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PROCEDURE TRAINING NOTES

INTRODUCTION

All pilots converting onto the A340 will be trained to Cat 3B limit.

LINE TRAINING

On completion of the Ground School and Simulator Course, which includes a dedicated AWOPS Simulator Session, First Officers are fully qualified for AWOPS Cat 3B. Captains will complete one Autoland with a Training Captain, Line Check Captain or Line Training Captain to become fully qualified, provided the training has been carried out in a simulator suitable for zero flight time training, otherwise three landings are required. Commanders will have to obtain 50 hours or 20 sectors as pilot-in-command on type before performing any category 2 or 3 operation, this requirement will normally be satisfied by the end of Line Training.

NEW CAPTAINS RESTRICTED MINIMA

In addition to these requirements, Commanders with less than 100 hours or 40 sectors as pilot-in-command on type shall add 100 metres to the applicable Category 2/3 RVR minimum. Captains with previous Category 2/3 experience are exempt from this requirement.

REVALIDATION

Pilots will revalidate their LVO qualification on each OPC by carrying out a minimum of three approaches, one of which must culminate in a missed approach. Additionally one low visibility take-off at the lowest minima must be flown. The individual's LVO card must be signed.

REGENCY

Recency for LVO is maintained by the recurrent training and checking prescribed above. It is desirable that Captains perform one autoland every six months on the aircraft and, although this landing will count towards normal landing recency, it is not intended that this alleviation would be used on a regular basis. At any time an autoland is carried out the pilots landing record card should be annotated.

FLIGHT PLANNING

In addition to the normal pre-flight planning, the following points must be covered :

WEATHER

The weather at the departure aerodrome must be equal to or greater than the prescribed take-off minima below:

RVR VISIBILITY FOR TAKE-OFF

FACILITIES	RVR/Visibility (m)
Nil (Day Only)	500
Runway Edge lighting and/or Centreline Marking	250 (1)
Runway Edge lighting and Centreline Lighting	200
Runway Edge centreline lighting with multiple RVR info	125 (2)

- NOTES:**
1. For night operations, at least runway edge and runway end lights are required.
 2. The reported RVR/visibility representative of the initial part of the take-off run may be replaced by pilot assessment.
 3. State take-off minima applies where more restrictive.

If the RVR is reported in segments, the required RVR must be satisfied in all segments. Airfields at which higher than normal take-off minima by Company restriction, or runways where take-off is prohibited will be notified in the Captain's brief.

Although the JAA definition of a low visibility T/O is a T/O in a reported RVR of less than 400m, Company LVO procedures are to be used whenever LVO procedures are in force or the RVR is less than CAT 1.

If the weather at the departure aerodrome is below the appropriate landing minima, a take-off alternate aerodrome must be nominated within 120 minutes at one engine out speed, with a MET report/forecast to be at or above Cat 1 from 1 hour before to 1 hour after the aircraft's ETA.

Planning Minima En-Route and Destination Alternate Airfields

Type of Approach at Alternate	Planning Minima at ALT
CAT II and III	Cat I (NOTE 1)
Cat I	Non-Precision (NOTE 2)
Non-Precision	Non-Precision plus 200 ft/1000m
Circling	Circling

- NOTES:**
1. RVR and ceiling Cat I or greater.
 2. The RVR and ceiling must be at or above the MDA.
 3. State minima may be at variance with the table above.

Two destination alternates are required if the destination weather is forecast to be below Cat 1 minima from 1 hour before to 1 hour after the aircraft's ETA. State alternate minima, where more restrictive apply.

BRIEFING or AIS

Check that there are no NOTAMS applicable for the destination such that a Cat 2 or 3 approach is precluded.

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CREW

Qualified for conditions :

In order to operate below Cat 1, all crew must be in possession of a current Low Visibility Operations Rating/ Revalidation Card.

FUEL

Careful consideration must be given to fuel requirements. Additional fuel will almost certainly be required for the following reasons :

1. Approach delays caused by increased separation between aircraft on Approach, probably involving low altitude holding and longer than normal approach routings.
2. Delays caused by a backlog of departing and arriving traffic.
3. Increments for anti-icing and manoeuvring.
4. Potential diversion delays and holding at the nominated diversion airfield.

It must be appreciated that there are a large number of aircraft equipped to operate in Cat 2 and 3 conditions, and that the ability to so operate will not necessarily guarantee priority approach clearance.

For these reasons, an additional amount equal to at least 45 minutes holding fuel at destination should normally be carried, and extra taxi fuel should be considered when planning a take-off in LVO conditions.

AT THE AIRCRAFT

In addition to the normal checks :

Check autopilot is not downgraded in the Tech Log. Autoland status is limited to the ADD declared status until the ADD is cleared.

Ensure that the aircraft has no other defects that would affect approach capability, which can be confirmed using the Required Equipment for Cat 2 and Cat 3 Table.

Check familiarity with the Cat 2/3 holding points for the take-off and any taxiways which should or should not be used. Within Europe if flow restrictions are in force due to destination weather conditions, prior to start-up inform ATC of the intention of Cat 2/3 landing at destination.

TAXI OUT

Bear in mind that in poor visibility, e.g. 100m (330 ft) RVR, one might expect to see bright lights 100m away, but not unlit or poorly lit obstacles such as aircraft tails or wingtips. From certain angles their navigation lights are not readily discernible and the greatest distance from which a white painted aircraft may be visible in 100m RVR may be less than 75m. Movement rates will be low in these conditions, but taxi as slowly as safety demands.

Use of Ground Movement radar, the compass, aerodrome chart and the low visibility ground movement chart will help to assess the aircraft position and help in anticipating bends in the taxiways. Centreline light spacing may be reduced on bends and caution should be exercised when coming out of the bend where the lighting reverts to normal. Be careful not to pass the Cat 2/3 holding point : green taxiway centre-line lights may be illuminated beyond the Cat 2/3 holding point if it does not coincide with a taxiway stopbar or if a preceding aircraft is just lining up.

The First Officer should monitor the groundspeed display, advising the Captain of excessive speed and generally keep a look out for other aircraft as well as assisting the Captain by reference to the taxi charts when required. No checks should be carried out until the aircraft is at the holding point for the runway in use and, in particular, until the Cat 2/3 holding point has been identified and complied with. The Jeppesen Charts show the minimum RVR for takeoff for the intended runway. All relevant RVR's must be at or above the minimum listed.

Prior to entering the runway, consider the runway state and braking action especially with a RVR of 125 m. Check the appropriate RVRs are above minima before passing the holding point.

As the aircraft is lined up on the runway, confirm that it is placed on the runway centreline lights and not the edge lights. Use of the ILS for that runway can be of assistance. Check that the number of visible centre-line lights is consistent with the reported RVR. The minimum number should be 9 or 5 for a spacing of 15 m or 30 m respectively for a RVR of 125 m.

TAKEOFF

The main aid during the take-off run will be the centreline lighting. Care should be taken not to confuse the centreline lighting with runway edge lighting. Prior to brake release check aircraft heading is the same as the expected runway direction.

If available, the departure runway ILS will be autotuned and LS pushbuttons must be ON for take-off. RWY mode will engage upon application of take-off thrust providing runway centreline guidance. Although useful as a centreline indication, they should not be used as a sole reference during take-off.

TOGA thrust should be used to minimise the ground roll and it should be noted that the maximum crosswind allowed for take-off in these conditions is 10 kts.

Should there be any significant deviation left or right of the runway centreline, the First Officer will call "deviating left" or "deviating right" as appropriate.

During the take-off the Captain may need to direct his attention inside (for example when entering a fog bank), and should announce this by calling "HEADS IN". The First Officer will then direct his attention outside and call "HEADS OUT". The Captain will keep control of the Aircraft and monitor that the Aircraft is tracking along the runway centreline by using localiser guidance on the PFD/ND. When the First Officer regains visual reference he calls "HEADS IN". The Captain then looks out and responds "HEADS OUT".

REJECTED TAKE-OFF

Standard abandon drills must be used, bearing in mind the following:

The green "DECEL" indication on the autobrake should be monitored carefully to ensure correct system operation.

As speed reduces the centreline lights become increasingly difficult to follow in low visibility. The Captain should concentrate his attention outside whilst the First Officer glances at the PFD indications, advising the Captain when appropriate.

On a standard Cat 2/3 runway, the centreline lighting changes from white to alternating red/white 900m from the end and to red for the final 300 m. It should be noted that the use of all external lights (including strobes) may aid the emergency services in finding the aircraft.

EN-ROUTE

The key to successful operations in poor weather is careful and timely preparation. Collection of weather reports and ATIS broadcasts is essential to maintain all diversion options.

When within the airways sector containing the airfield of intended landing, ATC should be informed of the intended Cat 2/3 approach. This ensures early notice of any change of airfield state and enables ATC to apply those procedures normally established to give priority to Cat 2/3 aircraft.

It may be assumed in the UK that when Low Visibility Procedures are promulgated as being in use, the absence of information to the contrary indicates that all relevant equipment is serviceable. In the UK LVPs will be initiated by ATC when RVR falls below 600 m or cloud base lowers below 200 ft.

The approach briefing should be carried out in good time and in a thorough and unhurried manner ensuring that the following items in particular are briefed in addition to those normally required :

1. Consideration should be given to switching off the white strobes and landing lights (reducing glare).
2. Seat position.
3. Call-outs during approach and PNF duties (i.e. remaining on instruments).
4. Visual reference required at DH (if applicable) to continue autoland.
5. Use of autobrake and flap.
6. Procedures for roll out and runway clearance.
7. Go around procedure.
8. Non-normal and emergency procedures.

The appropriate DH for Cat 2/3 is entered into the FMGC. If there is no DH, '0' must still be entered in the DH box on the Perf Page (produces the "100 above call"). Cat 1 MDA is selected on the standby altimeter to cater for failures and reversion to Cat 1 limits.

Autobrake should normally be selected to Low but Med can be used if runway length or surface conditions warrant it. The selection can be changed during the landing roll if necessary, but no attempt should be made to exit the runway other than at the specifically illuminated turn off points.

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BEFORE COMMENCING AN APPROACH

In addition to the normal checks :

CREW

Qualified and briefing completed.

AIRFIELD

Ensure that the runway approved for Cat 2/3 using the Approved Autoland Runways status list and extract minima from Jeppesen charts. Note that only type specific minima must be used and that Cat 3B operations are not to be planned on L status runways. Confirm the airfield is operating Cat 2/3 (ATIS or RT). Generally, if ATIS and ATC do not report to the contrary, all the necessary facilities are serviceable. If "Low visibility procedures in force" is transmitted, the appropriate runway and ILS protection procedures are active.

The touchdown RVR must be at or above MINIMA. For Cat 2/3, the midpoint RVR need not be reported, but if it is, then it must not be below 150 m, except where the RVR minima is less than 150 m, in which case it must not be less than 75 m. Rollout RVR is advisory only.

Approaching destination, advise ATC that a Cat 2/3 approach will be made, thus ensuring priority over non-Cat 2/3 holding aircraft. When the RVR is just below minimum, and it is necessary to make a decision whether to remain in the hold for an improvement or to divert, bear in mind that the Volmet and ATIS RVRs may not be the same as the current RVR. If workload permits, monitoring Tower frequency will give the latest.

AIRCRAFT

If any aircraft equipment is unserviceable (shown in either the Tech Log or on the status page) then prior to the approach, the landing capability (if not specifically stated in the Tech Log) may be confirmed using the Required Equipment for Cat 2 and Cat 3 Table. However once the approach has been armed (APPR pb pressed) the landing capability shown on the PFDs should be used for the remainder of the approach.

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COMMENCING THE APPROACH

Full flap is the normal setting for autoland for the following reasons :

1. Lowers the pitch angle thus bringing the lower limit of the visual segment nearer to the aircraft by reducing the cooling cutoff angle, and thereby enabling the PF to obtain visual reference earlier on the approach.
2. Approach and landing speed is reduced, and the landing distance is also reduced.

Prior to initial descent and at approximately 15nm finals carry out a NAV accuracy check.

If the check is positive, the ND can be set at ARC or ROSE NAV. If the check is negative, set the ND to ROSE LS and do not use NAV mode.

On first contact with approach control request a Cat 2/3 approach. When cleared for the approach, press the APPR pb on the FCU and check that LOC and G/S blue is annunciated on the FMA. Engage the second autopilot. The second autopilot is required for Cat 3 dual approaches and, although only one autopilot is required for Cat 2 and Cat 3 single approaches, it is recommended that both autopilots are engaged systematically.

A check should be made that the category indicated on the FMA is sufficient to complete a landing in the prevailing weather conditions.

If the touchdown or midpoint RVR falls below minimum prior to the OM or equivalent position, it is permissible to continue the approach to the OM or equivalent position, but the approach must be discontinued by that point if the RVR is still below minimum. If the touchdown RVR is not available, the midpoint RVR may be used in its place.

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FINAL APPROACH

Again, on first contact with the Tower, advise that the aircraft is making a Cat 2/3 approach. When the visibility is rapidly improving, the low visibility safeguarding procedures may be abandoned in order to increase the traffic flow. If this should occur after the aircraft has left the hold, the call to the Tower will enable the controller to advise that appropriate protection is no longer available.

RVR DETERIORATION

The RVRs to be borne in mind during the approach are those last reported by the OM or equivalent position. RVR information received after passing the OM or equivalent position is for information only. Deterioration in the RVRs after passing the OM or equivalent position does not mean an immediate G/A : the approach may continue to DH. Descent below DH is solely dependent on obtaining the required visual reference.

1500 ft AAL

The aircraft should be stabilized in the landing configuration by 1500ft AAL. After any speed control, the speed must be MANAGED thus ensuring G/S - mini protection throughout the approach and G/A phases.

1000 ft AAL

All call outs below 1000ft during Cat 2/3 approaches are Radio Altitudes. It is very important to observe the standard call outs and responses. The additional calls specific to an automatic approach and landing are included below.

700 ft RA

The ILS frequency and course are frozen in the receiver. Any attempt to change the ILS frequency or course through either the MCDU or RMP will have no effect. Also if the speed is managed, the FMGS will not accept any modification of information on the PERF APPR page.

500 ft RA

PNF calls "500 FEET RADIO"
PF replies "CHECK".

350 ft RA

Land mode engages automatically when the LOC and G/S modes are engaged and the aircraft is below 400ft AGL. The FMA displays "LAND" indicating that LAND mode has engaged.
PF and PNF checks the ILS course on the PFD.
PNF calls "LAND GREEN"
PF calls "COURSE CHECKED"

No action on the FCU will disengage LAND (it can only be disengaged by moving the thrust levers to TOGA and so engaging go-around mode, or after landing). FLARE and ROLLOUT modes will successively engage.

DECISION HEIGHT + 100 ft

PNF calls – "HUNDRED ABOVE"(duplicated by auto call).
PF replies "CHECK" and if not already visual seeks required visual references.

DECISION HEIGHT (IF APPLICABLE)

PNF calls – “MINIMUMS” (duplicated by auto call).

If PF has required visual reference calls “LANDING”.

If not PF initiates a G/A by applying TOGA (simultaneously rotating) and then calling “GO-AROUND FLAP”.

40 ft RA

Once the aircraft reaches approximately 40ft RA (the precise value is a function of V/S), FLARE mode engages. The FMA displays “FLARE” in green. If this is not annunciated the PNF calls “NO FLARE”. On hearing “NO FLARE”, the PF will either complete the landing manually or initiate a go-around.

30 ft RA

The AP/FD aligns the yaw axis with the runway centreline, and the aircraft flares on the pitch axis. If autothrust is active, thrust reduction (RETARD) is activated. The A/THR initiates a thrust reduction towards idle. PNF checks THR IDLE annunciated on FMA.

10 ft RA

Auto call “RETARD”. PF reduces the throttles to idle and the autothrottle disconnects. PNF monitors engine parameters.

REQUIRED VISUAL REFERENCES

Category II approaches - A pilot may not continue an approach below the decision height unless a visual reference containing a segment of at least 3 consecutive lights being centreline of the approach lights, or touchdown zone lights, or runway centreline lights, or runway edge lights, or a combination of these is attained and can be maintained. This visual reference must include a lateral element of the ground pattern, i.e an approach lighting crossbar or the landing threshold or a barette of the touchdown zone lighting.

Category IIIA approaches - A pilot may not continue an approach below the decision height unless a visual reference containing a segment of at least 3 consecutive lights being centreline of the approach lights, or touchdown zone lights, or runway centreline lights, or runway edge lights, or a combination of these is attained and can be maintained.

Category IIIB approaches with a decision height - A pilot may not continue an approach below the decision height unless a visual reference containing a segment of at least one centreline light is attained and can be maintained.

Category IIIB approaches with no decision height - There is no requirement for visual contact with the runway prior to touchdown.

LANDING

The maximum available automatic capability must be used, and an automatic approach and landing is to be planned and accomplished for all Cat 2 and Cat 3 approaches. Only in very exceptional circumstances, as in the non-normal section below, is a manual landing permitted.

At touchdown, the PNF checks that "ROLLOUT" is annunciated on FMA calling "ROLLOUT" and that the yaw bar comes up on the PFD. The PNF continues monitoring inside and makes the normal call outs – "SPOILERS", "REVERSE GREEN", "DECEL" and the speed calls.

The PF will monitor lateral guidance by external reference and select and control reverse thrust.

On a standard Cat 2/3 runway, the centreline lighting changes from white to alternating red/white 900 m from the end and to red for the final 300 m. At the end of the landing roll disengage the autopilots. (The autopilots will disengage automatically when the aircraft track differs by more than 20 ft from the LOC axis).

Note: For ILS Cat 3B No DH operations, establish visual reference after nosewheel contact.

Apply reverse thrust as required. When landing on a status (R) runway, leave the autopilot engaged until the Captain is ready to turn off the runway. The autopilots maintain the localiser centre-line through the rudder and nosewheel steering. The rollout control and autobrakes may remain engaged until a full stop if required.

In Cat 2 or 3 conditions, on a (L) Category runway disengage the autopilot after nosewheel touchdown as rollout guidance is not assured. In Cat 1 conditions, the autopilot may remain engaged to evaluate rollout guidance.

Should there be any significant deviation left or right of the runway centreline, the PNF will call "deviating left" or "deviating right" as appropriate.

TAXI IN

Only the normal turn-off and subsequent exit lights will be illuminated during Cat 3 Operations. Do not report "runway vacated" until the whole of the aircraft is outside the sensitive area shown on the Jeppesen charts. It is important that the crew are fully aware of the runway exit point they have used as it will provide a reference point for the taxi in routing and reduce the possibility of getting lost on the taxiways. If at any time the crew become uncertain of their position on the airfield they must inform ATC immediately.

GO-AROUND

The GO-AROUND phase and modes are engaged by setting the thrust levers to TOGA position (provided at least CONFIG 1 is selected).

Should a go-around be necessary, the PF calls "GO-AROUND FLAP" and monitors the flight path and FMA. The PNF retracts the flap one step and monitors the engine parameters. The PF calls out the FMA indications i.e. MAN TOGA-SRS-GA-TRK. The aircraft pitches up to maintain SRS speed (the lower of VAPP or current speed).

The PNF calls "POSITIVE CLIMB" and selects the landing gear up on the PF's command. NAV or HDG can now be selected according to ATC clearance. (When another lateral or vertical mode is engaged, No.2 AP will disengage).

At the GA thrust reduction altitude, the PF sets the thrust levers to the CL detent.

At the GA acceleration altitude, monitor that target speed goes to green dot and clean up on schedule.

PILOT DUTIES ON APPROACH

The Company philosophy regarding the duties to be performed by each pilot during automatic approaches will be as follows :

1. The Captain will be PF (in less than Cat 1) and will control the aircraft using autopilot and autothrottle. He will monitor his flight instruments until the "100 above" call at which point he will look outside to assess the visual cues available, making a continuous assessment of his visual reference so that at the "MINIMUM" call, he can immediately respond by calling "LANDING " or "G/A Flap".
2. The PNF will monitor his flight instruments throughout the approach and landing/go-around making the appropriate calls. At no time will he attempt to seek visual reference. He will make the appropriate call if the parameters below are exceeded.
 - a) During GLIDE beam capture :
 - "PITCH" : lower than 2.5° or greater than 10°.
 - "Vertical Speed" : exceeds 500 ft/min climb or 1250 ft/min descent.
 - b) During final approach :
 - "SPEED" : lower than VAPP -5 kt or greater than VAPP + 10 kt.
 - "PITCH" : attitude lower than 0° or greater than 10°.
 - "BANK". : bank angle greater than 7°.
 - "SINK RATE". : descent greater than 1000 ft/min.
 - "LOC" or "GLIDE". : excessive LOC or glideslope deviation.
 - b) During go-around :
 - "BANK" : bank angle greater than 7°.
 - "PITCH". : attitude greater than 20° or less than 10°.
 - "SINK RATE". : if there is no climb rate.
3. It should be noticed that these procedures are at variance with those used on non Cat 2/3 approaches in that the normal procedure is for the PNF to seek visual reference prior to decision altitude, reporting to the PF what he can see with the PF looking up at DA and making his assessments. In Cat 2/3 conditions this leaves insufficient time to make a proper assessment, since the cues are often quite difficult to see and require a continuous rather than instantaneous assessment.
4. To avoid confusion, the Cat 2/3 procedures described above will be used for all autoland approaches, whether Cat 1, 2 or 3 whereas for all approaches, automatic or manual, culminating in manual landings, standard non-LVO procedures will be used. In conditions of Cat 1 or better either pilot may act as PF. The Cat 1 minima should be entered in the MDA box on the performance page and not in the DH box.

REQUIRED EQUIPMENT FOR CAT 2 AND CAT 3

This table should be used to check the Landing Capability should any aircraft equipment be unserviceable prior to making an approach. During the approach Landing Capability is shown on both PFDs.

	CAPABILITY→	CAT 2	CAT 3 SINGLE	CAT 3 DUAL
	EQUIPMENT→			
F M G S M O N I T O R E D	AP/FD	1 AP ENGAGED	1 AP ENGAGED	2 AP ENGAGED
	AUTO THRUST	0	1	1
	FMA	1	2	2
	ELECTRICAL POWER SUPPLY SPLIT	0	0	1
	PRIM/SEC	1/1	1/1	N°1 + N°2/2
	YAW DAMPER/ RUDDER TRIM	1/1	1/1	2/2
	HYDRAULIC CIRCUIT	2	2	3
	PFD	2	2	2
	DMC	2	2	2
	FLIGHT WARNING COMPUTER	1	1	2
	BSCU CHANNEL	0	1	1
	RADIO ALTIMETER	1 (displayed on both sides)	2	2
	DH INDICATION	1 for PNF		
	ILS RECEIVER	2	2	2
	ATTITUDE INDICATION (PFD1/PFD2)	N°1+N°2	N°1+N°2	N°1+N°2
	ADR/IR	2/2	2/2	3/3
C R E W M O N I T O R E D	AP DISCONNECT PB	2	2	2
	"AP OFF" ECAM WARNING	1	1	2
	"A/THR OFF" ECAM CAUTION	0	1	1
	"AUTOLAND" LIGHT	1	1	1
	RUDDER TRAVEL LIMIT SYSTEM	1 required for autoland with crosswind greater than 12kt		
	WINDOW HEAT (L or R windshield)	1 for PF		
	WINDSHIELD WIPERS OR RAIN REPELLENT (if activated)	1 for PF		
	ND	1	2	2
	ANTISKID	0**	1	1
	NOSEWHEEL STEERING	0**	0**	1
	AUTOCALLOUT FUNCTION	One is required for autoland	1	1
	ATTITUDE INDICATION (STBY)	1	1	1
	BEAM EXCESSIVE DEVIATION	1 for PNF	2	2

NON-NORMALS

GENERAL

During the approach the PNF should carefully monitor the flight instruments and call any deviations defined in the previous section. The PNF should also monitor the FMA calling any changes in the normal way. Any abnormal indications should be announced and for multiple warnings the most limiting course of action should be applied. If any doubt exists, a G/A may be the safest course of action.

FMA LANDING CAPABILITY AND ANNUNCIATIONS

Prior to making an approach if any aircraft equipment is unserviceable the landing capability may be confirmed using the Required Equipment For Cat 2 and Cat 3 Table. (For unserviceable ground equipment see Failed or Downgraded Ground Equipment Table).

Once the APPR pb is pressed the second autopilot should be selected and the FMA checked for LOC and G/S blue and the Landing Capability and autopilot status confirmed. The Landing Capability shown on the FMA should be used as the reference throughout the remainder of the approach.

The highest possible capability and therefore lowest minima should be used when available to ensure the best chance of a successful autoland. Without failures this will mean using a CAT 3 DUAL approach which has the advantage of being a fail operational system.

An automatic landing system is fail-operational if, in the event of a failure below alert height, the remaining part of the automatic system allows the aircraft to complete the approach, flare, and landing. Alert Height on the A340 is 200 feet RA.

Both CAT 3 SINGLE and CAT 2 are fail-passive systems. This means that, 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.

Any downgrade of capability will be accompanied by three clicks and should be announced. Down to 1,000 feet AAL the DH for the new capability may be entered into the MCDU. Although if the downgrade occurs prior to the approach ban position the approach may not be continued past this point unless the RVRs are at or above that required for the new capability. Between 1,000 feet AAL and 200 feet RA with any downgrade a G/A should be initiated. Below 200 feet RA the FMGS freezes the landing capability until LAND mode is disengaged or both autopilots are off.

If both LOC and G/S modes are engaged and the aircraft is below 400 feet RA, LAND mode will engage automatically. The FMA will display LAND and this should be called by the PNF. If LAND mode has not engaged by 350 feet RA the PNF should call "NO LAND GREEN" which should prompt a G/A.

The ILS course should also be checked by 350 feet RA and if the displayed course is not correct then again a G/A should be initiated.

If FLARE is not annunciated on the FMA by 30 feet RA the PNF should call "NO FLARE" . On hearing this call the PF should G/A except where the aircraft has already landed.

FAILURE INDICATIONS - GENERAL

There are three priority levels for warnings and cautions:

Level 1 - Amber caution without aural warning: Requires crew monitoring.

Level 2 - Amber caution with single chime: The flight crew should be aware of the configuration or failure, but need not take immediate action.

Level 3 - Red warning plus continuous repetitive chime or specific sound or synthetic voice:
Aircraft in dangerous configuration or limit flight conditions.

Anything more than a Level 1 warning, i.e. levels 2 & 3, therefore will require crew action and so in the event of such a failure or failures occurring during the approach the following procedure should be adopted:

Go around unless the appropriate drill can be adequately reviewed and completed prior to reaching 1,000 feet AAL.

Except for illumination of the red autoland light, when below 200 feet RA, the approach may be continued bearing mind that for certain failures the autopilot may have to be disconnected for the roll out phase.

Level 3 warnings require immediate action and should be dealt with on an individual basis according to the circumstances.

SPECIFIC FAILURE INDICATIONS

AUTOLAND WARNING

With "LAND" or "FLARE" in green on the FMA and at least one AP engaged, the AUTOLAND red light appears on the glareshield when the aircraft is below 200 feet RA and one of the following events occurs:

- The autopilots are lost, or
- The aircraft gets too far off the beam (LOC and G/S flash on PFD) or
- Loss of LOC signal above 15 feet or loss of glide signal above 100 feet (transmitter or receivers), or
- The difference between both radio altimeter indications is greater than 15 feet.

AUTOLAND warning flashes for 3 seconds when the AP is manually disconnected (instinctive disconnect pushbutton) below 200 feet.

ILS

Warning of excessive beam deviation

This warning is a flashing of the LOC and G/S scales on the PFD and ND ROSE ILS. It occurs whenever:

- G/S deviation is greater than 1 dot (above 100 feet RA)
- LOC deviation is greater than 1/4 dot (above 15 feet RA).

Failure of one localizer and glide slope receiver

The respective PFD and ND (rose ILS mode) display red LOC and G/S flags (if the LS pushbutton has been pressed green). LOC and G/S scales disappear from respective PFD. ECAM warning NAV ILS 1 (2) FAULT with associated master caution and chime.

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Failure of both localiser and glideslope receivers

Both PFD and ND (rose ILS mode) display red LOC and G/S flags (if the LS pushbutton has been pressed green). LOC and G/S scales disappear from the PFD.

ECAM warning NAV ILS 1+2 FAULT with associated master caution and chime.

If LOC or G/S modes are engaged and at least one AP/FD is engaged:

- The AP disengages.
- The FD reverts to its HDG - V/S or TRK - FPA modes.

Failure of localiser or glideslope transmitter (when captured)

- The corresponding index is lost.
- The LOC and G/S scales flash.
- The corresponding FD bar flashes.

The FMA retains the LOC and G/S modes: if the transmitter failure is temporary, the autopilots are able to regain these modes. If the failure is long term or if it occurs when the aircraft is below 200 feet RA, this allows the aircraft to perform a GO AROUND with one or two autopilots engaged.

AUTOPILOT DISCONNECT

If during the approach one AP fails this should lead to a capability downgrade. If the second AP subsequently fails this will trigger the full AP disengagement warning: flashing red master warning, ECAM AUTO FLT AP OFF and cavalry charge audio warning. Below 200 feet RA the red autoland light will also illuminate.

AUTOTHRUST

The autothrust (A/THR) is a function of the FMGS. It includes 2 independent A/THR commands, one per FMGS. Each one is able to control the thrust of the 4 engines simultaneously through 4 engine interface units and 4 engine control units. Only one FMGC controls the active A/THR, it is called the master FMGC. When both APs are engaged or no AP/FD engaged, A/THR 1 has the priority. If the A/THR fails during the approach it will trigger a master caution and chime. The landing capability will also downgrade to CAT 2. After go around, or if the situation allows, disengage AP1 (or change over if only one AP is engaged) and try to re-engage A/THR. If successful, CAT 3 SINGLE will be available.

Alpha floor is activated when the aircraft angle of attack is above a predetermined threshold. The A/THR is automatically activated and commands TOGA thrust regardless of thrust lever position. This protection is available from lift off to 100 feet RA on approach, and the following indications are provided:

- A-FLOOR on the FMA and on the EWD as long as alpha floor conditions are met
- TOGA LK on the FMA when the aircraft leaves the alpha floor conditions
- TOGA thrust is then frozen

AP(s) will disconnect when the angle of attack protection is active. Alpha floor protection is lost in case of A/THR failure.

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ENGINE FAILURE

It has been demonstrated that the A340 is capable of an automatic approach, autoland and rollout on Config 3 with one engine inoperative. All ECAM actions associated with the engine failure and selection of Flap 3 on the MCDU should be completed before reaching 1000 feet RA on the approach in order that both pilots give maximum attention to the subsequent automatic approach and landing. Failure of an inboard engine will mean the loss of one hydraulic system resulting in the loss of CAT 3 DUAL capability. Autolands are not allowed with two engines inoperative.

ABNORMAL CONFIG

Autolands are not allowed with slats/flaps in less than Config 3.

RUDDER TRAVEL LIMIT FAULT

With the failure of one Rudder Travel Limit System (F/CTL RUD TRV LIM 1 (2) FAULT) the maximum crosswind for autolands is 12kts.

ANTI SKID / NOSE WHEEL STEERING

Failures of the antiskid or nose wheel steering systems are only partially monitored by the FMGS. If they occur they will trigger a master caution and chime. If this does not prompt a G/A then be prepared to disengage the autopilots at touchdown or when the failure appears during the landing roll.

PILOT INCAPACITATION

If one pilot becomes incapacitated during a Cat2/3 approach, it is generally preferable for the other pilot to continue the approach provided that the FMA shows CAT 2, CAT 3 SINGLE or CAT 3 DUAL. The only exception might be if the incapacitated pilot was obstructing the flying controls.

PFD / ND WARNINGS

Loss of information from ADIRUs

A red ATT/HDG/SPD warning on the PFD indicates a loss of information from the associated ADIRU. These failures should trigger a master caution plus chime and Landing Capability downgrade during the approach. No switching should be attempted below 1,000 feet RA.

Attitude discrepancy

An amber CHECK ATT warning appears on both PFDs when there is a disagreement (of at least 5°) in the attitude information displayed by the two PFDs. This will also trigger a master caution plus chime. Use the standby horizon to determine which PFD is showing incorrect attitude information. Since no switching should be attempted below 1,000 feet RA, a manual go-around using the standby horizon may be the safest course of action.

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Heading discrepancy

Amber CHECK HDG appears on the PFDs and NDs when there is a discrepancy of 5° between the two sides. This will trigger a master caution plus chime during the approach. Use the standby compass to identify which side is showing the correct information. No switching should be attempted below 1,000 feet RA.

Failure of radio altimeters

The aircraft has two radio altimeters, which give the height of the main landing gear above the ground. Normally the CAPT PFD displays the RA1 height and the F/O PFD displays RA2 height. If either radio altimeter fails this will trigger a master caution plus chime on the approach and both PFDs will display height from the remaining radio altimeter. The Landing Capability should also downgrade to CAT 2.

If both radio altimeters fails, a red RA flag appears on both PFDs in place of the radio height indication when the aircraft altitude is below the transition altitude. The ground reference indication (red ribbon) will disappear. This will trigger a master caution plus chime and a Landing Capability downgrade to CAT 1. If or when the landing gear is selected down USE MAN PITCH TRIM appears in amber on both PFDs. The AP will revert to basic modes (APPR mode is inoperative) and flare law occurs when the AP is disengaged.

DMC failure

In normal operation:

- DMC 1 supplies data to the Captain's PFD and ND.
- DMC 2 supplies data to the First Officer's PFD and ND.
- DMC 3 supplies data to the upper and lower ECAM DU.

In case of DMC 3 failure, DMC 1 automatically takes over and supplies the ECAM DUs provided the ECAM SWITCHING selector is in the AUTO position. If a DMC fails (corresponding DU shows a diagonal line), the flight crew can replace DMC 1 or 2 with DMC 3 by turning the EFIS DMC selector on the EFIS DMC panel to 3. DMC failure will trigger a master caution plus chime. No switching should be attempted below 1,000 feet RA.

DU failure

The affected DU may go blank or the display may be distorted. If a PFD DU fails, the system automatically transfers the PFD to the ND DU. Should the upper ECAM (engine/warning page) DU fail it will automatically replace the system/status page on the lower ECAM DU.

STANDBY HORIZON

A flag will appear if the instrument or power fails.

TECHNICAL LOG

PILOT REPORTING

In order to maintain the autoflight systems at the highest level of serviceability, it is essential that pilots report any performance or integrity defects as they occur.

AUTOPILOT STATUS ADD's

Autopilot status downgrading will be achieved via a "Performance" ADD entry in the Tech Log, originating from a pilot report of poor performance, routine examination of Flight Data or a defect in any other system associated with autoland. Irrespective of the PFD annunciation, the autoland status is limited to the ADD declared status.

Pilot reports of a degraded PFD annunciation may result in the raising of a "non-performance" ADD if it proves impossible to investigate the defect immediately. Such ADDs do not downgrade autopilot status and are intended to indicate probable PFD annunciation for subsequent autoland attempts. This may be taken into account when scheduling to a destination where minima could be limiting.

PRACTICE AUTOLANDS IN GOOD WEATHER

It is recommended that crews conduct practice autolandings on a regular basis.

In conditions of Cat 1 or better, either pilot may operate as PF and such autolandings should be annotated in the Autoland Record of their LVO card.

Prior to the approach ATC should be informed that you wish to do a practice autoland. However crews should be aware that when LVPs are not in force, the ILS may be subject to interference making excessive beam deviation and autoland warnings more likely.

SUMMARY

LOW VISIBILITY TAKE-OFF

1. Return Alternate required within 2 hours, Cat 1 or above.
2. Check H I edge and C/L lighting available.
3. Check threshold and R/W end lighting available.
4. Check T/O minima.
5. All relevant RVRs at or above minima.
6. Maximum crosswind 10 kts.
7. TOGA thrust to be used.
8. Verify ILS tuned on RAD NAV page (LS pb ON).
9. Check lights visible 8/4 for spacing 15m 130m with RVR 125m.

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RTO

- Max autobrake
- Maintain C/L
- Call ATC
- 900m to go C/L lights to alternating red/white.
- 300m to go C/L lights on red.

LANDING IN CAT 2/3

1. A/C autoland operative Check Tech Log and QRH page
2. Airfield equipment to Cat 2/3 standard (FCOM 2 + NOTAMS/ATIS)
3. (a) Both pilots to hold valid LVO certificates
(b) Capt as PF
4. Confirm runway approved for autoland (No Cat 3B on L status runways.)
5. Minima checked (Cat 1 minima bugged on S/B altimeter)
6. Two alternates required Cat 1 and above
7. Extra fuel for holding/approach delays (normally >45 mins).
8. Autoland wind limits (30 kt HWC, 10 kt TWC, 20 kt XWC)
9. Use config "Full" (config 3 - one engine inoperative)
10. Approach briefing to include
 - (a) Callouts on approach
 - (b) Different PF/PNF duties
 - (c) R/W and approach lighting expected
 - (d) Visual cues at DH
 - (e) Procedures for Rollout, R/W clearance and taxi
 - (f) GA procedure
 - (g) Alternates and fuel state
 - (h) Seat position
 - (j) Aircraft external lighting
 - (k) Autobrake LOW unless runway length or surface conditions warrant MED

APPROACH

- APPR selected - select second A/P, check category
- TD or mid-point RVR fair below minima - continue to OM or equivalent

OM OR EQUIVALENT

- RVRs must be at or above minima

1000' AAL

- PF calls "1000 feet G/A ALT set"
- PNF calls "Check"

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500' RADIO

- PNF calls "500 feet radio"
- PF calls "Check"

350' RADIO / LAND GREEN ANNUNCIATED

- PF and PNF check ILS course on PFD
- PNF calls "LAND green"
- PF calls "Check"

DH + 100'

- Auto Call - PNF calls "One hundred above"
- PF responds "Check"

DH

- Auto Call - PNF calls "Minimum"
- PF response "Landing" or "G/A Flap"

If visual reference lost below DH - Go-Around

40' R

- PNF check 'FLARE' annunciated - call "NO FLARE" if not

10'R

- Auto call "RETARD". PF closes thrust levers

GO-AROUND

- Thrust levers to 'TOGA' - A/P commands G/A

AFTER LANDING

- Report "runway vacated" when the entire aircraft is clear of CAT 3 protected area.

NON-NORMAL PROCEDURES

- Carry out a G/A if following occurs:

Between 1000ft and 200ft:
 Capability decrease (CLICK, CLICK, CLICK)
 Amber Caution plus single chime
 No 'LAND' green by 350ft / Incorrect RWY course
 Engine Failure
 AP Off (cavalry charge)

200ft or below:

Red autoland light.

SUMMARY OF NON-NORMAL PROCEDURES

By OM or equivalent position, check RVR's above limits

1000 AAL

200' Radio

Failures/abnormals
 deal with problem
 continue if able.
 If downgrade enter
 new D.H.

G/A for any M/C, Eng Fail, A/P Off,
 capability decrease (click, click, click)

Continue except
 for Red Autoland
 light

CALL OUTS FOR CAT 2/3 APPROACHES

STAGE	ITEM/INDICATION	CALL-OUT	BY	RESPONSE	BY
Take Off or Landing Roll	Deviating left or right of runway centreline	Deviating left/right	PNF	Correcting	PF
Take Off or Landing Roll	Loss of external references	Heads In	PF	Heads Out	PNF
Take Off or Landing Roll	External references regained	Heads In	PNF	Heads Out	PF
2500 ft RA	'Two Thousand Five Hundred' autocall	QNH SET ____	PF	Cross Checked	PNF
Cleared to Establish Localiser	LOC P/B PUSH LOCALISER CAPTURE LOCALISER STABILISED	LOC BLUE LOC Star LOC Green	PF PF PF	LOC BLUE LOC Star LOC Green	PNF PNF PNF
Cleared for Approach	APPR P/B PUSH A/P 2 P/B PUSH G/S CAPTURE G/S ESTABLISHED	G/S Blue FMA Capability e.g. Cat 3 Dual G/S STAR G/S GREEN	PF PF PF PF	G/S Blue FMA Capability e.g. Cat 3 Dual G/S Star G/S Green	PNF PNF PNF PNF
FAF or Outer Marker	DME or BEACON PASSAGE	Outer Marker	PF	____ Feet Checked	PNF
1000 ft AGL	1000 ft AAL on pressure altimeter	1000 ft G/A ALT SET	PNF	Check	PF
500 ft RA	500 ft radio altitude	500 ft radio	PNF	Check	PF
350 ft RA	Both pilots check ILS Course	Land Green	PNF	Course Checked	PF
DH + 100 ft RA	PNF makes call (duplicated by autocall)	100 above	AUTO/ PNF	Check	PF
DH RA	PNF makes call (duplicated by autocall)	MINIMUM	AUTO/ PNF	Landing or G/A Flap	PF
40 ft RA	If no "FLARE" annunciated	No Flare	PNF		
Touchdown	PF selects reverse thrust	Roll-out Spoilers Reverse Green Decel 100 kt 70 kt	PNF		
Runway Vacated	When clear of protected area	Runway Vacated	PNF		
Go-Around	When positive climb indicated	Positive climb	PNF	Gear up	PF
	After gear selected up select appropriate lateral mode	G/A TRK or NAV, HDG	PF	G/A TRK, NAV, HDG	PNF
	Call out FMA	MAN, SRS TOGA	PF	CHECK	PNF

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AIRFIELDS

Prior to an LVO approach commanders must check that the required runway has autoland approval for A340 aircraft. This can be done by referring to the Autoland Status List. If approved, runways may be classified as follows:

STATUS (E)	Runway is suitable for Autoland evaluation. Capts are requested to complete the Autoland Report Form about all such autolands.
STATUS (L)	Runway is suitable for Autoland. Disengage Autopilot after nosewheel Touch down. During practice or evaluation Autolands, Automatic rollout may be attempted but performance has not been evaluated.
STATUS (R)	Runway is suitable for Autoland with automatic rollout and control.

EFFECT ON LANDING MINIMA OF FAILED OR DOWNGRADED GROUND EQUIPMENT

The following table is intended for use both pre-flight and inflight. It is not expected however that the commander would consult this table after passing the outer marker or equivalent position. If failures of ground aids are announced at such a late stage, the approach could be continued at the commander's discretion. If, however, failures are announced before such a late stage in the approach, their effect on the approach should be considered as described in the table, and the approach may have to be abandoned to allow this to happen.

Table 1 - FAILED OR DOWNGRADED EQUIPMENT - effect on landing minima

FAILED OR DOWNGRADED EQUIPMENT	EFFECTIVE ON LANDING MINIMA			
	CAT IIIB (Note 5)	CAT IIIA	CAT II	CAT I
Approach lights	Not allowed for operations with DH > 50 ft		Not allowed	Minima as for nil facilities
Approach lights except the last 210 m	No effect		Not allowed	Minima as for nil facilities
Approach lights except the last 420 m		No effect		Minima as for intermediate facilities
Standby power for approach lights	No effect		RVR as for Cat 1 basic facilities	No effect
Whole runway light system		Not allowed		Day - Minima as for nil facilities Night - Not allowed
Edge lights		Day only; Night - not allowed		
Centreline lights	Day - RVR 300 m Night - not allowed		Day - RVR 300 m Night - 550 m	No effect
Centreline lights spacing increased to 30 m	RVR 150 m		No effect	
Touchdown zone lights	Day - RVR 200 m Night - 300 m		Day - RVR 300 m Night - 550 m	No effect
Standby power for runway lights		Not allowed		No effect
Taxiway light system	No effect - except delays due to reduced movement rate			

Table 2 - FAILED OR DOWNGRADED GROUND EQUIPMENT - effect on landing minima

FAILED OR DOWNGRADED EQUIPMENT	EFFECTIVE ON LANDING MINIMA				
	CAT IIIB (Note 5)	CAT IIIA	CAT II	CAT I	NON PRECISION
ILS Standby transmitter	Not allowed			No Effect	
Outer Marker	No effect if replaced by published equivalent position				Not applicable
Middle Marker	No effect				No effect unless used as MAPT
Touch Down Zone RVR	May be temporarily replaced with midpoint RVR if approved by the State of the Aerodrome. RVR may be reported by human observation.				No effect
Midpoint or Stopend RVR	No effect				
Anemometer for R/W in use	No effect if other source available				
Ceiliometer	No effect				

Notes:

1. Multiple failures of runway lights other than indicated in Table 1 are not acceptable.
2. Deficiencies of approach and runway lights are treated separately.
3. A combination of deficiencies in runway lights and RVR assessment equipment is not allowed.
4. Failures other than ILS affect RVR only and not DH.
5. For Category IIIB approaches with no decision height.
 - a. At least one RVR value must be available at the aerodrome.
 - b. Runway lights:
 - (i) No runway edge lights or no centreline lights: DAY RVR 200 m
NIGHT - not allowed
 - (ii) No TDZ lights: No restrictions.
 - (iii) No standby power to runway lights: DAY - 200 m
NIGHT - Not allowed.

NATIONAL DIFFERENCES

USA **APPROVAL**

Approved for Cat 2, Cat 3A and Cat 3B approaches.

REQUIRED RVR EQUIPMENT

Three transmissometers are normally provided.

CAT 2

At least two transmissometers are required when the RVR is less than 1600 ft. The mid point is not required but if installed is advisory and may be substituted for the stop end if that is unserviceable. (Note that midpoint RVR is a company requirement).

CAT 3

All three transmissometers are required. The touchdown and mid point are controlling and the mid point RVR must be reported at or above touchdown RVR.

OPERATING LIMITATIONS

The approach ban position is in the Final approach Fix (FAF).

A Cat 2 ILS approach shall not be commenced if the touchdown RVR < 1800ft unless the following components of the Cat 2 ground system are installed and in normal operation:

1. ALSF-1 or ALSF-2 approach lighting system. Sequenced flashing lights are required.
2. High intensity runway lights.
3. Approved touchdown zone lights and runway centreline lights.
4. Maximum crosswind 10 kts.

A CAT 3 ILS approach shall not be commenced if the RVR is reported to be less than CAT 2 minima unless:

1. All required elements of the ground system except sequence flashing lights are in normal operation.
2. Maximum crosswind 10 kts.

No critical ILS area protection is provided by ATC when the weather is at or above 800 ft and 2 statute miles visibility.

CHINA
APPROVAL

No approval.

REQUIRED RVR EQUIPMENT

No differences.

JAPAN
APPROVAL

Approved for Cat 2 and Cat 3A approaches.

REQUIRED RVR EQUIPMENT

No differences.

OPERATING LIMITATIONS

No differences.

SOUTH AFRICA
APPROVAL

Approved for Cat 2 and Cat 3A approaches.

REQUIRED RVR EQUIPMENT

No differences.

OPERATING LIMITATIONS

No differences.

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HONG KONG APPROVAL

Approved for Cat 2 and Cat 3A approaches

REQUIRED RVR EQUIPMENT

No differences.

OPERATING LIMITATIONS

Landing minima are based on high intensity Approach Lighting System (ALS), Runway centreline (CL), touchdown zone and threshold lighting in use.