOFF (LVTO)

- 7.1 GENERAL**
- 7.2 LVTO with RVR between 400m & 150 m**
- 7.3 LVTO with RVR between 150m & 125 m**
- 7.4 LVTO with RVR between 125m & 75 m**

7.1 GENERAL

Takeoff with RVR less than 400m is considered as LVTO by JAR OPS 1.

The maximum RVR at Takeoff is quite independent of the aircraft type and aircraft equipment except for very low RVR.

The Takeoff minima is mainly determined by the airport installation (runway lighting system, RVR measurement system, ...).

When weather conditions are more severe than the landing minima, a takeoff alternate is normally required:

- within one hour for twins
- within two hours for quads
- within the maximum approved diversion time for aircraft qualified for ETOPS, but not more than 2 hours (JAR OPS).

Above time is determined at the one engine inoperative speed.

7.2 LVTO with RVR between 400m and 150m

The minimum RVR in this range of value is a function of the aircraft category and of the runway equipment.

A300, A310, A319, A320, A321, A330-200, -300 and A340-200, -300 are in category C.

For this aircraft category, the JAR OPS gives the following minima.

Ground facilities	RVR
Nil (day only)	500m
Runway edge lighting and/or centerline marking (for night, edge and runway end lights are required)	250m
Runway edge and centerline lighting	200m
Runway edge and centerline lighting and multiple RVR information	150m

Note: The requested RVR value representative of the initial part of the takeoff run can be replaced by pilot assessment.

No operational approval is required to perform LVTO with these minima according to JAR OPS1.

7.3 LVTO with RVR between 150m and 125m

JAR OPS 1 has provision to further reduce the minimum RVR provided the Airline has obtained an operational approval to conduct LVTO with this minima.

Among the conditions which must be met, one is related to the aircraft type.

A visual segment of 90m is required from the cockpit during the takeoff run with the minimum RVR.

The visual segments for RVR 125m are given in the table below for each Airbus model:

Airbus model	Visual segment
A300	105,5m
A310	106m
A319, A320 , A321	112,5m
A330, A340	108,5m

Consequently, all Airbus models have the capability to be operated with 125m RVR at takeoff.

Additional requirements are as follows:

- Low Visibility Procedures are in force
- High intensity runway centerline lights spaced 15m or less and high intensity edge lights spaced 60m or less are in operation
- The 125m RVR value has been achieved for all of the relevant RVR reporting points
- Flight crewmembers have satisfactorily completed training in a simulator approved for this procedure.

7.4 LTVO with RVR between 125m and 75m

JAR OPS 1 has provision to authorize takeoff with RVR between 125m and 75m provided the aircraft is equipped with an approved lateral guidance system and an operational approval has been obtained by the operator.

Such systems have been certified on Airbus Aircraft and have been installed in option:

WGD	Windshield Guidance Display (A310, A300-600)
HUD	Head-Up Display (A330, A320, A319, A321)
PVI	ParaVisual Indicator (A320, A330, A340)

All these systems provide the pilot flying with a lateral guidance using LOC signal.

This kind of display allows the pilot to follow the guidance orders and to continue the monitoring of external visual cues (centerline lights).

The FD lateral guidance indication alone is not considered to be in itself an acceptable means.

With above mentioned optional systems, Airbus Aircraft can be operated at takeoff with a minimum RVR of 75m (as indicated in the AFM) provided runway facilities are equivalent to CAT III landing capabilities and ILS protections are active.

To obtain the operational approval, the Airline must address in particular the flight crew training which must be done in a simulator approved for this procedure.

The training syllabi should include at least:

- Takeoff with engine failure before and after V1
- Takeoff with sudden reduction of RVR
- Takeoff with loss of lateral guidance.

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