

## A340 LOW VISIBILITY OPERATIONS

( AWO = CAT I, **CAT II, CAT III, LVTO, LV taxi** )  
*Beta version*: this paper is working in progress, any mistakes or comments pls notify punn 33567 [punnthep@gmail.com](mailto:punnthep@gmail.com)

### INTRODUCTION

**OBJECTIVE** of CAT 2/3 opns is to provide a level of safety when landing in low visibility conditions, equivalent to that of 'normal' operating conditions.

The main difference between CAT 2 and CAT 3 opns is that CAT 2 provides sufficient visual references to permit a manual landing at DH, whereas *CAT 3 does not provide sufficient visual references for a manual landing and require an automatic landing system.*

Approval for CAT 2/3 opns is dependent on **4As** in order to maintain the required level of safety:

**Aircraft, Airfield, Aircrew, Airline.**

### DEFINITION

**"Low Visibility"** is any visibility below 800m or 550m RVR and minima (or ceiling) below 200' (HAT) for landing and any visibility below 800m for take-off.

**TDZ**: from the runway beginning (threshold) to the intended touchdown point (900m)

**MID zone**: from 1,000 to 1,500m from the threshold

**END zone**: last 300m of the runway

### MINIMA CONCEPTS

	minima	visibility
CAT 1 minima	DH not less than 200' (altimeter)	not less than 800m or 550m RVR

<b>CAT 2 minima</b>	100' ≤ DH < 200' RA	550m > RVR ≥ 350m
	(rollout RVR provides only as an advisory)	

<b>CAT 3A minima</b>	DH < 100' RA or no DH	350m > TDZ & MID RVR ≥ 200m
	(DH ≥ 50' if fail-passive)	
	(rollout control guidance is not required)	

<b>CAT 3B minima</b>	DH < 50' RA or no DH	200m > TDZ & MID RVR ≥ 50m
	(rollout control guidance is required)	

THAI A340 are approved (by DCA) to CAT 2/3A/3B.

CAT 2 : DH=100'RA RVR ≥ 350m (300m\*)

CAT 3A: DH=50'RA RVR ≥ 200m  
(200m/200m/\_m)

CAT 3B: DH=20'RA RVR ≥ 100m  
(100m/100m/\_m)

CAT 2 (\*with RVR < 350m FAA) and CAT 3 opns always require autoland.

### CAT 2/3 OPERATIONS

**CAT 2 OPNS** CAT 2 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).

**CAT 3 OPNS** CAT 3 weather minima *do not provide sufficient visual references at DH to allow a manual landing.* The minima only permit the pilot *to decide if the aircraft will autoland in touchdown zone (basically CAT 3A) and to ensure safety during roll out (basically CAT 3B).*

CAT 3 weather minima also include those opns conducted with an AH 200' or less above the touchdown zone (no DH) and RVR < 350m.

\_ The primary objective of CAT 3 opns is to provide a level of safety equivalent to CAT 1 and CAT 2 opns without the use of these visual cues. As the weather and environmental conditions encountered in CAT 3 opns severely restrict seeing-conditions. External visual reference is not acquire until the aircraft reaches a very low altitude.

\_ Typically, external visual references begin to become available below 100' in CAT 3A opns and below 50' in CAT 3B. Even though visual references are usually available before touchdown, the seeing-conditions are not sufficient for a safe manual landing. Therefore, the aircraft must be controlled by the autoland system throughout the approach, flare and touchdown in CAT 3A weather conditions and through rollout to a safe taxi speed in CAT 3B weather conditions.

*Note: Autoland is not CAT 3. (CAT 3 is a subset of autoland) An automatic landing system is only equipment providing automatic control of the aircraft during approach and landing and is not related to particular weather conditions. This system is mandatory for all CAT 3 opns. However, the ILS performance must be sufficient and ILS signals be protected.*

For FAA requirements, the TDZ, MID and Rollout RVR reporting systems are normally required. However, one of these may be inoperative and the operations may be initiated and continued using the two remaining RVR reporting systems.

Any ILS may be flown with auto-coupled procedures but autoland requires approval by the company (see Lido ILS chart).

### FAIL-PASSIVE & FAIL-OPERATIONAL OPNS

**FAIL-OPERATIONAL OPNS**: *An automatic landing system is fail-operational if, in the event of a failure below the alert height, the approach, the flare and landing can be completed by the remaining part of the automatic system (failure below the AH generally does not require a go-around.) In the event of failure, the automatic landing system will operate as a fail-passive system.*

\_ Fail-operational system must use at least 3 independent sets of flight guidance and control computations ("triple channel") to detect errors and determine which two calculations remain valid. If an error is detected during the comparing process, the systems remain fully operational by comparing all of the calculations to determine which computations is erroneous. The calculation which disagrees with the rest of that computations is disregarded by the system (the bad calculation is voted out by majority rule).

\_ The fail-operational system remains fully operational by continuing to use the remaining computations to provide flight guidance and control. When the failures occurs, there is

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no need for immediate crew action or intervention. The systems which remain functional following these failures provide adequate redundancy and integrity to safely complete the landing.

\_ Fail-operational capability is typically provided by either 3 APs (3 "black boxes") each of which has an independent flight control computation capability ("single channel") [*triple-single by Boeing*] or 2APs (2 "black boxes") each of which has a dual independent computation ("dual channel") [*dual-dual by Airbus*].

\_ Fail-operational opns usually use an AH instead of a DH. Fail-operational landing systems can be used for CAT 3A opns and can also be used in CAT 3B opns if these systems have **at least a fail-passive rollout control capability**.

\_ Fail-operational systems remain operational even if failures occur. In other words, the loss of CAT 3 capability is not permitted when the aircraft is in the critical phases of approach and landing (below 100'AGL).

\_ Fail-operational systems are designed so that the system remains fully operational following any failure that are likely to occur after the aircraft passes 200'AGL.

\_ The system have been shown to have the capability to safely deliver the aircraft to the touchdown zone if the system is still fail-operational when the aircraft passes 200'AGL, even if failures occur in the system after passing this height. Therefore, there is no requirement to establish external visual reference before touchdown to confirm that the aircraft will land safely.

**Fail-operational capability is announced by the display of CAT 3 DUAL on the FMA.**

**CAT 3 DUAL** is announced when the airborne systems are fail-operational. In case of a single failure, the AP will continue to guide the aircraft on the flight path and the automatic landing system will operate as a fail-passive system. In the event of a failure below the AH, the approach, flare and landing can be completed by the remaining part of the automatic system. In that case, no capability degradation is indicated. Such a redundancy allows CAT 3 opns with or without DH.

CAT 3B approach must be fail-operational. For CAT 3 fail-operational operations either a DH or an AH may be used.

**FAIL-PASSIVE OPNS:** 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 (aircraft maintaining a stable flight state i.e. flight path, trim, attitude, etc.) but autoland is not possible.** A manual landing can be completed if there is enough visibility to flare, touchdown and rollout or a go-around is still an option especially if visual cues are inadequate, no matter what RVR is reported.

\_ Fail-passive systems usually use only 2 independent sets of flight guidance and control computations ("dual channel"). If an error is detected during the comparison process, fail-passive system can not determine which computation is erroneous since only two solutions are available, the system fails (disconnects for autoland systems) and immediately provides an aural and visual warning.

\_ Fail-passive capability is provide by either 2APs (2 "black boxes") each has a single flight control computation capability ("single channel") [*dual, single-channel by Boeing*] or 1AP (1 "black boxes") which provides two independent flight control computation ("dual channel") [*single, dual-channel by Airbus*]

\_ Fail-passive opns are restricted to CAT 3A and must use a DH 50' and RVR 200m. Fail-passive CAT 3 systems are permitted to fail below 100'AGL, provided that the flight guidance and control always fail passively (does not disturb the aircraft's flightpath when its fails) and the flight crew immediately receives an aural and visual warning of system failure.

\_ Since a fail-passive system is permitted to fail, a DH must be used to assure that, before passing 50'AGL, the flightcrew established external visual reference with the touchdown zone to determine that the flight guidance and control system is functioning properly and to assure that the aircraft is being properly delivered to the runway.

\_ A go around is mandatory if the systems fails before touchdown during fail-passive opns in CAT 3 weather conditions. If the system fails below 100' AGL, the external visual cue are not sufficient to permit the pilot to use these cues to consistently and safety manually complete the landing in certain CAT 3 weather conditions when RVR is less than 300m.

**Fail-passive capability is announced by the display of CAT 3 SINGLE on the FMA.**

**CAT 3 SINGLE** is announced when the airborne systems are fail-passive which means that a single failure will lead to the AP disconnection without any significant out of trim condition or deviation of the flight path or attitude. Manual flight is then required. This minimum DH is 50ft.

CAT 2 approach can be fail passive (a manual landing and rollout can be completed although this is not to be planned). The failure case applies when the fault occurs when ON the approach and not prior. Fail-passive is associated with **CAT 3 SINGLE** or **CAT 2** on the FMA.

### DECISION HEIGHT & ALERT HEIGHT

**DECISION HEIGHT DH** **The point at which a missed approach must be initiated if required visual reference is not established.** The DH is measured by means of Radio Altimeter RA.

\_ For CAT 2 and CAT 3 (when using a fail-passive landing system) a DH (or an equivalent IM position) is used as the controlling minima ( DA is considered as advisory).

\_ A DH is applied to all fail-passive opns and is specified at certain locations where fail-operational minima is authorized. For CAT 3, a DH is usually based on a specified RA above terrain on the final approach or touchdown zone. The DH is established to assure that prior to passing that point the pilot is able to determine that adequate visual reference exists to allow verification that aircraft should touch down in the touchdown zone.

**ALERT HEIGHT AH (FCOM 4.05.70)**

**The AH is the height above the runway (touchdown zone), based on the characteristics of the airplane and its fail-operational automatic landing system.**

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+ Above this height, if a failure occurred in one of the required redundant operational systems or the relevant ground equipment, a CAT 3 approach would be discontinued and a missed approach executed.

+Below this height, if such a failure occurred, it would be ignored and the approach continued (except if AUTOLAND warning is triggered) flare, touchdown and rollout may be safely accomplished by the remaining automatic system.

\_ The AH is specified by an operator of an aircraft and approved by DCA. For A340, the AH (airworthiness demonstration by AIRBUS) is 200' and an operator THAI company use AH 100'.

\_ Operational AH must always be equal to or lower than that specified in the airworthiness demonstration, and may be specified at or below 200' HAT.

\_ Procedure should be specified for call-out of the AH and if applicable for conversion of the AH to a DH in the event that aircraft reverts from fail-operational to fail-passive flight control.

\_ The AH is associated with both the AP and the ILS beams. If the pilot can continue by visual reference (CAT 1 or better) then a manual landing can still be completed.

\_ All CAT 3A fail-passive ops are conducted in accordance with the DH (50') and RVR concept. All CAT 3A and 3B fail-operational ops are normally conducted in accordance with the AH and RVR concept. (DH are only used with fail-operational systems in very unique situations.)

DH and AH are never used together in any operation since the DH requires that external visual reference be established before passing a specified point but AH does not.

### VISUAL REFERENCES

"Require visual reference" means that the section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot have made an assessment of the aircraft position and the rate of change of position in relation to the desired flight path (ICAO).

#### VISIBILITY REQUIREMENTS AT MINIMA

**SVR** (slant visual range) can vary greatly (less or more) from RVR. SVR cannot be measured. SVR is more often (90% of cases) less than RVR.

**RVR** (runway visual range) is measured when visibility is below 500m. End zone measurement is not required unless mid zone is not available. For CAT 3B ops all RVR zones are required.

#### WHAT TO SEE ? and SEE FOR WHAT ?

CAT 1: at minima, a portion of the approach lights or the threshold lights (if no approach lighting). Threshold should come into view shortly. For non-precision approach and precision approach CAT I, an approach may not be continued below MDA or DA/H, unless **at least one of the following**

visual references for the intended runway is distinctly visible and identifiable to the pilot: (lights + markings)

1. Element of the approach light system
2. Threshold
3. Threshold markings
4. Threshold lights
5. Threshold identification lights
6. Visual glide slope indicator
7. Touchdown zone or touch down zone markings
8. Touchdown zone lights.

**CAT 2:** Visual reference means "being able to see to landing" (i.e. able to conduct a hand-flown landing).

At DH, a substantial span of the approach lights commencing midway between the first 2 crossbars and extending to the threshold, provide sufficient visual references *to permit an autoland (RVR <350m) or automatic approach with a manual landing (RVR ≥350m).*

Visual aids required for CAT 2 operations consist of

1. High intensity approach lights system (HIALS),
2. High intensity runway edge lights (HIRL),
3. Runway centerline lights (CL),
4. Touchdown zone lights (TDZ),
5. Runway end lights (REIL),
6. Threshold lights and runway markings.

**CAT 3:** Visual reference means "being to see to verify aircraft position for landing" (ALAR).

at DH, TDZ or other runway lights appropriate to the DH must be visible, The minima only permit the pilot to decide if the aircraft will land in the touchdown zone (CAT 3A) and to ensure safety during rollout (CAT 3B). *Therefore an automatic landing system is mandatory to perform CAT 3 operations.* Its reliability must be sufficient to control the aircraft to touchdown in CAT 3A operations and through rollout to a safe taxi speed in CAT 3B

For **CAT 2 and CAT 3A**, a pilot may not continue an approach below DH unless a visual reference containing a segment of at least 3 consecutive lights of the following is attained and can be maintained: (lights)

1. Centerline of the approach lights, or
2. Touchdown zone lights, or
3. Runway centerline lights, or
4. Runway edge lights, or

A combination of these lights.

Note Only applied to CAT 2, the visual reference must include a lateral element, such as an approach lighting crossbar or threshold lights or a barrette of the touchdown zone lights.

For **CAT 3B**, a pilot may not continue an approach below the DH, unless a visual reference containing **at least one centerline light** is attained and can be maintained.

### 4A AIRPORT

#### **AIRPORT FACILITIES**

Threshold Crossing Height (TCH) for ILS suitable for CAT 2 and CAT 3 ops is 50' to 60'.

Airports with low vis operation approval must have:  
\_ non-visual aids; accurate ILS beams (strict criteria and sensitive area)

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- \_ back-up power to the ILS and lighting equipment
  - \_ certified lighting (approach, runway, taxiway)
  - \_ visual aids and runway marks
  - \_ approach, tower and ground ATC procedures and ATC clearance
  - \_ ILS beam clear areas for integrity of signal
  - \_ runway characteristics ex. min runway width (45m), runway slope
  - \_ special taxiway design, sign-age and lighting
  - \_ accurate weather measuring equipment (especially RVR)
  - \_ obstacle clearance area
- An autoland runway does not necessarily meet LVO approval.

### AIRPORT LIGHTING

**\*Approach Light (ALS):** High Intensity Approach Light (HIAL), approach lighting unserviceabilities the minimum required working sections of the approach lights is:

- \_ the inner 720m for CAT 2 opns.
- \_ the inner 300m for CAT 3 opns.

For CAT 3 opns to below 50' DH, HIAL is not required (optional). CALVERT, ALSF I or ALSF II approach lighting systems are approved for CAT 2/3 opns. The strobes within the ALSF lights should be independently switched off for low vis opns.

**\*Runway Touchdown Zone Light (RTZL)** must be available for all CAT 2/3 opns.

**\*Runway Centerline Light (RCCL)** must be available for all CAT 2/3 opns. CAT 2 requires 7.5m, 15m or 30 m spacing. CAT 3 requires 7.5m or 15m spacing. (CL alternates red and white from the last 900m to the last 300m of the runway. For the last 300m of the runway the CL are all red.)

**\*Runway Edge Light** High Intensity Runway Edge Lighting (HIRL) required for CAT 2/3 approach.

**Runway End Identifier Light (REIL).** **Sequenced Flashing Light (SFL)** is considered incompatible with low vis ops. It should be turned off. The pilot can request this if not already off.

### Taxiway lights

1. Taxiway edge lights (blue) are not required for CAT2/3.
2. \*Taxiway centerline lights (green, green and yellow) are required for operations with RVR 400m (CAT 2) or less with max spacing 15m (straight line) or 7.5m (curve).

**Stop Bars** (red) are used at each taxi-holding position when RVR less than 400m and are specially required for all CAT3 approach.

## 4A AIRCRAFT ( SYSTEM FAILURE)

### Aircraft Light

1. Landing light are not recommended for low vis ops.
2. The runway turn off lights may be use by pilot discretion.

**Automatic Call-out** The automatic retard call is 20' for manual landing and 10' for autoland.

At 200' CAT 3 DUAL AH

At 100' CAT 3 DUAL no DH

### SYSTEM FAILURES

With a failure there are only 3 options:

- \_ continue to planned minima
- \_ revert to a higher minima
- \_ go-around

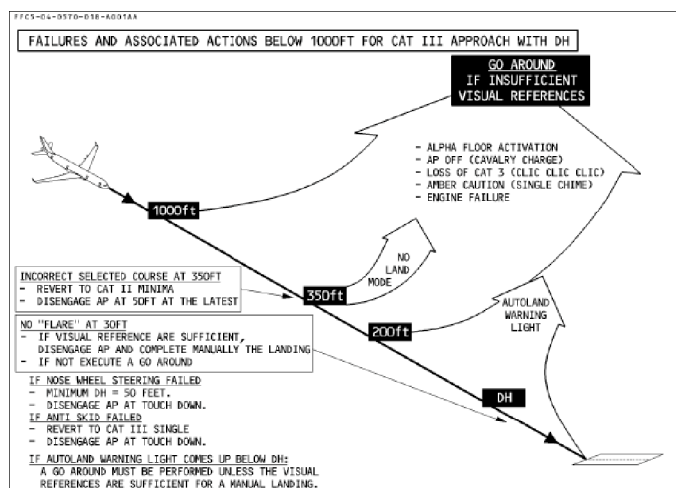
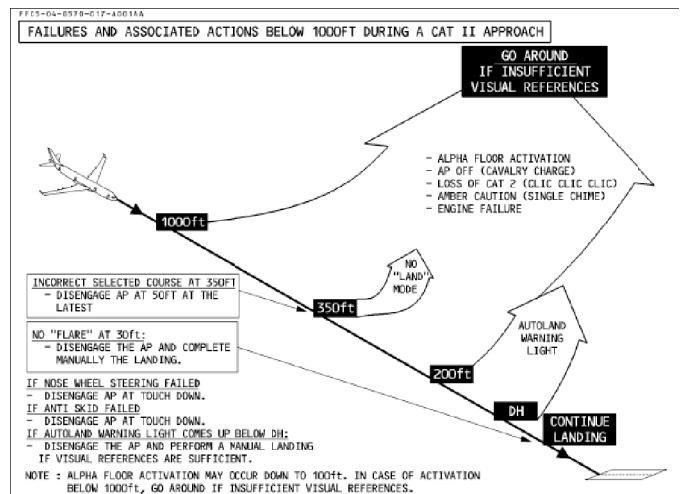
" It is considered preferable to discontinue an approach rather than attempt corrective following a system failure or warning below 1,000' RA "

Continuation of approach following a failure can be done if:

- \_ all ECAM actions are completed
- \_ the failure does not affect the minima (no reversion)
- \_ the failure requires reversion to a higher minima and the weather is suitable for the higher minima and the decision to revert is completed by 1,000' HAT.

**AP** AP engagement or re-engagement below 1,000' RA is not permitted.

**A/THR** If A/THR has failed, try using the other AP and re-engaging A/THR (above 1,000' RA only)



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### Below 1,000' RA down to 200' RA

In true low vis ops, a GO AROUND must be performed if insufficient visual references when;

- \_ ALPHA FLOOR activation
- \_ AP OFF (cavalry charge)
- \_ loss of CAT 2 or CAT 3 (clic clic clic)
- \_ Any AMBER caution (single chime)
- \_ ENGINE failure
- \_ Any FLAG (including STBY ASI)
- \_ LOC/GS excessive deviation

**At 350' RA** no "LAND" = GO AROUND

**Below 200' RA** CAT 2/3 - "AUTOLAND" warning light = GO AROUND

**Below DH** In true low vis ops ;

- \_ CAT 2 "AUTOLAND" warning light = *manual landing* if visual references are sufficient.
- \_ no FLARE on FMA at 30'
  1. CAT 2 - disengage AP, *manually flare and rollout.*
  2. CAT 3 with DH
    - if visual, disengage AP *manually landing.*
    - if not GO AROUND

### If NWS & Anti Skid fail

1. NWS failed (CAT 2/3 with DH)= disengage AP at touchdown, manual rollout control with rudder
2. Anti skid failed
  - CAT 2- disengage AP at touchdown
  - CAT 3 with DH - revert to CAT3 SINGLE, disengage AP at touchdown

### "AUTOLAND" Light

Comes on with RA below 200' and:

- \_ both AP s fail or
- \_ lost of LOC signal above 15' or lost of GS signal above 10' ( transmitters or receivers fail) or
- \_ the two RAs differ by more than 15' or
- \_ the a/c becomes too far off the beam (LOC and GS flash on PFD)

### Unserviceabilities

With MELs or in-flight ECAM actions check the required equipment table in the QRH or the MEL text itself for low vis ops restrictions.

- \_ One engine out autoland can be completed to CAT 2 and CAT 3 SINGLE criteria (see Limitations).

### Failure and actions above 1000' for CAT2/3

FAILURE (for multiple failures, the most limiting applies)	ACTION TO BE PERFORMED ABOVE 1000 FT	LANDING CATEGORY
ONE OUTER ENGINE-OUT	Complete ECAM procedure. Land in CONF3	CAT III DUAL
ONE INNER ENGINE-OUT	Complete ECAM procedure. Land in CONF3.	CAT III SINGLE
TWO ENGINES OUT	Complete ECAM procedure	CAT I Disengage AP
ENGINE EPR MODE FAULT	Complete ECAM procedure	CAT II (if A/THR not used)
LANDING CAPABILITY DECREASE	Try to recover	As displayed on FMA
"AP OFF" warnings	Try to recover	As displayed on FMA
LOSS OF A/THR	Switch AP, and try to re-engage	CAT II (if A/THR not recovered)
NOSEWHEEL STEERING		CAT III SINGLE (DH = 50 feet) Disengage AP at touch down
ANTI-SKID		CAT III SINGLE Disengage AP at touch down
AMBER "CHECK ATT" ON TWO PFDs	Check with standby horizon, use switching to recover (no switching below 1000 feet)	CAT III SINGLE (if the warning disappears) CAT I (if not)
AMBER "CHECK HDG" ON TWO PFDs AND TWO NDs	Check with standby compass, use switching to recover (no switching below 1000 feet)	
RED "HDG" ON ONE PFD AND ONE ND	Use switching to recover (no switching below 1000 feet)	
RED "ATT" ON ONE PFD		
RED "SPD" ON ONE PFD		
DIAGONAL LINE ON ONE PFD AND ONE ND		
RED "RA" ON TWO PFDs	AP and FD unavailable	CAT I (minimum RVR as per regulation)
SLATS/FLAPS FAILURE (LESS THAN CONF 3)		CAT I Disengage AP at or above 500 feet

4A

AIRCREW

### CAT 2/3 Qualification Requirements (THAI)

1. Flight crew members with no CAT 2 or 3 experience must complete the full training program.
2. Flight crew with CAT 2/3 experience (Conversion) may require to undertake the following:
  - A) Abbreviated ground training; and
  - B) Simulator training – At least successful completion of 8 approaches and/or landing; or
  - C) Flight training – Where no type-specific simulator is available, at least successful completion of 3 approaches including at least 1 go-around is required .
3. Following the simulator or flight training, R/I or LIFUS must be flown simulated according to the listed number of landings given below:
  - a) CAT 2 – When a manual landing is required, a minimum of 3 landing from autopilot disconnect. For ACFT certified for an autoland, this requirement is disregarded.
  - b) CAT 3 – A minimum of 3 auto-lands, except that only 1 autoland is required when the training in para 2 b) or c) above has been carried out.

Note Simulated CAT 2/3 shall be carried out when actual weather report is at or above CAT 1 minima.

4A

AIRLINE (OPERATOR)

### COMPANY REGULATIONS FOR CAT 2/3 OPNS (THAI)

#### General

1. Do not request "Practice CAT 2/3" approach unless necessary as the capacity of the aerodrome will decrease due to increased separation minima.
2. CAT 2 procedure is mandatory when RVR is below 550m. CAT III procedure is mandatory when RVR is below 350 m

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(300 m where stated by local authorities.)

3. RWYs approved for CAT 2/3 are indicated in the appropriate approach charts. DH is based on Radio Altimeter (RA) reading.

4. Both pilots must be qualified for the approach in question, except during LIFUS and Route Introduction.

### Operations

1. LP must perform the approach and landing, except during R/I or LIFUS, the instructor or Line Check pilot occupying right seat is allowed to perform a CAT 2/3 approach in CAT 2/3 weather conditions.

2. The P-i-C shall satisfy himself, prior to commencing CAT 2/3 approach, that:

- + The status of the visual and non-visual facilities is sufficient;
- + Low visibility procedures are in force; and
- + The flight crew members are properly qualified.

3. Before commencing CAT 2/3 operations, the following additional requirements are applicable to the P-i-C or delegated pilots who are new to the aircraft type:

- + 50 hours or 20 sectors on the aircraft type, including LIFUS, must be obtained; and
- + 100m must be added to the applicable CAT 2/3 RVR minima until a total of 100 hours or 40 sectors, including LIFUS, has been achieved on aircraft type.

4. Max available flap setting shall be used.

5. Below 200' RA, the flight path must stay within the limitations stated in the respective AOM/FCOM regarding localizer and glide path.

6. Wind component measured on ground shall not exceed limitations for the aircraft types (AOM/FCOM).

### Use of Automatic Flight System

1. Autoland is approved for all ILS runways, except where localizer is offset and when otherwise stated on the approach chart.

2. Type of approach to be performed:

CAT 2 – Automatic approach, when RVR not less than 350 m, and with automatic landing when RVR less than 350 m down to 300 m.

CAT 3 A/B – Automatic approach with automatic landing.

3. Whenever performed an autoland, the autoland record form available in the FFF shall be filled in.

4. The CAT 2/3 unsatisfactory autoland shall be reported, according to FOM 5.8.10.

### Airborne and Ground Equipment

1. In case of airborne equipment/system is downgraded to be below the minimum required for the respective aircraft MEL, including autopilot failure/disengagement, the following actions shall be performed:

	CAT II	CAT IIIA	CAT IIIB
After passing OM or equivalent PSN	Reversion to higher minima	Reversion to higher minima	Reversion to higher minima
Below 1000 ft RA	Reversion to higher minima	Go around	Go around
At or below AH 100 ft	Not applicable	Not applicable	Continue to land if AUTOLAND * can be maintained and without certain malfunctions in respective AOM/FCOM otherwise Go around
At or below DH	Continue to land if visual reference is maintained	Go around	Go around

**RVR Reporting Requirements** See FOM 4.1.1.

**Recurrent Training and Checking** In conjunction with the normal recurrent training and checking, stated in FOM 6.1.4.,

the required number of approaches within the validity period of the PFT is to be a minimum of three (3), one of which may be substituted by an approach and landing in the aircraft using approved CAT 2 or 3 procedures. One missed approach shall be flown during the conduct of PFT.

Note Recency for CAT 2/3 based upon automatic approaches and/or autoland is maintained by the recurrent training and checking as prescribed above.

### LIMITATIONS

#### Max Wind for CAT2/3 AUTO APP or AUTOLAND and AUTO ROLLOUT

	A345	A346
HWC	30 kt	35 kt
XWC	23 kt	20 kt
TWC	10 kt	10 kt

Note: Wind is based on surface wind as reported by the tower. If the wind displayed on the ND exceeds the above-noted autoland limitations, but the tower reports surface wind within the limitations, then AP can remain engaged.

If the tower reports surface wind beyond the limitations, only a CAT 1 automatic approach without autoland can be performed.

#### AUTOMATIC APP, LANDING and ROLLOUT

	minima	AFS	FMA
CAT 2	DH 100'AGL	at least 1AP	"CAT 2/ CAT 3 SINGLE/ CAT 3 DUAL"

CAT 3 Fail-Passive	DH 50'	at least 1AP+A/THR	"CAT 3 SINGLE/ CAT 3 DUAL "
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CAT 3 Fail-Operational	AH 200' min RVR 75'	2APs+A/THR	"CAT 3 DUAL"
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#### Engine Out Autoland

CAT 2/3 autoland are only approved in conf 3 if engine out procedure are completed before 1,000' in app.

CAT 3 Fail-Passive autoland is approved in [single inner engine out](#).

CAT 3 Fail-Operational autoland is approved in [single outer engine out](#).

#### Automatic Landing

CAT 2/3 autoland are approved in conf 3 & conf FULL Automatic Landing has been demonstrated: (not limitation)

- \_ with CAT 2/3 ILS beam,
- \_ with ILS slope angle A345 2.85 to 3.15 ° A346 2.5 to 3.15 °
- \_ airfield elevations < 5,750' 9,200'
- \_ weight less than MLDW
- \_ at app. speed ---- VAPP=VLS+(5 to15) kt
- \_ demonstrated to MLDW only (crew responsibility) 250t 270t

Automatic rollout performance has been approved on dry and wet runways (but snow covered or icy runways not demonstrated)

#### Autoland with Unprotected Beams

Autoland has been demonstrated on CAT 2 and CAT 3 ILS beams. However autoland in CAT 1, or better, weather conditions is possible on CAT 1 ground installation or CAT 2/3 facility when ILS-sensitive area are not protected, if the following precautions are taken:

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\_ airline checked the ILS beam quality and terrain profile has no effects on AP guidance (terrain discontinuities within 300m before runway threshold must be evaluated).

\_ pilot is aware and prepare to disconnect AP and take action if LOC or GS beam fluctuations, and unsatisfactory guidance occur.

\_ at least CAT 2 capability displayed on FMA and CAT 2/3 procedures are used.

\_ visual references are obtained at a DH appropriated for CAT 1 approach being flown, or a go-around is performed.

*Note Autoland can be performed up to (A345= 250 ton/ A346= 270 ton) in case of emergency and under crew responsibility.*

### PROCEDURES

**General** Low Vis Procedures must be established by 1,000' RA. Above this, changing between procedures is OK provided that the necessary calls and height checks have been done.

Down-grading procedures can be done at any time however changing from Low Visibility Procedures to Instrument Procedures at low level is not recommended due to the complexities of exchanging HEAD DOWN and HEAD FREE roles.

Captain must always be PF when low vis procedures in use. Low vis procedures are always required when low vis weather exists.

Low vis approach is not to be commenced unless there is a reasonable chance of becoming visual at the minima. Approach bans for each state may also apply.

Low vis procedures normally start at the IAF, the intercept of finals leg or no later than 1,000'.

**Minima Reversion** An approach should always be flown to the lowest published minima for which the aircraft serviceability will allow. Reversionary minima due system failures, etc, should be briefed by the Captain.

#### **CAT 2 approach requires:**

- \_ see lightings and/or markings requirements above
- \_ Braking action no worse than medium.
- \_ Landing distance available greater than 2,400m (or performance chart figure x 1.15).
- \_ FMA displays either "CAT 2" or "CAT 3 SINGLE" or "CAT 3 DUAL".
- \_ At least 1 AP engaged.
- \_ autothrust is recommended.

#### **CAT 3 approach requires:**

- the same conditions as above as well as:
- \_ FMA "CAT 3 SINGLE" or "CAT 3 DUAL" for CAT 3A approach and at least 1 AP
  - \_ FMA "CAT 3 DUAL" for CAT 3B app. and both APs

- \_ autothrust is mandatory.
- \_ automatic go-around capability is required.

#### **Standard Calls**

F/O (PNF) is head down from the beginning of the approach to the completion of the go-around or the disconnection of the autopilot at the end of the landing roll (or if the Captain changes procedures).

Support calls should be:

- \_ concise
- \_ unambiguous
- \_ correct terminology
- \_ not using words which are reserved for use elsewhere such as stable or visual.

See Low Vis Calls document for standard (an failure-case) calls.

#### **Task Sharing CAT 2/3 App with DH**

PF	PNF
<b>At 350 feet RA</b>	
- Check ILS course on PFD - Commence outside scanning - Announce "LAND GREEN" when displayed on FMA	
<b>At Decision Height + 100 feet</b>	
	- Monitor AUTO CALL OUT "Hundred above"
<b>At Decision Height</b>	
	- Monitor CALL OUT "Minimum".
<b>If external visual references are sufficient</b>	
- Announce "LANDING"	
<b>If Automatic landing not performed</b>	
- Disconnect the AP's and perform the landing	- Monitor CALL OUT or announce as appropriate : 400ft 300ft 200ft 100ft 50ft 30ft 20ft
- At "RETARD" annunciation, retard thrust levers to IDLE if not yet performed	10ft "RETARD" auto call out*
<b>If Automatic landing is performed</b>	
refer to CAT 3 without DH	
<b>If external visual references are not sufficient</b>	
- ANNOUNCE "Go-around" and EXECUTE	

\* "RETARD" auto call out comes up at 10 feet if LAND mode is engaged with one or two APs engaged. Otherwise it is announced at 20 feet.

#### **Changes to Chart Visibility Minima**

If the glideslope height check (OM or DME) is not able to be completed the low vis ops may not be continued. With weather better than CAT 1 revert to the LOC minima. For low vis conditions, a go-around is required.

If HIAL is installed but not available then the visibility minima must be increased to 1,500m.

If the ILS is not flown with FDs or AP used then the visibility/RVR minima must be increased to 1,200m.

#### **General**

\_ The QRH Low Vis Opns Briefing is to be consulted prior to low vis takeoff and low vis landing.

## A340 LOW VISIBILITY OPERATIONS

- \_ Hands are to be kept on the thrust lever below 1,500' HAT
- \_ ACARS entry for autoland is CAT 2 or CAT 3 and AUTOLAND.
- \_ Taxi slowly in low vis weather.
- \_ Low vis weather may also bring contaminated runway issues or cold weather issues.

### Stabilized Approach Criteria

Approaches should be stable by 1,000' HAT  
 If the approach is not stable by 500' HAT then a go around is immediately required.

### LOW VISIBILITY TAKEOFF LVTO

All takeoffs in RVR of 500 m or less (visibility if RVR not available) must be performed by the LP.  
 Max crosswind is 10 kts.

**LVTO** procedure: Takeoff with RVR less than 400m.  
 A low visibility takeoff with RVR/VIS below 400 m is considered as LVTO by JAR OPS1 and requires verification that Low Visibility Procedures (LVP's) have been established and are in force.  
 THAI aircraft, A330, A340 have been approved for conducting low visibility takeoff by qualified pilots as low as RVR 150m.

*Takeoff minima* are expressed as visibility or RVR limits, taking into account all relevant factors for each aerodrome planned to be used and the aircraft characteristics. Where there is a specific need to see and avoid obstacles on departure, takeoff minima may include cloud base limits.  
 \_ When both visibility and RVR are given, RVR has priority.  
 \_ Whenever multiple RVR reported, the lowest RVR shall be used to determine takeoff minima.

### LVTO Lighting Requirements

Category B, C, D ACFT

Vis/RVR (M)	Cat.	Conditions
500 <sup>1)</sup>	B C D	• NIL (Day only)
300 <sup>1)</sup>	D	• REDL (H or L) or runway centerline markings. • LVP in force.
250 <sup>1)</sup>	D	• REDL (H or L) and RCLL • LVP in force.
250 <sup>1)</sup>	B C	• REDL (H or L) or RCLL • LVP in force.
200 <sup>1) 2)</sup>	D	• REDL (H or L) and RCLL and multiple RVR INFO. • LVP in force.
200 <sup>1)</sup>	B C	• REDL (H or L) and RCLL • LVP in force.
150 <sup>1) 2)</sup>	B C	• REDL (H or L) and RCLL and multiple RVR INFO. • LVP in force.
150 <sup>2)</sup>	D	• Multiple RVR INFO. • LVP in force
125 <sup>2)</sup>	B C	• HI RCLL, spacing 15M/50ft or less • HI REDL, spacing 60M/200ft or less • No RWY contamination • 90M/300ft - visual segment from the flight deck. In addition: • Approved lateral guidance system for TKOF. • RWY protection and facilities equivalent to CAT III AVBL.
75 - 149	D	
75 - 124	B C	

**Note:**  
 1) PIL assessment (see above)  
 2) RVR value must be achieved for all RVR reporting PTs with the exception given under Note 1)

### Other Requirements for LVTO

+ If there is a turn of more than 15 degrees required after takeoff then the minimum visibility is 500m.

- + All nav aids are to be used (PFD yaw bar guide OK as is based on the LLZ signal) to assist with runway tracking during take-off.
- + On line-up, the correct runway must be confirmed.

### LVTO Crosswind Limit

Take-off with vis less than 400m – max XWC is 10 kts

### Lost Visibility during Takeoff

- \_ Below 100 kts (low speed) reject the take-off if visibility is lost.
- \_ Above 100 kts (high speed) continue the take-off if visibility is lost unless some other failure also occurs (such as engine failure) which requires a RTO below V1.

### CAT 2/3 OPNS BRIEFING

..... under construction !! .....