

**ROYAL AERONAUTICAL SOCIETY
FLIGHT OPERATIONS GROUP
SPECIALIST DOCUMENT**

THE ALL WEATHER OPERATIONS GUIDE

CONVERSION COURSE TRAINING MODULE



OUT OF THE FOG



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The Royal Aeronautical Society has 20 Specialist Group Committees, each of which has been set up to represent the Society in all aspects of the aerospace world. These committees vary in size and activity, but all their members contribute an active knowledge and enthusiasm. The Groups meet four or five times a year and their main activities centre on the production of conferences and lectures, with which the Society fulfils a large part of its objectives in education and the dissemination of technical information.

In addition to planning these conferences and lectures, the Groups also act as focal points for the information enquiries and requests received by the Society. The Groups therefore form a vital interface between the Society and the world at large, reflecting every aspect of the Society's diverse and unique membership.

By using the mechanism of the Groups, the Society covers the interests of operators and manufacturers, military and civil aviators, commercial and research organisations, regulatory and administrative bodies, engineers and doctors, designers and distributors, company directors and students, and every other group of professionals who work within aerospace.

GUILD OF AIR PILOTS AND NAVIGATORS

A Guild of the City of London

Founded in 1929, the Guild is a Livery Company of the City of London, receiving its Letters Patent in 1956.

With as Patron His Royal Highness The Prince Philip, Duke of Edinburgh, KG KT and as Grand Master His Royal Highness The Prince Andrew, Duke of York, CVO ADC, the Guild is a charitable organisation that is unique amongst City Livery Companies in having active regional committees in Australia, Canada., Hong Kong and New Zealand.

Main objectives

- To establish and maintain the highest standards of air safety through the promotion of good airmanship among air pilots and air navigators.
- To constitute a body of experienced airmen available for advice and consultation and to facilitate the exchange of information.
- To raise the standard knowledge of airmen.
- To make awards for meritorious achievement and to issue Master Air Pilot and Master Air Navigator Certificates.
- To assist air pilots and air navigators and their dependents with their children's education and those in need through a Benevolent Fund.

The first concern of the Guild is to sponsor and encourage action and activities designed to ensure that aircraft wherever they may be, are piloted and navigated by highly competent, self reliant, dependable and respected people. The Guild has therefore fostered the sound educational and training of air pilots and air navigators, from the initial training of the young pilot to the specialist training of the more mature. It rewards those who have reached the top of their profession through long years of experience and accomplishment and those who, by their outstanding achievement, have added to the lustre of their calling.

The majority of Guild members are or have been professional licence holders, both military and civil, but many are also private pilot licence holders. Guild members operate not only aircraft in airlines and all the branches of Her Majesty's armed forces but also in every area of general aviation and sporting flying.

The aircraft considered, range from supersonic military and civil, through single and multi-engine fixed-wing and helicopters, training aircraft, microlights, gliders and balloons, to experimental aircraft. This is, for many members, the particular strength and attraction of the Guild, with its diverse spread of interests together with an entirely non-political outlook, forbidding any trade union activities.

To join the Guild, please contact the Clerk, Guild of Air Pilots and Air Navigators, Cobham House, 9 Warwick Court, Gray's Inn, London WC1R 5DJ -Tel: +44 (0)20 7404 4032. Fax: +44 (0)20 7404 4035. E-mail: gapan@gapan.org & web site: www.gapan.org

This specialist document represents the views of the Flight Operations Group of the Royal Aeronautical Society. It has not been discussed beyond the Learned Society Board and hence it does not represent the views of the Society as a whole.

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THE ALL WEATHER OPERATIONS GUIDE AWO/LVO COURSE TRAINING MODULE

by
Captain Ralph Kohn, FRAeS

LOW VISIBILITY OPERATIONS (LVO) ALL WEATHER OPERATIONS (AWOPS)

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The Guild of Air Pilots & Air Navigators

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1. INTRODUCTION

This is a Flight Operations Group Specialist Document intended to be a single information source Guidance Handbook, for Operators to adopt or adapt as required, before use by aircrew as reference material during training; or to refresh memory whilst on flight operations if so desired. Contents must satisfy the National Regulatory Authority before such use, or its inclusion in the Company Operations Manual library.

This Specialist Document (SD) is intended to be an instruction manual for use when preparing for the All Weather Operations (AWO) content of an aircraft type-conversion course. The whole is a reference manual to be read and studied in class and then at home, with the All Weather Operations section of the aircraft type conversion course module. It is intended to give pilots more background to add to their knowledge of All Weather Operations. The SD is not intended to be carried in briefcases.

The intent of this compilation is to make it self-sufficient so as not to have to go to other documents for information. However, 'Source' Regulatory documents should be consulted for their amendment status. The content, as offered, makes this manual a one-stop source of relevant data that should be of interest to all pilots engaged in Low Visibility Operations (LVO). *Some information appears in more than one place. This is intentional for ease of rapid reference, making it unnecessary to look for it elsewhere to refresh memory, so not breaking the reading flow.*

At the time of going to press European Flight Operations are governed by EU-OPS but the European Community has decided that from April 2012 both Flight Operations and Flight Crew Licensing regulation will become the responsibility of the European Aviation Safety Agency (EASA). EASA has already produced draft requirements which are currently under consultation with industry and other stakeholders; proposing to promulgate these during 2010. EASA Regulations are based largely on EU-OPS; and JAR-FCL regulations are no longer in force. EASA AWOPS Sub Part E Core legislation as currently in force is held in Appendix A. AWO are now conducted under EU-OPS regulations.

From April 2012, a new set of regulations come into force. In most areas there will be little or no change from EU-OPS, but EASA OPS will apply to all professional flying, including Business Jet Operations and the operations of Professional Aviation Training Organisations. FCL rules will apply as will FTL schemes for this category of operators.

1.1 THE ROYAL AERONAUTICAL SOCIETY FLIGHT OPERATIONS GROUP

The Flight Operations Group committee consists of 41 members and ten Consultants from both the civilian airline and military transport & flying training sectors, with Flight Safety and the Quality of Training throughout the Public Transport Industry being its primary objectives. The FOG is a discussion group that focuses on issues which primarily concern civil aviation, although it touches upon aviation safety in the armed forces, specifically where the safety issues could also be applicable to civilian operations. Its membership is highly respected within the civil aviation operations area and brings together a team with many years of experience in the field of aviation.



Flt Lt Philip Kemp RAF (Secretary),

Dr Kathy H. Abbott (FAA), Dr John C. Barnett, Capt Nils Bartling (Hapag-Lloyd), Capt Terence 'Terry' J. Buckland JP (CAA), Capt F. Chapman (Airbus Test Pilot), Capt Ian Cheese (FlyBe), Capt John M Cox (Safe Ops Sys Inc), Capt Hugh P.K. Dibley (Airbus Consultant), Capt Robin Evans (Jet2.com), SFO Linton Foat (Thomas Cook Airlines), Laurent J. Ghibaut, Sqn Ldr Nick Goodwyn RAF, Mark P. Green (NATS), Capt Richard 'Dick' K.J. Hadlow, Capt John C. Hutchinson, Air Cdre Richard Jones CBE (UKSFC), Capt Ralph Kohn, Capt Simon J. Lawrence (Emirates Airlines), Capt Paul D. Lightbody (Virgin Atlantic), Capt Seamus J.P. Lyttle, Tim J. MacKay (GATCO), Capt David A.J. Martin, Capt Anthony 'Mac' C. McLauchlan, Peter Moxham, Matthew Moxon (RAeS YMB), Capt David Owens (Airbus Test Pilot), Kim O'Neil, Capt Dhamseth Pallawela (Emirates Airlines), Capt Anthony Petteford (Oxford Aviation Academy), SEO Peter G. Richards, Sqn Ldr Adam W. Robinson RAF, Sqn Ldr Nigel 'Nige' R. Scopes RAF, Capt Christopher 'Flip' Seal (FlyBe), Capt Tim H. Sindall, Capt Philip 'Phil' H.S. Smith, Capt David H. Thomas (FTE Jerez), Capt Richard M.H. Weeks (NetJets), Capt Christopher 'Chris' N. White.

Participating Consultants

Peter P. Baker (Test Pilot), Dr Mary P. Baxter (FAA), Dr Simon A. Bennett (University of Leicester), Dr Barbara K. Burian (NASA), Capt J.H. Casey (Safe Ops Sys Inc), Capt Gerry L. Fretz, Capt Ronald 'Ron' Macdonald, Capt David Pelchen (Sky Europe Airlines), Capt Robert 'Bob' A.C. Scott, Capt David R. Smith (Alaska Airlines)

The following Specialist Documents are joint RAeS Flight Operations Group and GAPAN publications

The Future Flight Deck (1992 - 93) by Captain Peter Buggé, FRAeS & Capt John Robinson, AFC, FRAeS
British Aviation Training (1998) by Captain G.L. Fretz, FRAeS
Smoke and Fire Drills (1999) by Captain Peter Buggé, FRAeS, Captain Ron Macdonald, FRAeS and SEO Peter Richards. IEng, FRAeS
So You Want to be A Pilot? (2002) by Captain Ralph Kohn, FRAeS
The Human Element in Airline Training (September 2003) by Captain Ralph Kohn, FRAeS
So You Want to be A Pilot? (2006) by Captain Ralph Kohn, FRAeS
Reducing the Risk of Smoke, Fire & Fumes in Transport Aircraft (January 2007) by Captain John M. Cox, FRAeS
So You Want to be A Pilot? (2009) by Captain Ralph Kohn, FRAeS
Aeroplane Upset Recover Training (October 2010) by Captain John M. Cox, FRAeS

The Documents listed above represent the views of the Specialist Flight Operations Group of the Society and of the Guild committee that were involved with their preparation. They were not discussed outside the Specialist Group Committee or the Guild's Secretariat. As such, they do not necessarily represent the views of the Society or the Guild as a whole, or any other specialist Group or Committee or of the Civil Aviation Authority (the UK National Aviation Regulatory body).

1.2 ABOUT THE AUTHOR

Captain Ralph KOHN, FRAeS



Born in Alexandria, Egypt, Ralph Kohn was educated at Victoria College (Alexandria) and at Nottingham. He majored in Textiles prior to a career in aviation. Learning to fly in 1950 whilst still at college, he served with the RAFVR then obtained his commercial pilot licence in 1953.

He was an aero-club instructor before joining Eagle Aviation as a First Officer in 1955 then, in 1960 he gained his first command on Vikings, staying with the company as it changed name until Eagle Airways ceased operations in 1968. After a short spell with Dan Air, he joined the British Aircraft Corporation as a training captain, and then moved to the UK CAA Flight Operations Inspectorate in 1971.

After retiring from the CAA as a senior flight operations and training inspector in 1991, he went on to help the Bermuda DCA as a principal inspector of flight operations during the setting up of the necessary regulatory infrastructure to satisfy ICAO, UK CAA and FAA norms for the supervision of aircraft operations within the Bermuda Aircraft Register jurisdiction. Other 'overseas' Regulatory Authorities were also helped on a consultancy basis to achieve a similar status.

Ralph has flown some 16,500 hours of which over 11,000 were in command of such aircraft as the Vickers Viking, DC-6A/B, Vickers Viscount, Bristol Britannia 300s, all the BAC 1-11 variants, Boeing 707-100/300/720 and Boeing 747-100/200/400 series aircraft, not to mention a variety of smaller aeroplanes like the HS 125, Beagle 205, Beech 90, DH Dove, DH Heron, Airspeed Oxford and Consul, DHC Chipmunk, Percival Proctor, DH82A Tiger Moth and various Austers, instructing on many of these. The totals mentioned above do not include countless hours spent on classroom instruction, the few thousand hours spent in simulators instructing or examining on a variety of jet aircraft, or the many hours spent on flight inspections and checking / testing simulators, during his operational career.

His experience ranges from ab-initio instructing, to teaching pilots on conversion to a new aircraft type in an airline training environment. He was a flight operations and training inspector (TRE/IRE on Boeing 747 and 707 aircraft) with the UK CAA. His many duties included CAA Flying Unit initial instruction of trainee Instrument Rating and Type-rating examiners at Stansted, where airline pilots underwent training and testing to achieve Authorised Examiner status.

A Fellow of the Royal Aeronautical Society, Captain Kohn is a founder member of The Society's Flight Operations Group and was its chairman from 2003 to 2006. He is a Liveryman of the Guild of Air Pilots and Air Navigators. He was awarded the Guild's Master Air Pilot Certificate in 1978 and is also a participating consultant on the Education and Training Committee of that Guild.

1.3 ACKNOWLEDGEMENTS

I wish to thank the members of the FOG Documents Working Group, namely (alphabetically) Dr Kathy H. Abbott, PhD, FRAeS, Dr John C. Barnett, PhD (Affiliate), Captain Terence 'Terry' J. Buckland, FRAeS JP, Captain Francis 'Frank' Chapman, FRAeS, Captain John M. Cox, FRAeS, Captain Hugh P.K. Dibley, FRAeS, Captain Richard 'Dick' K.J. Hadlow, FRAeS, Flt Lt Philip Kemp, MRAeS RAF, Captain Maurice Knowles, FRAeS, Captain Ronald Macdonald, FRAeS, Captain David A.J. Martin, FRAeS, Peter Moxham, FRAeS, SEO Peter G. Richards, IEng, FRAeS, Captain Robert A.C. Scott, FRAeS, Captain Christopher 'Flip' Seal, BPharm, MRPharmS, MRAeS, Captain Philip 'Phil' H.S. Smith, MRAeS, Captain David Thomas, FRAeS, Captain Peter Terry, FRAeS and Captain Christopher 'Chris' N. White, FRAeS, for their help with the proof reading of this document, their contributions and their suggestions for inclusion. Last but not least, I must thank Captain Andy Gaskell of the UK CAA, a Training Standards Inspector, for his erudite help on the subject.



FOG Publications Core Editorial team
Peter Moxham, Peter Richards, David Martin, Ron Macdonald, Seamus Lyttle
Phil Smith, Ralph Kohn, Chris White, Dick Hadlow
(Not in picture: Maurice Knowles, Peter Terry and John Barnett)

In particular, I must acknowledge the invaluable help given by Captain Christopher (Chris) N. White, FRAeS, with whom I have had the privilege to work in the past, on 747 training matters and also on this and other documents. I must thank him for his assistance with the initial screening and proof reading of the original text as written for an airline, for which he produced additional type specific Chapters for the B777 and the B747-400. Captain White is a member of the Flight Operations Group Committee. He was a British Airways B747 (100/200 & 400 series) training captain and CAA Delegated Type Rating and Instrument Rating examiner, until his retirement some 9 years ago. Though retired, Chris went on to become a Type Rating instructor with UK and overseas TRTOs in a Consultancy capacity. I must also mention his boundless energy, enthusiasm and patience when dealing with those who were fortunate enough to be trained by him in the multi-crew, heavy-jet co-pilot role and on command courses. The dedication of his approach to teaching is an exemplar of training excellence that must be recognised for its effectiveness, as I was privileged to witness in my role as a CAA training and flight operations inspector on the British Airways Boeing 747 fleets until my retirement. He is dedicated to constructive instruction and always trained pilots up to a Standard so that they would Pass. He never "Checked to Chop".

Special thanks to Captain Hugh P.K. Dibley, FRAeS, FOG Committee member, British Airways (Ret) & Airbus (Ret) for his inputs on the A320 SOP in Part 4, as an example of available manufacturer's guidance but not for operational use, Captain R. (Bob) Scott, FRAeS, (Cathay Pacific Airways B747-400 (Ret) and FOG Specialist Consultant for his useful comment, [SEO Peter Richards FRAeS \(British Airways Ret\) who spent much time proof-reading and also contributed practical technical advice from his former operational flight engineering career and last but not least, Captain P H S \(Phil\) Smith MRAeS, British Airways \(Ret\), for his proof-reading eagle-eye, his photos & his contribution in refining definitions.](#)

In addition, I am indebted to the following for text excerpts and illustrations:

(Alphabetically): 1 AIDU (RAF), Airbus, The Boeing Aircraft Company, British Airways, The Civil Aviation Authority (UK), The European Aeronautical Group (AERAD), GAPAN, Jeppesen Inc., The Royal Aeronautical Society and GAPAN.

1.4 THE REASON WHY?

While converting to the Boeing 747-100/200 then later, the 400 series, I had to refer to four separate Operations Manual volumes to extract AWO/LVO information prior to sitting my technical examinations; and before commencing flight training on the simulator, then the aircraft. Going from one manual to the next to seek information, scattered in all four volumes, was a dreadful and frustrating, not to say infuriating, waste of time. The lack of continuity made it more difficult than deemed desirable, because of all the leapfrogging involved. Worse still, the manuals did not contain or discuss background information that is vital to the understanding of the legal requirements source and their means of compliance, or the environmental airport infrastructure necessary for Low Visibility Operations. The pilot undergoing transition training was supposed to know it already, but if he did not, there was no indication of where to look for it or where to find the information. Yes, there are references scattered in many books and legal documents if, that is, one can actually find the source book or document.

It became clear that there was a need to offer an example of what an AWO/LVO training module should contain with regard to the whole spectrum of information that such operations require. The range of matters needing to be addressed includes all airport markings and its auto-approach [installations, such as ILS & MLS](#), their location and power supply needs, to aircraft equipment and how it should be used on an individual aircraft type basis.

As a result, this document was developed as a one-stop shop, where a synopsis of all AWO/LVO requirements are held for ready reference and as an example to Operators on what to aim for when preparing training modules, for their aircraft fleets with autoland capabilities.

In the case of this Specialist Document written to reflect EASA legislation held in EU-OPS 1 in Sub-part E, the aircraft type illustrated is the Airbus A320 series. Company volumes could hold additional Parts for other aircraft types operated. However, to keep it easy to handle, it might be best to produce individual fleet versions, one for each aircraft type, such as is shown in Part 5 of this document, now holding the A-320 AWO/LVO SOP example..

With all this in mind, I approached my long time friend and colleague Captain Christopher 'Chris' N. White (BA retired), with whom I had worked alongside in the training unit of the British Airways B747 fleets. He has a lifetime of experience in training as an airline captain instructor and examiner of airmen. He helped with the formulation of the envelope and what to include in such a document. That is how "**The All Weather Operations Guide**" was born. For ease of reference the means of deriving Aerodrome Operating Minima (AOM) according to current EASA legislation are also included for illustration. This means of self calculating AOM, where permitted may also be found on your flight deck in a section of the Flight Guide.

I trust that by adopting such a one-stop-shop training module, Operators may reduce the need for cross-reference to other sources of information, so that when using a guide on an AWO/LVO on the lines of this one during training, all the information needed to understand the underlying requirements would be readily accessible then and again later when 'refreshing'.

May your understanding of the overall AWO/LVO operational environment help to brush up your knowledge of operations in weather conditions that are below Cat 1. Remain alive to the vital need of ensuring that the latest requirements are being met, by referring to current legislation and other source documents in their fully amended state.

1.5 ABOUT THE ALL WEATHER OPERATIONS GUIDE

The All Weather Operations Guide is a reference manual, as implied by its name. It is presented in the format and layout of a typical Operation Manual volume, which contains comprehensive information needed to address and understand the current Regulatory Requirements for the introduction of a new aircraft type to Low Visibility Operations (LVO) and training its aircrew.

The Low Visibility Operations guidance material in this document is based on Requirements that currently satisfy ICAO Standards and Recommended Practices and reflect the contents of EU-OPS 1 relating to Low Visibility and All Weather Operations. The information is held in *PARTS* divided into *Sections*. EU-OPS 1 has replaced JAR-OPS 1 in mid 2008. In due course (the target period being 2012), these regulations will be replaced in turn by EASA developed texts.

The general information for Training Purposes and the Standard Operating Procedure (SOP) contained herein satisfy Regulatory Authorities' Air Safety Department (ASD) requirements for Low Visibility and All Weather Operations. Low Visibility Procedures come into effect when the Reported Visibility is less than 400m for take-off or below 800m (RVR 550m) for approach and landing.

1.6 CONTENT

PART 1 (Introduction) does just that. It introduces the Guide, its editorial team and the Flight Operations Group.

PART 2 (Airports and AOM) discusses airport facilities required before aircraft are authorised to operate to and from its runways, when weather conditions are below Cat 1 AOM. This Chapter also discusses the calculation of AOM for precision approaches and is intended to be used when operating in reduced visibility and in cloud below 200 feet.

PART 3 (AWOPS Procedures & Training) discusses the level of Authorisation granted for auto-approaches, followed by an automatic or manual landing. This level of authorisation depends on the automatic hardware installed on the aircraft and a given minimum level of specialist and ongoing maintenance, to attain and then maintain whatever Category 2 or Category 3 operation is targeted. The level of authorisation is also dependent upon the training, autoland practise and "AWO currency" the crews achieve and maintain.

On new-to-automatic-approach and landing aeroplanes, a proving period is generally required, during which crews practise automatic approaches and landings in good weather (above Cat 1 AOM) and then return completed result-forms for analysis by the Fleet and Engineering Departments. Later, when a formal application is submitted for AWOPS to be allowed as initially applied for, the Regulatory Authority will inspect crew training and 'recency' records. This procedure is required before approval is formally granted for All Weather Operations to commence within Commercial Air Transport Operations, provided that the inspection of records and then Flight Inspections during autoland operations are satisfactory.

It must be noted that for operations below Cat 1 AOM, it is **not only** generally necessary to obtain the Formal Permission of the NAA granting the Air Operator Certificate, **but the Company must also be given formal permission to so operate** by the NAA of aircraft Registry; required whenever the aeroplanes are registered elsewhere than in the State of AOC issue. The State of Destination **must also be asked for formal permission** to use suitably equipped runways, for such low visibility operations at aerodromes under its jurisdiction, to and from which flight operations are intended. Foreign operators no longer require CAA approval to conduct AWOPS in the UK, but must be so authorised beforehand by the NAA of their State of Registry.

For Category 3 auto-lands, the State of Destination sets the appropriate AOM and permits operations to or from runways, nominated on a runway end by runway end basis. The State of AOC issue (and of Registry if different) must then agree in-turn to permit such operations, before these are commenced.

PART 4 (Airbus A320 type-specific) contains sample instructions for the operation of Airbus A320 aircraft in low visibility conditions. It is an example of the type-specific Chapter that would be included in an All Weather Operations Guide such as this one, for pilots to study during LVO training and later, to consult regarding a particular LVO detail or as a reminder of a Standard AWOPS Procedure. The examples of SOP offered may need to be reviewed by the operator because some examples of the recommended calls and actions are generic by design. As such, they may need editing to reflect a Company's SOP, for 'crew calls' and methods of operation, within the Manufacturer's type-specific operating instructions envelope. For instance, references to flap setting may need to be altered to reflect Manufacturer 'parlance'. For example, Flap 0, 1, 2, 3 or FULL for the A321 series, may need to be changed to Flaps 10°, 20°, 30° etc., for other type-variants from the same 'stable'.

A number of **APPENDICES** complete this Document.

Appendix A has the underlying EU-OPS 1 Sub-Part E regulations that underpin the All Weather Operations scene for European Community (EC) airlines and those operating into and out of the European Union (EU). Sub-part E includes all the necessary data for the calculation of Aerodrome Operating Minima (AOM).

Appendix B is a procedure checklist breaking-down all the various matters that need addressing and satisfying when contemplating the introduction of AWOPS in an EC/EU airline.

Appendix C covers Winter Operations

Appendix D holds names and addresses of useful contacts.

Appendix E contains a list of useful bibliography references

Appendix F is a Glossary of Terms and Expressions used in All Weather Operations and generally in Aviation.

IMPORTANT

Please note that **ALL** references made to men '*pilots in command*' in this Guide, equally apply to lady '*pilots in command*'. Hence, where *He, Him* and *His* are mentioned, read it to also mean *She, Her* and *Hers*; respectively he/she, him/her or his /hers.

The operator of any particular aircraft type will have a preferred Standard Operating Procedure (SOP) for managing approaches (and other phases of flight) so as to ensure standardization across all the crews. In such cases, company SOPs have primacy and this publication should be seen as indicative rather than prescriptive.

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1.7 PURPOSE

This Guide is intended to be used by Pilots undergoing initial AWOPS training, after which it becomes a reference source of 'refresher' information. It brings together between one set of covers, details that explain the preparation and ongoing recurrent training required by crews, with the necessary airport and runway infrastructure and 'blind-landing' equipment requirements, before All Weather Operations can be entertained.

It is also important to understand that all references to CAA and JAR-OPS Regulatory material in their present formats have been replaced by EU OPS 1. Later, EASA Regulations will be produced in some equivalent form, during 2012.

Throughout this Publication,

References to *AERAD* mean the charting product of **Navtech Inc** producers of Flight Guides and Supplements containing airport data and "instrument approach let-down plates"; and

References to *Jeppesen*, mean the North American **Jeppesen Inc**, Flight Guide providers. Jeppesen is headquartered in Englewood, Colorado and has offices located around the world. Jeppesen is a subsidiary of Boeing Commercial Aviation Services, a unit of Boeing Commercial Airplanes.



Captain Ralph Kohn, FRAeS
Flight Operations Group (FOG) Watch-keeper Publications
1 October 2010

END OF PART 1 – INTRODUCTION

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COMMANDER'S DISCRETION TO APPLY HIGHER MINIMA

Operators are reminded that in accordance with certain National Regulations, a Commander is authorised to exercise discretion and apply minima higher than those published for both take-off and landing, if it is necessary in his opinion to do so in order to secure the safety of his aircraft.

PART 2 - SECTION 1 - THE AIRPORT

1.1 AIRPORT RESTRICTIONS DURING LOW VISIBILITY OPERATIONS (LVO)

All radio navigation aids, essential communication equipment and the RVR assessment system are 'no-break power-supplied'. Finely calibrated Dual ILS systems for Cat 2 and Cat 3 operations have no-break change-over, back-up power supplies and automatic monitoring systems. Localiser (LLZ) beams for Cat 2 & 3 operations have an additional 'far field' monitor used in AWO conditions. All visual aids are backed-up by a one second change-over secondary power supply.

During periods when Low Visibility Operations are in force, airport authorities put into action special movements' restrictions to sterilise ground movements in the environment near or across the active runway which is to be used by aircraft on Cat 2 and/or Cat 3a and 3b approaches. In such periods, vehicles are forbidden to cross the operational runway and Aircraft manoeuvring on taxiways are 'held' at SPECIALLY MARKED Cat 2 & Cat 3 holding points that are further from the active runway than the more usual Cat 1 holding positions, before being cleared on to the runway. These restrictions are enforced so as not to interfere with the ILS signal being used by aircraft on a below Cat 1 AOM approach for autoland (or for a manual landing in the Cat 2 AOM case). Pilots are reminded that if they detect vehicles compromising the LVP holding points, they have an obligation to report this to ATC immediately it is safe to do so.

Similar restrictions are imposed when aircraft are due to depart in low visibility conditions, particularly when the use of a PVD is also proposed; unless the ILS ground installation is approved for a 'PVD departure' at any time where so promulgated. When mixed LVO arrivals and departures use the same runway, approaching aircraft are held-off by ATC until the runway is fully clear of any preceding landing aircraft. This means that the last aircraft that has landed is well clear of the runway and on its way to the terminal (and hence beyond the Cat 2 / Cat 3 taxiway interference limit where taxiway centre line lights change from alternate Yellow / Green to all Green). Using airfield Ground Movements radar as necessary for extra guidance is an additional option.

There are similar restrictions for approaching aircraft when a runway is also in use for departure, when an autoland approach is not authorised until the preceding departing aircraft has turned away from the centreline after take-off, beyond any possible Back Beam interference.

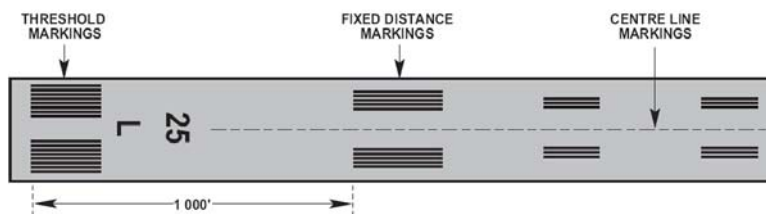
1.2 RUNWAY & TAXIWAY MARKINGS

Runway lighting and marking must be in compliance with *ICAO Annex 14 Standards and Recommended Practices*. Runways certified for Cat 2 and Cat 3 ILS Operations must be equipped accordingly, including threshold lighting, runway markings, runway edge lighting, runway-end lighting and markings, runway centre line lighting and markings and touch down zone lighting and markings.

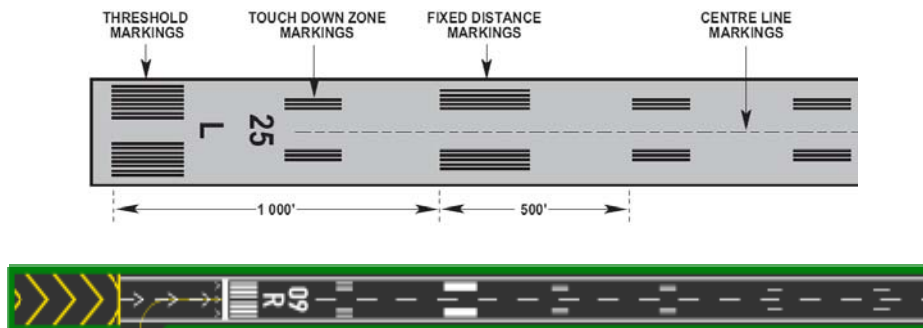
1.2.1 Runway Surface Markings (Source: Transport Canada AIM)

Runway markings vary depending upon runway length and width. The colour of the markings is white

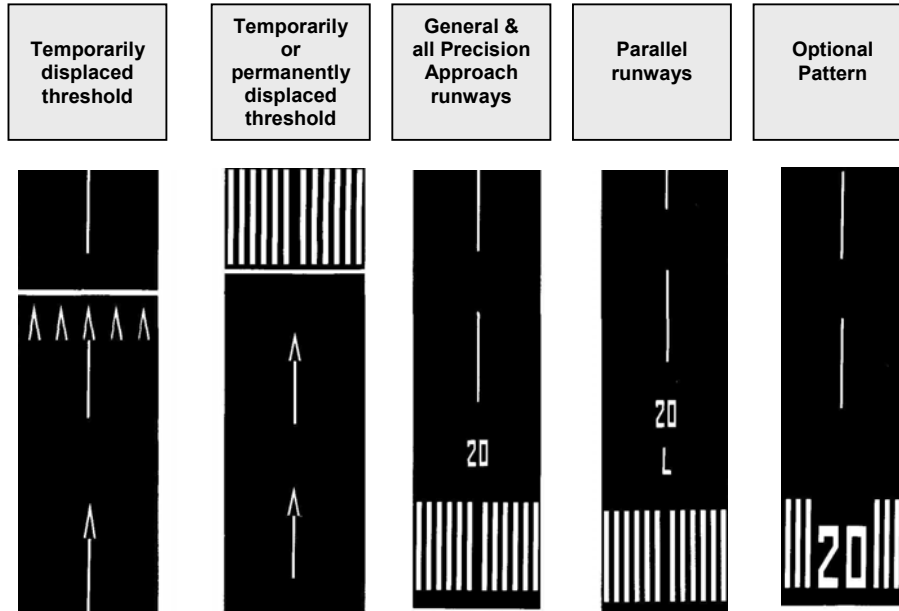
(a) Non-instrument Runway over 5,000 feet in length



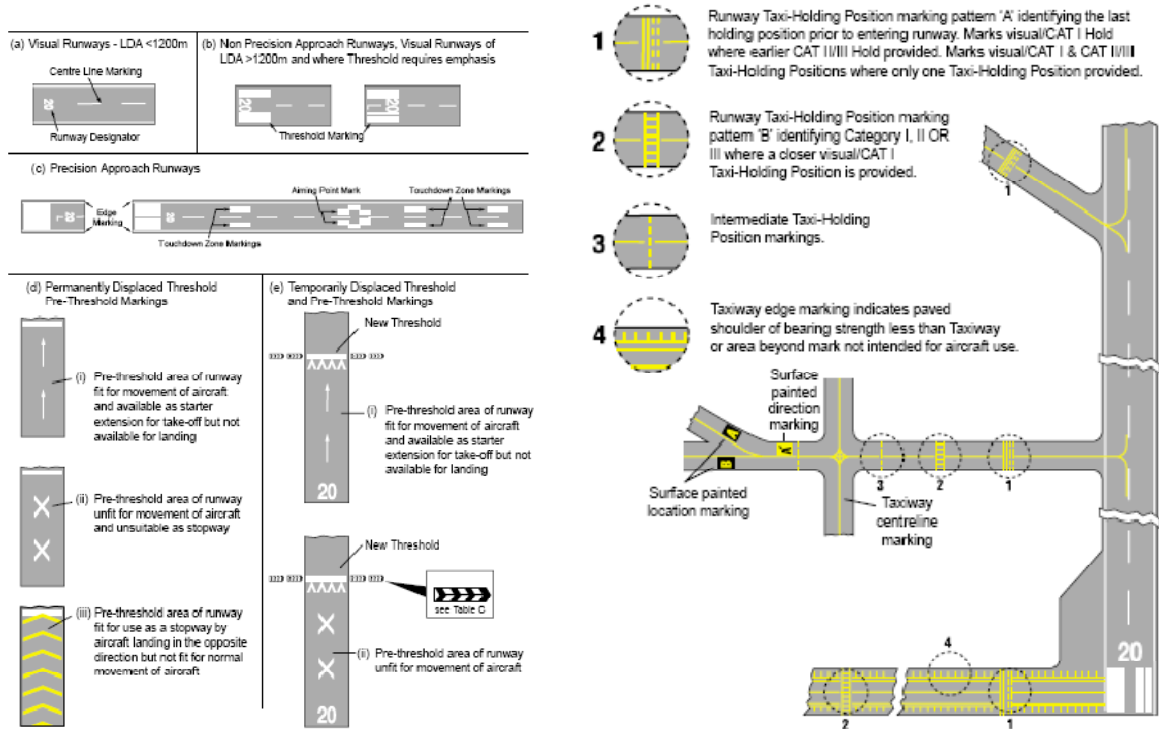
(b) Instrument Runway over 5,000 feet in length



(c) **Threshold Markings** (Source 1 AIDU RAF)

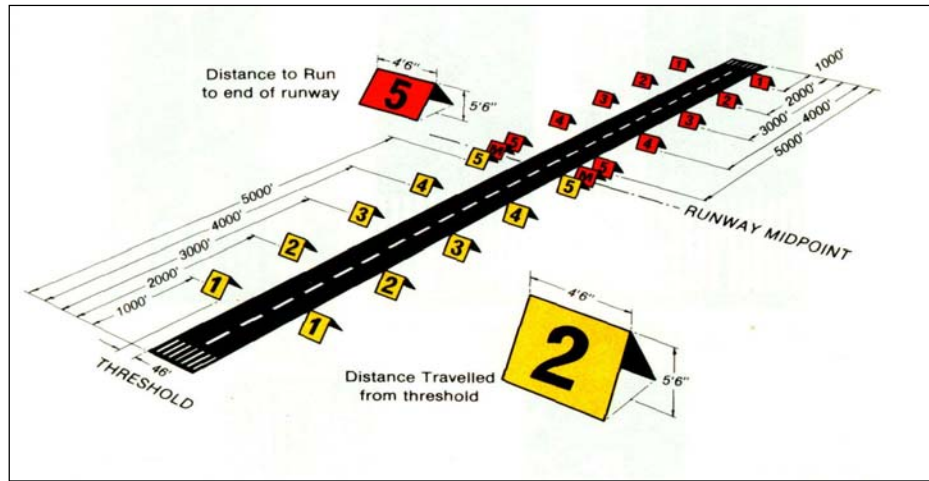


1.2.2 **Other Runway & Taxiway Markings**
 (Source UK CAA CAP 637)



1.2.3 **Civilian airports marker board system** (Source 1 AIDU RAF)

- a. Marker boards are 5 ½ feet high and 4 ½ feet wide and are positioned 46 feet from the runway lights
- b. The boards indicate (in feet)
 - i. **YELLOW** - Distance travelled from threshold (e.g., 1 = 1,000 ft, 2 = 2,000 ft, etc)
 - ii. **RED** - Length of runway remaining (e.g., 5 = 5,000 ft, 4 = 4,000 ft, 3 = 3,000 ft, etc)
- c. The arrangement of marker boards varies according to the airport. A note on the landing chart will explain differences from the layout illustrated.



Note 1: At runway/taxiway intersections where the centreline is curved towards the nearside edge of the runway centreline, pilots should take account where appropriate of any loss of 'Runway Declared Distances' incurred in following the lead-on line whilst lining up for take-off.

Note 2: At major aerodromes in the UK, taxiway width is determined so as to ensure a specified minimum clearance between the taxiway edge and the main undercarriage outer wheels of the largest aircraft that the taxiway is designed to accommodate. The minimum wheel clearance is assured in turns, provided that the pilot keeps a flight-deck point over the taxiway centreline.



Helsinki Vantaa Airport

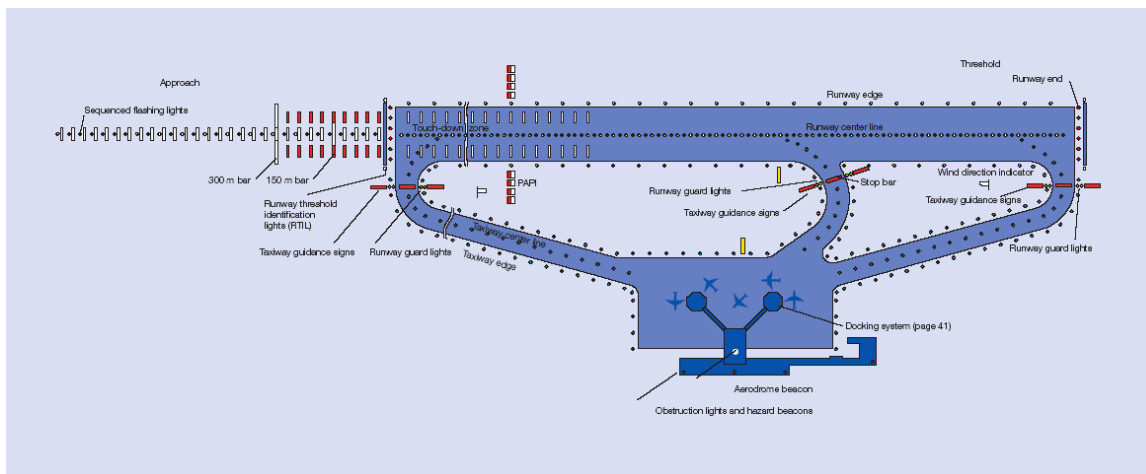
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1.3 AIRPORT LIGHTING & SURFACE MOVEMENTS SIGNS

Runway lighting and marking must be in compliance with *ICAO Annex 14 Standards and Recommended Practices*. Runways certified for Cat 2 and Cat 3 ILS Operations must be equipped accordingly, including threshold lighting, runway markings, runway edge lighting, runway-end lighting and markings, runway centre line lighting and markings and touch down zone lighting and markings.

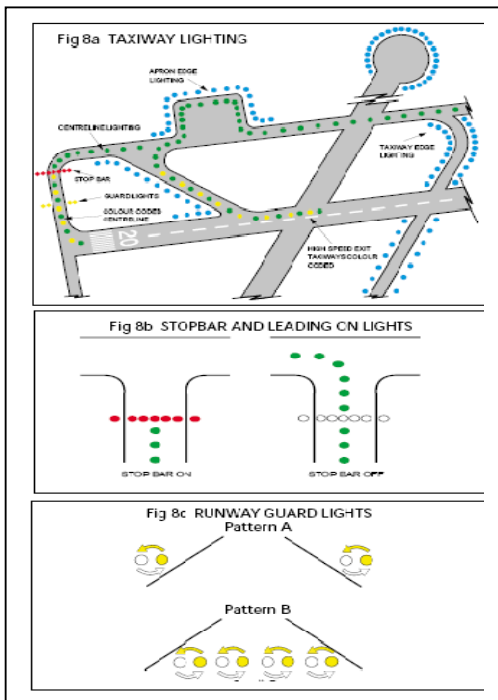
Typical airport lights installations for All Weather Operations are as follows

- Red:** Obstruction and runway end lights,
- Green:** Runway threshold lights and taxiway centreline lights,
- White:** Runway edge and approach lights,
- Blue:** Taxiway edge lights,
- Yellow:** Taxiway to Apron intersection lights.



Source: ADB Airfield Solutions 2010 (Siemens subsidiary) - Lighting

1.3.1 Taxiways Lighting (Source UK CAA CAP 637)



- Taxiway Cat 1, Cat 2 & Cat 3, lighting is in compliance with *ICAO Annex 14 Standards and Recommended Practices*. (CAP 637 Fig 8a refers)
- Stop bars, taxi-holding positions and illuminated notice boards must be installed to provide adequate clearance for aircraft taxiing to and from the runway. (See 1.3.1)
- All taxiways leading to and from precision approach runways are equipped with centreline inset lights, installed every 15 metres (50 feet) on straight sections and every 7.5 metres (25 feet) on curved sections of the taxiways.
- Taxiway edge lights are **BLUE** and stop-bar lights across taxiways are **RED**. Taxiway “lead-on” centreline lights are **GREEN**, but note the alternating **YELLOW - GREEN** centreline lights from the runway to a taxiway leading off the runway, until the taxiway is outside the protected LVO conditions area, after which the taxiway centreline lights become **ALL GREEN**. (CAP 637 Fig 8a refers)
- Taxiways leading to or from runways intended to be used during Cat 2 and Cat 3 weather conditions must be equipped with centreline lights. Taxiway centreline lights within the LLZ sensitive area must be colour-coded alternately **Yellow** then **Green**, to indicate to pilots exiting the runway they are still in the protected area. When the aircraft is clear of the LLZ sensitive area, the lights change to ‘all green’. At this point, a “runway vacated” call can be made to ATC. (CAP 637 Fig 8b refers)

• Pairs of ‘Wig-Wag’ RUNWAY GUARD lights are mounted one pair per side of the taxiway at Cat 2/Cat 3 stop bars, where painted on the taxiway. The lights are turned on and flash alternately when LVO procedures are in force, to attract the pilot’s attention and reinforce the position of the stop bar. These wig-wag lights are in addition to the illuminated RED marker boards placed on either side of the taxiway to identify the holding point. (CAP 637 Fig 8c refers)

1.3.2 **Airport Surface Movements & Guidance Signs** (Source UK: CAA CAP 637)

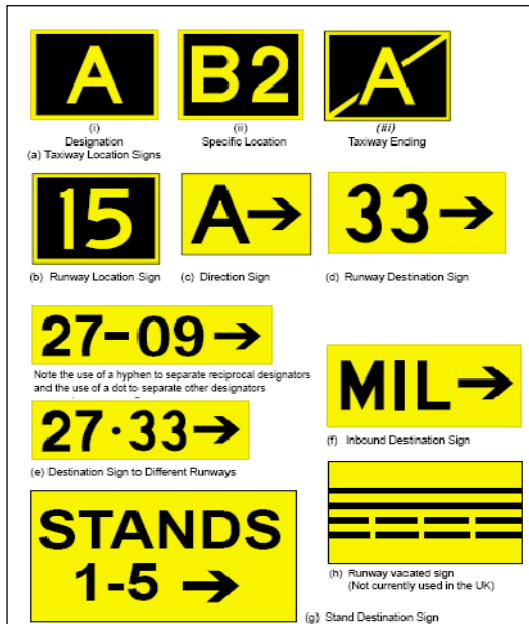
Three of the more important types of Airport signs are:

Mandatory Instruction signs: They have a red background with a white inscription. These signs denote the entrance to a runway, or a critical area, or a prohibited area.

Location signs: These are black with yellow inscriptions and a yellow border and do not have arrows. They are used to identify a taxiway, or a runway location, or to identify the boundary of a runway, or to identify an Instrument Landing System (ILS) critical area.

Direction signs: They have a yellow background with black inscriptions. The inscription identifies the designation of the intersecting taxiway(s) leading out of an intersection.

1.3.2a **Surface Movements Signs** (Source UK CAA CAP 637)

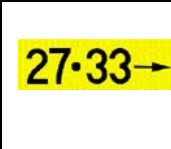





- Board used to denote the entrance to a runway or critical area in conjunction with hold bars.
 - It has white inscriptions on a red background.
 - It must not be passed unless permission is granted by ATC.
 - It should be **NOTAMed** when unavailable or unlit.
- Source FAA**









In addition to signs that identify holding positions on taxiways in Cat 1 or Cat 2 & Cat 3 conditions, there are six types of signs that can be found at airports. The more complex the layout of the airport, the more important the signs become to pilots. The illustrations show examples of signs, their purpose, and appropriate pilot action. Many airports have such complicated signage and lighting patterns that a visit might be necessary prior to Line Operation.

1.3.2b **Other Airport Signs** (Source AOPA with amended runway boundary sign explanatory)

	ILS critical area holding position sign When the ILS is in use ATC may hold you short of this sign so your aircraft does not interfere with the ILS signal.		Runway boundary sign (r/w on = = = = side & taxiway on ===== side) This sign faces the runway and is visible to pilots exiting the runway so taxi past it, to be sure you are clear of the runway.
	Runway approach area hold position sign You must hold at this sign until cleared to cross the runway, to avoid interference with runway operations.		Taxiway ending marker This sign indicates the termination of the taxiway. It is located at the far end of the intersection.
	Taxiway location sign This sign indicates which taxiway you're on. It may be posted next to direction or holding position signs.		Closed runway & taxiway marking Located at both ends of permanently closed runways and at 1,000-foot intervals. It is also placed at taxiway entrances if they are permanently closed.
	Runway holding position sign Until cleared onto the runway you must hold at this sign. In this example, the runway 15 threshold is to the left and the runway 33 threshold is to the right.		Direction sign for runway exit This sign will indicate the approaching taxiway while on the runway. In this example, taxiway Bravo is approaching to the left.
	Destination signs and location sign This sign indicates current position and direction to other taxiways. In this example, you are on Alpha taxiway. Taxiway Charlie passes from right to left and Alpha continues ahead to the right.		ILS critical area boundary sign Indicates when you are safely clear of the ILS critical area. It is located directly beside the ILS holding position markings. While ILS approaches are in use, taxi past the sign before stopping on taxiway.

	Outbound destination sign This sign indicates directions to common taxi routes. In this example, runway 27 and 33 are to the right. The dot in the middle, separates the destinations identified on the sign.		Holding position and location signs In this example you are on taxiway Alpha; runway 5-23 passes perpendicular to your position. Runway 9-27 passes at an angle starting ahead and left of your position to behind and right of your position.
	Inbound destination sign This sign directs pilots to destinations on the airport. This example indicates that the military installation is to the right.		Runway location sign This sign identifies the runway on which your aircraft is located.

1.3.2c **Runway designator signs**

a.	Visual Runway Taxi-holding Position denotes the visual Taxi-Holding position and also the ILS Cat 1 Holding Position where the Visual and Cat 1 Holding Positions are co-located.	i.	
		ii.	
b.	Cat I Runway Taxi-Holding Position Sign Denotes ILS Cat I Taxi-Holding Position only where a visual holding position is established closer to the runway to expedite traffic flow.	i.	
		ii.	
c.	Cat II Runway Taxi-Holding Position Sign Marks the ILS Cat II Taxi-Holding Position. A Visual Cat I Taxi-Holding Position may be established closer to the runway where it is necessary to expedite traffic flow	i.	
		ii.	
d.	Cat III Runway Taxi-Holding Position Sign Marks the ILS Cat III Taxi-Holding Position. A Cat 2 Taxi-Holding Position & a Visual Cat I Taxi-Holding Position may be established closer to the runway where it is necessary to expedite traffic flow	i.	
		ii.	
e.	Combined Runway Taxi-Holding Position Sign Marks the Taxi-Holding Position where the ILS-Taxi-Holding positions are co-incident. A Visual or Cat I Taxi-Holding Position Sign may be placed closer to the runway where it is necessary to expedite traffic flow	i.	 
		ii.	
f.	Intermediate Taxi-/holding Position Sign Marks a Holding Position established to protect a priority route		
g.	No Entry Sign		
Notes	The signs (i) are used where the taxiway serves only one runway direction. The signs (ii) are used where the taxiway normally serves both runway directions		

(Source UK: CAA CAP 637)

1.3.3 **RUNWAY LIGHTING**

a. **Runway Edge Light Systems**

High intensity edge lighting as used on all runways has up to five levels of brightness.

- i. Runway edge lights are used to outline the edges of runways during periods of darkness or restricted visibility conditions. These light systems are classified according to the intensity or brightness they are capable of producing: they are the High Intensity Runway Lights (HIRL), Medium Intensity Runway Lights (MIRL), and the Low Intensity Runway Lights (LIRL). The HIRL and MIRL systems have variable intensity controls, whereas the LIRLs normally have one intensity setting.
- ii. The runway edge lights are white, except on instrument runways where yellow replaces white on the last 2,000 feet (610 metres) or half the runway length, (whichever is less), to form a "caution zone" for landings.
- iii. The lights marking the ends of the runway emit RED light toward the runway, to indicate the end of runway to a departing aircraft. These lights also emit GREEN light outward from the runway end, to indicate the threshold to landing aircraft when it is used in the opposite direction for Arrivals.

b. **Runway centreline lighting**

Runway centreline lights are installed on precision approach runways to facilitate landing under adverse visibility conditions. Runway centre line lighting, installed at 50 feet (15 metres) or 100 feet (30 metres) intervals, is colour coded on many runways. When viewed from the landing threshold, the runway centreline lights are white until the last 3,000 feet (915 metres) of the runway. The white lights begin to

alternate with red for the next 2,000 feet (610 metres) and for the last 1,000 feet (305 metres) of the runway, all centreline lights are red. Lighting intensity levels may be modified by the Tower controller, on request

Once off the runway, Cat 2 / Cat 3 runway exit points are identified by alternate green and yellow centreline lights leading to the taxiway. Taxiway centreline lights turn to all green when the aircraft passes the Cat 2 / Cat 3 holding point, marking the limit of the protected area. Taxiways edges are marked by blue lights.

c. **Category 2, 3a & 3b Systems**

In-pavement touchdown zone lighting and centreline lighting is installed on Cat 2 and Cat 3 Runways, with high-speed turn-off centreline lighting (alternating yellow/green) leading to taxiways.

d. **Runway End Identifier Lights (REIL)**

REILs are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of two pairs of synchronized flashing lights located on each side of the runway threshold lights. The REIL installation may be either omni-directional or the lights can be uni-directional, facing the approach area. REILs are effective for

- i. Identification of a runway surrounded by a preponderance of other lighting; and/or
- ii. Identification of a runway which lacks contrast with surrounding terrain; and
- iii. Identification of a runway during reduced visibility.

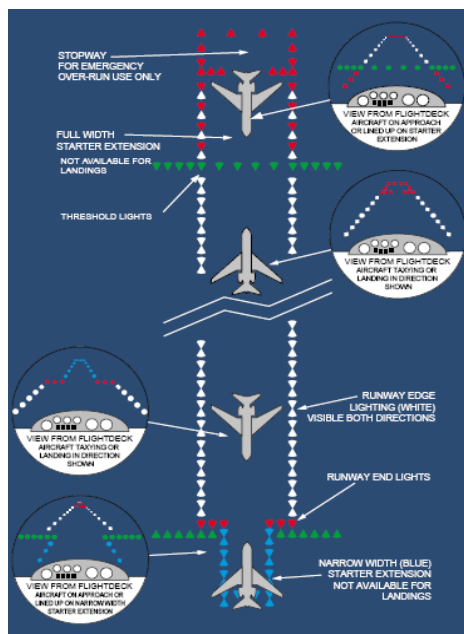
e. **Runway Surface Flush-mounted Lighting**

i. **Runway Centreline Lighting System (RCLS):** Runway centrelines lights, located along the runway centreline, are spaced at 50 or 100 feet (15 or 30 metre) intervals. Centre-line and other colour-code lighting details are explained in (b) above.

ii. **Touchdown Zone Lights (TDZL):** Touchdown zone lights are installed on some precision approach runways to indicate the touchdown zone when landing under adverse visibility conditions. They consist of two rows of transverse light bars disposed symmetrically about the runway centreline. The system consists of steady-burning white lights which start 100 feet (30 metres) beyond the landing threshold and extend to 3,000 feet (915 metres) beyond the landing threshold or to the midpoint of the runway, whichever is less.

iii. **Taxiway Lead-Off Lights:** Taxiway lead-off lights extend from the runway centreline to a point on an exit taxiway, to expedite movement of aircraft from the runway. These lights alternate green and yellow from the runway centreline to the runway holding position or the ILS/MLS critical area, as appropriate.

iv. **Land and Hold Short (LAHSO) Lights:** Land and hold short lights are used to indicate the 'hold short' point on certain runways which are approved for Land and Hold Short Operations (LAHSO). Land and hold short lights consist of a row of pulsing white lights installed across the runway at the hold short point. Where installed, the lights will be on any time LAHSO is in effect. These lights will be off when LAHSO is not in effect.



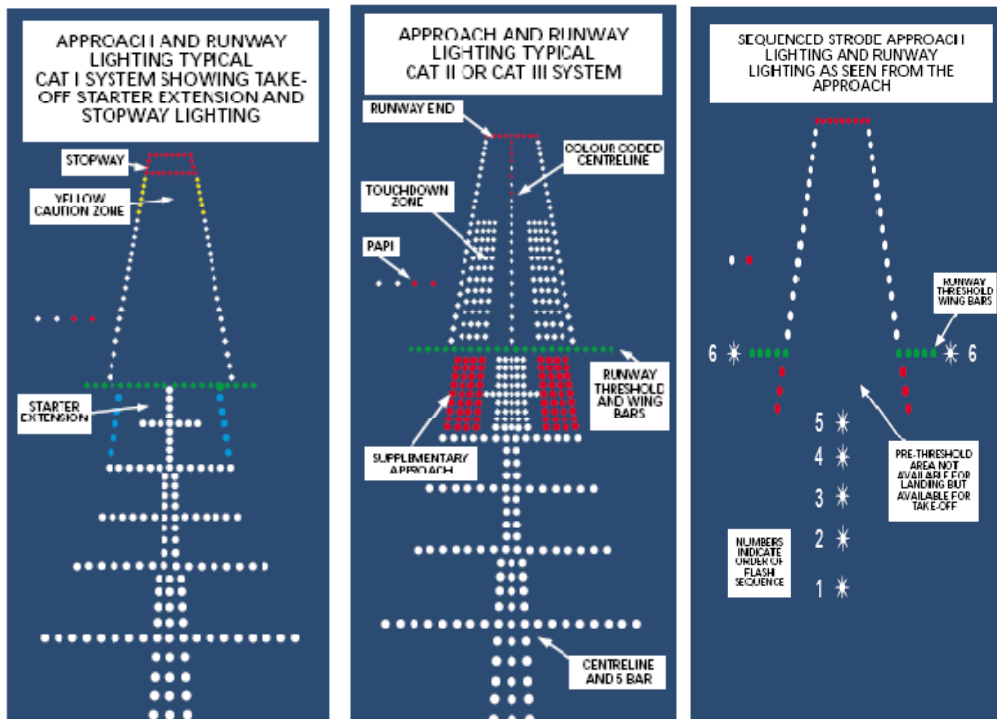
Runway edge, Threshold & Ends lighting as seen from the flight deck looking ahead (Graphic from UK CAA CAP 637)



Approach & Runway lights at dusk USAF/FAA Photo

1.3.4 Approach Lighting & Runway Lights Patterns
 (Graphics from UK CAA CAP 637)

Approach lighting for precision approach runways must be in compliance with *ICAO Annex 14 Standards and Recommended Practices*. **Approach lighting & centreline strobes (if fitted)** may be equipped with low, medium or high intensity lights. Runway identification lights are installed at runway thresholds. Precision Approach Path Indicator (PAPI) lights are also installed on the side either side of the runway touch down area. Strobes may be installed at certain airports for added conspicuity of path alignment



Note: At certain aerodromes with displaced thresholds, the supplementary approach lighting is inset into the runway and in some weather ambient light conditions the centreline barrettes when at the higher intensity settings, can partially obscure the runway centreline lighting to pilots lining up for departure. Pilots who are experiencing problems of this nature should ask ATC to adjust the intensity or extinguish the offending light(s).

1.4 APPROACH LIGHTING (Also see Section 2)

1.4.1 Approach Lights Systems Categories

Not all airport approach lighting installations are suitable for All Weather Operations (AWOPS). Installations illustrated conform to a number of different specifications.

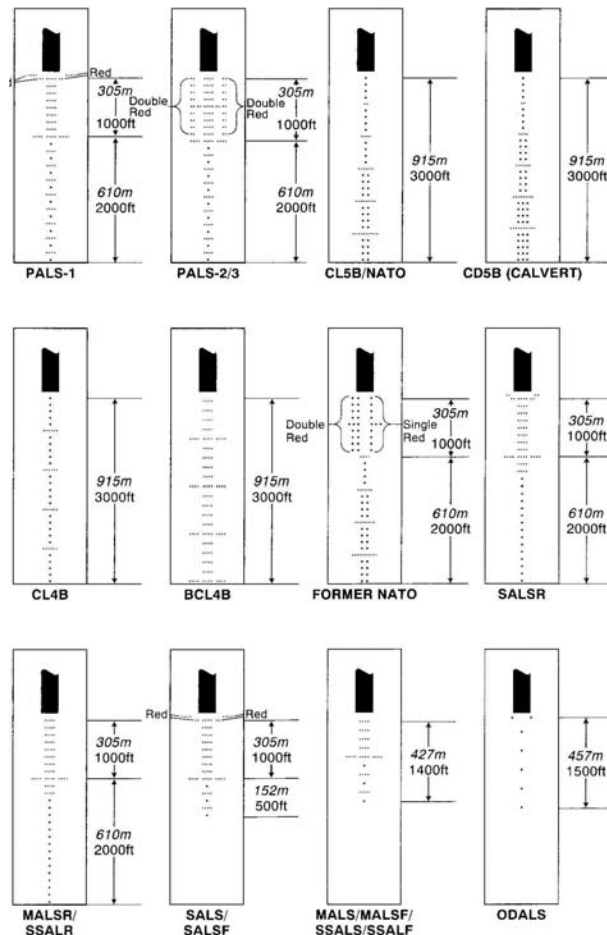
FAA CAT	EU-OPS EQUIVALENT	EU-OPS designator & Category
(A) ALSF-2	Full	PALS 2/3 Cat 2 or 3
(A1) ALSF-1	Full	PALS 1 Cat 1
(A3) SSALR	Full	SSLAR Cat 1
(A5) MALSR	Full	MALSR Cat 1
(A2) SALS	Intermediate	Calvert CD5B1 or 2 - 5 bar - Cat 1 or 2
(A2) SALSF	Intermediate	Calvert CL5B (5 bar) Cat 1
(A4) MALS	Intermediate	Calvert CL4B (4 bar) Cat 1
(A4) MALSF	Intermediate	BCL4B 'bar centreline' & 4 bars - Cat 1
(A4) SSALS	Intermediate	SALSR Cat 1
(A4) SSALF	Intermediate	Cat 1
ODALS	Basic	Visual

1.4.2 Approach & Runway Lighting Glossary

- CD5B** (CALVERT) Colour coded approach lighting system with 5 bars; if known, suffixed (- 1) for ILS Cat 1 configuration and (- 2) for Cat 2 configuration. Red Barrettes in last 1,000ft (305m) of ALS centreline.
- CGL** Circle Guidance Light(s)
- CL-1B** Centreline with one bar (single row not coded). May be up to CL-7B (with up to 7 bars).Prefixed by 'B' indicates bar centreline.
- F** Sequenced flashing lights.
- LDIN** Sequenced flashing lead-in lights.
- MALS** Medium intensity approach lighting system.
- MALSF** Medium intensity approach lighting system with sequenced flashing lights.
- MALSR** Medium intensity approach lighting system with runway alignment indicator lights.
- NATO** North Atlantic Treaty Organisation standard system (Military). Centre-line & 5 bar (CL-5B).
- ODALS** Omni-directional sequenced flashing lead-in lighting system.
- PALS -1** Precision Approach lighting with sequenced flashing lights in ILS Cat 1 configuration.
- PALS -2** Precision Approach lighting with red barrettes + sequenced flashing lights in ILS Cat 2 configuration.
- RAI** Runway alignment indicator lights. (Only installed with other lighting systems)
- RAL BCN** Runway alignment beacon at distance from threshold indicated.
- SALS** Short or Simple approach lighting system.
- SALSF** Short or Simple approach lighting system with sequenced flashing lights.
- SALS SR** Short or Simple approach lighting system with runway alignment indicator lights.
- SSALS** Simplified short approach lighting system (May be installed with SALSF and SALS SR)
- SHINGALS** Supplementary high intensity narrow gauge approach lighting system
- T (Red T)** Normally used with other lighting systems; located at runway end of approach lighting.

1.4.3 Approach lighting systems arrays (Source 1 AIDU RAF)

APPROACH LIGHTING SYSTEMS

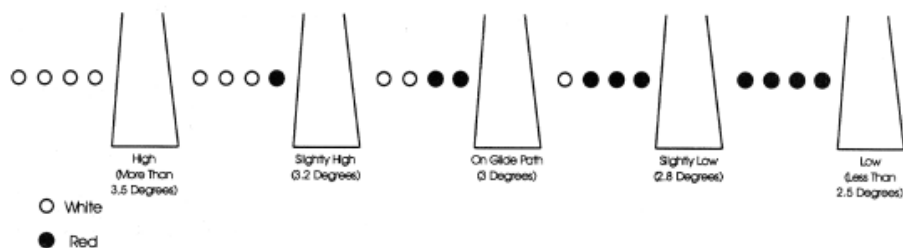


1.5 APPROACH PATH GUIDANCE SYSTEMS

1.5.1 Precision Approach Path Indicator (PAPI)

The precision approach path indicator (PAPI) uses light units similar to the VASI but the lights are installed in a single row of either two or four light units. These systems have an effective visual range of about 5 miles during the day and up to 20 miles at night. The row of light units is normally installed on the left side of the runway and the glide path indications are as depicted in the illustration hereunder (where two RED and two WHITE lights indicate that the aircraft is on the correct glide slope). If installed on both sides of the runway, then the RED lights are always seen nearer the runway, whenever both WHITE and RED lights are visible to the pilot

Precision Approach Path Indicator (PAPI)



PAPI Array - Luxembourg Findel Airport

Source: Luxembourg Airport Authority

1.5.2 Visual Approach Slope Indicator (VASI) – Two bar

The full system consists of twelve units which are arranged to form two lighted wing-bars on each side of the runway showing white light above the glide slope and red below it. They are placed at 150 m and 300 m along the runway and at least 15m outside the runway lights.

Abbreviated VASI systems (AVASI) have a fewer lights for each wing bar, on one or both sides of the runway.

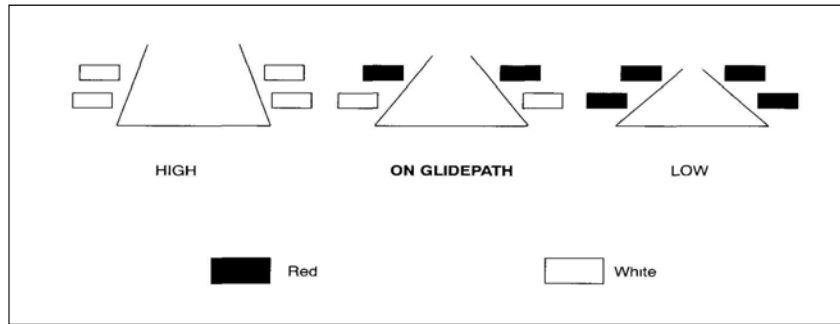
The aircraft should be flown within the white beam of the nearer bar(s) and the red beam of the upwind bar(s) during an approach, to aim to touch down at the correct distance from the threshold. If both bars are red the aircraft is too low, conversely, if both are white, it is too high. If well below the target glide path, the red bars tend to merge into one and care must be taken not to continue descending in the pink sector of the nearer bar.

Note the following operational considerations when using VASIS:

- At maximum range,, the white bars bay be seen before the red ones and might appear yellow in certain conditions.
- In poor visibility the VASI may not be seen before the runway threshold and can only then be used to indicate a possible undershoot if showing red/red.
- The coverage of the system in azimuth varies between 10° and 15° either side of centreline in daylight and 15° either side at night. The system should only be used for guidance when lined-up with the runway centreline, as obstacle clearance protection cannot be guaranteed if the VASI is seen and used before lining-up with the extended centreline.

Pilots of long bodied aircraft should not rely on this system for approach slope guidance, since this would cause an early touch-down. The standard system is modified at some airfields by adding a third pair of wing-bars (one on either side of the runway), for use by long bodied aircraft. It is known as a three-bar VASI.

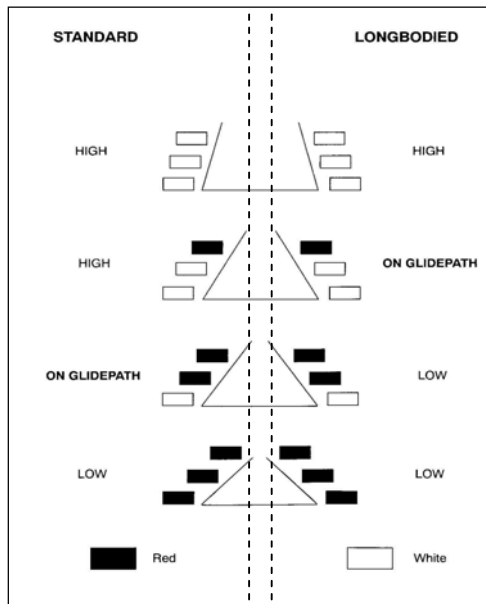
Two-bar VASI



1.5.3 Visual Approach Slope Indicator (VASI) – Three bar

A three-bar VASI is obtained by adding a third (upper) bar to the standard VASI system. Use of this arrangement allows enough wheel clearance over the threshold for very large aircraft, where a significant difference in eye height exists between a pilot's eye and the landing gear.

Long-bodied aircraft use the second and third set of wing-bars and ignore the nearest first one. Other aircraft should use the first and second set of bars and ignore the third (far one). Particular care should be taken to fly the correct set of bars appropriate to the aircraft type flown.



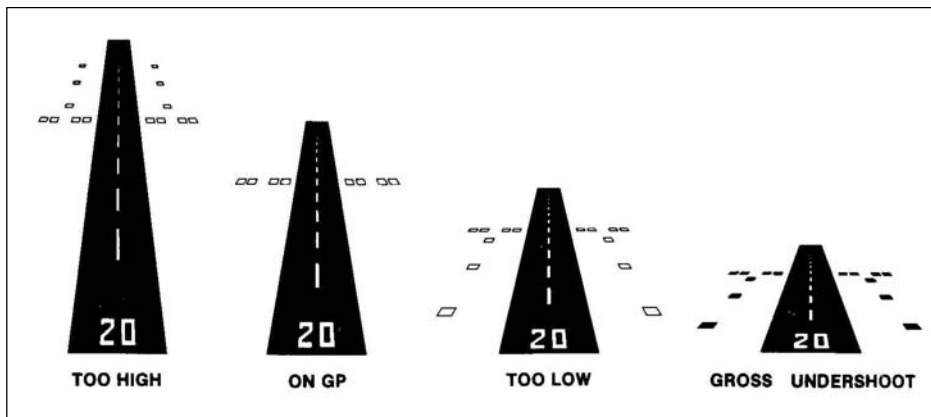
The dotted vertical lines down the centre of this diagram separate the two body-length requirements

1.5.4 T-VASIS

The T-Visual Approach Slope Indicator System (T-VASIS) is one of the three radio navigation aid inventions for which Australia is justly famous; the others being Distance Measuring Equipment (DME) and the Interscan Microwave Landing System (MLS). As an Australian development, it is mainly found at airports in that country.

- The T-VASIS consists of two wing-bars one on each side of the runway with 4 lights each and extending fore and aft, parallel to the runway edge, are lines of 6 single lights. An 'AT-VASI' is located on one side of the runway only.
- When ABOVE the glide slope, the pilot will see the wing-bars WHITE with the furthest single lights ("fly-down" lights) showing WHITE. The more lights visible the higher the aircraft is above the glide-slope.
- When on the glide-slope (normally 3°) only the wing bars will be visible.

- d. When BELOW the glide-slope the pilot will see the wing-bars WHITE and the nearer single lights ("fly-up" lights) WHITE. The more lights visible the lower the aircraft is below the glide-slope.
- e. When only the wing-bar lights are visible, the pilot's eye height over the threshold is between 39ft and 52ft.
- f. If the wing bar and one "fly down" light is visible, the pilot's eye is 52 feet to 69 feet above the threshold. Similarly, seeing a Wing bar + 2 lights means the eye is 69 ft to 89 ft, whereas a Wing bar + 3 lights means the eye is 89 ft to 174 ft above the threshold.
- g. The azimuth spread of the lights varies between 5° either side of the extended runway centre line by day to 15° by night.
- h. Since the light spread may extend to areas where adequate terrain clearance cannot be guaranteed the system should not be used for glide-slope guidance until the aircraft is lined up on the extended runway centre-line.
- i. During light ground fog conditions the "fly-up" and "fly-down" lights may be visible at the same time as the wing-bar lights, due to reflection from water droplets. However, the reflected light should appear fuzzy and less distinct than the main wing bar lights and it should be apparent to the pilot, in which case the approach should be made on direct lights. If in doubt do not use the T-VASIS



T-VASIS - Gross undershoot is indicated when the TOO LOW lights turn to RED

1.6 SEQUENCING OF GROUND MOVEMENTS FOR TAKE-OFF IN LOW VISIBILITY

As a typical example, when the RVR at London Heathrow (LHR) is below 400m, pilots are asked not to request start-up clearance until the reported RVR is equal to or greater than the value given below.

Aircraft Take-off Minima RVR/ m	Minimum for Start-up Clearance RVR/m
350	300
300	250
250	200
200	150
150	150
100	100
75	75

It is emphasized that these measures apply only when the reported RVR is below 400m. The co-operation of all pilots is sought in maintaining this safety oriented level when in low visibility minima conditions.

1.6.1 Cat 2 & Cat 3 Low Visibility Operations ATC Procedures Examples

Runways 09R, 09L, 27R and 27L at London Heathrow (LHR), subject to serviceability of the required facilities, are suitable for Cat 2 & Cat 3 operations by operators whose minima have been accepted by the UK CAA (since LHR is in their jurisdiction) and also the NAA of the aircraft's registration.

During Cat 2 & Cat 3 operations, special ATC Low Visibility Procedures will be applied and pilots will be informed when these procedures are in operation by ATIS or RTF.

Departures: Still using London Heathrow as an example, ATC will require departing aircraft to use the Cat 3 holding points listed below. However, other departure points may be used at ATC discretion, in which case due allowance will be made by ATC for the necessary ILS protection.

- Runway 27L:** Holding points N2W, N2E, N3, S1S, S1N and S3.
- Runway 27R:** Holding points A3W, A3E, A2, TITAN, A4 and A5.
- Runway 09L:** Holding point A13.
- Runway 09R:** Holding points N11 and S7.

Arrivals: Surface Movement Radar (SMR) is normally available and all runway exits will then be illuminated. Pilots should select the first convenient exit. Pilots are to delay the call "runway vacated" until the aircraft has completely passed the end of the yellow/green colour-coded taxiway centreline lights and the whole aircraft is on the ALL GREEN centreline lights section of the taxiway.

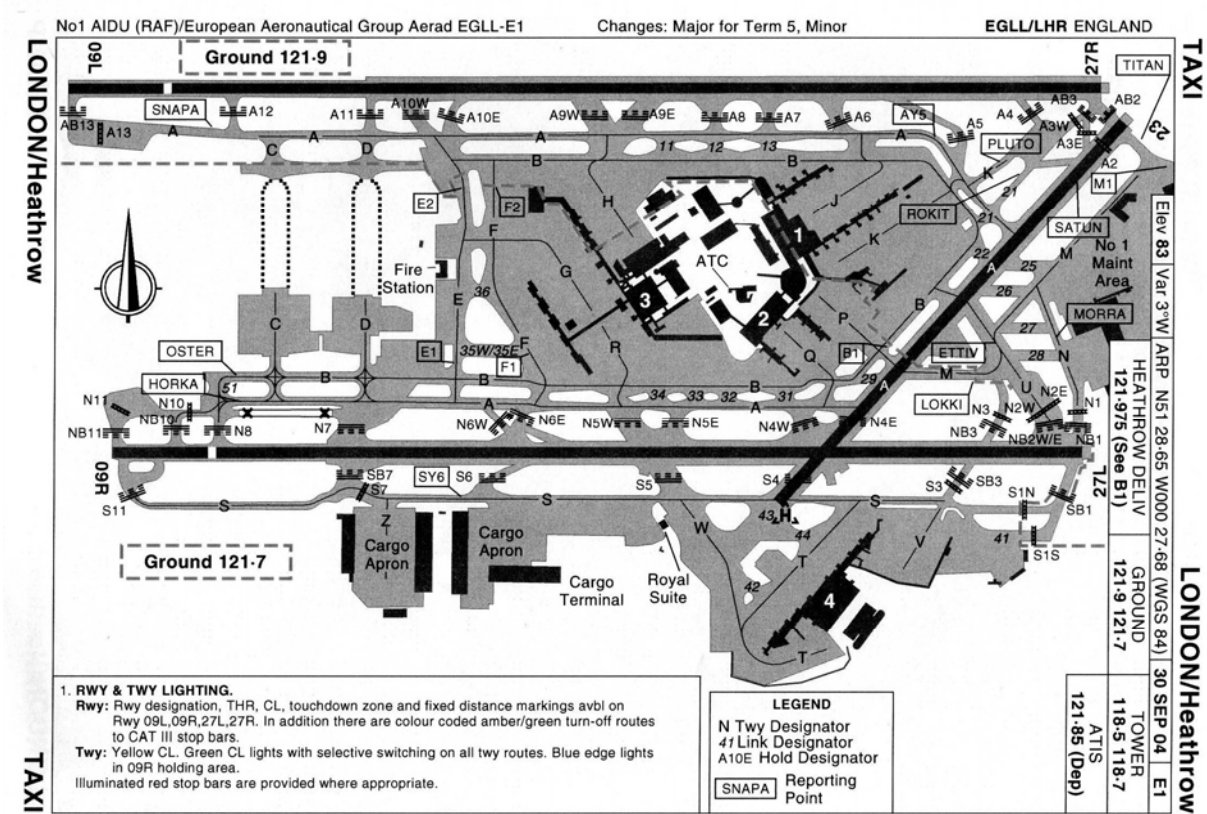
1.6.2 Expected landing rates when LVO Procedures are in force

Still using London Heathrow (LHR) as an example, in common with other Cat 2 and Cat 3 airports, a much reduced landing rate can be expected when LVO procedures are in force, due to the requirement for increased spacing between arriving aircraft. In addition to the prevailing weather conditions, such factors as equipment serviceability may also have an effect on the actual landing rates. For information and planning purposes, the approximate landing rates that can be expected are:

IRVR	Expected Landing Rate
Between 1,000-600m	34 per hour
Between 600-150m	24 per hour
Less than 50m	Less than 20 per hour

1.6.3 Sample Ground Movements Chart for Use When Taxiing

Sample chart only – Not to be used operationally



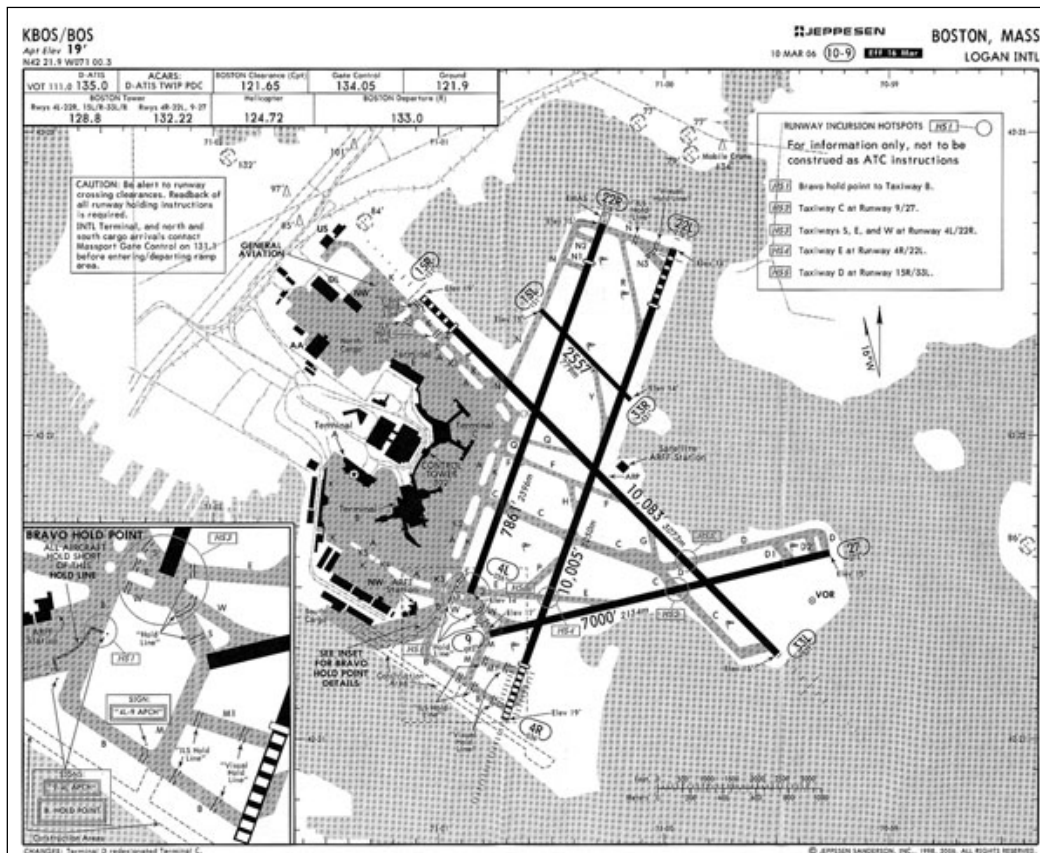


BA B747s 'feeding' at Heathrow (LHR)

Source BA

1.6.4 Taxi chart showing runway surrounding terrain features

Sample chart only – Not to be used operationally
BOSTON (LOGAN) USA



Boston (Logan) USA - Taxi chart Source: FAA & Jeppesen Inc

1.7 MEASUREMENT OF RUNWAY VISIBILITY AT AIRPORTS

1.7.1 Runway Visual Range (RVR)

Permissible Low Visibility Operations are dependent upon the reported visibility for arrivals and for departures. Where the visibility is less than 300 metres (m) it must be measured by a Transmissometer and reported as RVR.

1.7.2 Measurement of Visibility

- a. Visibility must be measured in the **touchdown zone** and the **mid-point zone**. If the mid-point is not available, the **stop-end zone** is required when the visibility is more than 200 metres (m).
- b. For RVRs of more than 200 m, two zones are required (**touchdown & mid** OR **touchdown and end**).
- c. If any zone's visibility is less than 200 m then a measurement is required in all zones.

1.7.3 Transmissometers

When an aircraft lands in less-than-ideal weather conditions, one of the most important factors is runway visibility. The Runway Visual Range (RVR) system collects visibility and background luminance data from the visibility sensors, and runway light setting data from a dedicated interface unit. It calculates the runway visual range on the basis of this data. Automatic RVR instruments (Transmissometers) have long been the established visibility sensors for RVR measurement. The basic set includes a light transmitter and one or more receivers. The transmitter projects a narrow beam of light towards the receiver, which measures the intensity of the beam. The attenuation of the light is easily calculated once the intensity of the transmitted light is known. This relatively straightforward method is a direct measurement of attenuation that provides very precise results in all weather conditions.

State-of-the-art technology Transmissometers measure and present the RVR at airports with 'All Weather Operations' (AWOPS) capability. The units are mounted at the side of the runway, at each end and mid-way, giving an instantaneous electronic measurement for ATC and hence Flight Crew use.

The system collects data for the RVR computer in the meteorological station. This reading is then further distributed and shown on Digital Displays in the air traffic control tower.

The unique feature of the latest available systems is their extensive self-monitoring capabilities and refined optical contamination compensation. The presence of light intensity measuring units, both at the transmitter and the receiver, make for highly accurate and reliable measurements and a significant reduction in the need for maintenance and cleaning, compared with earlier generations of optical sensors.



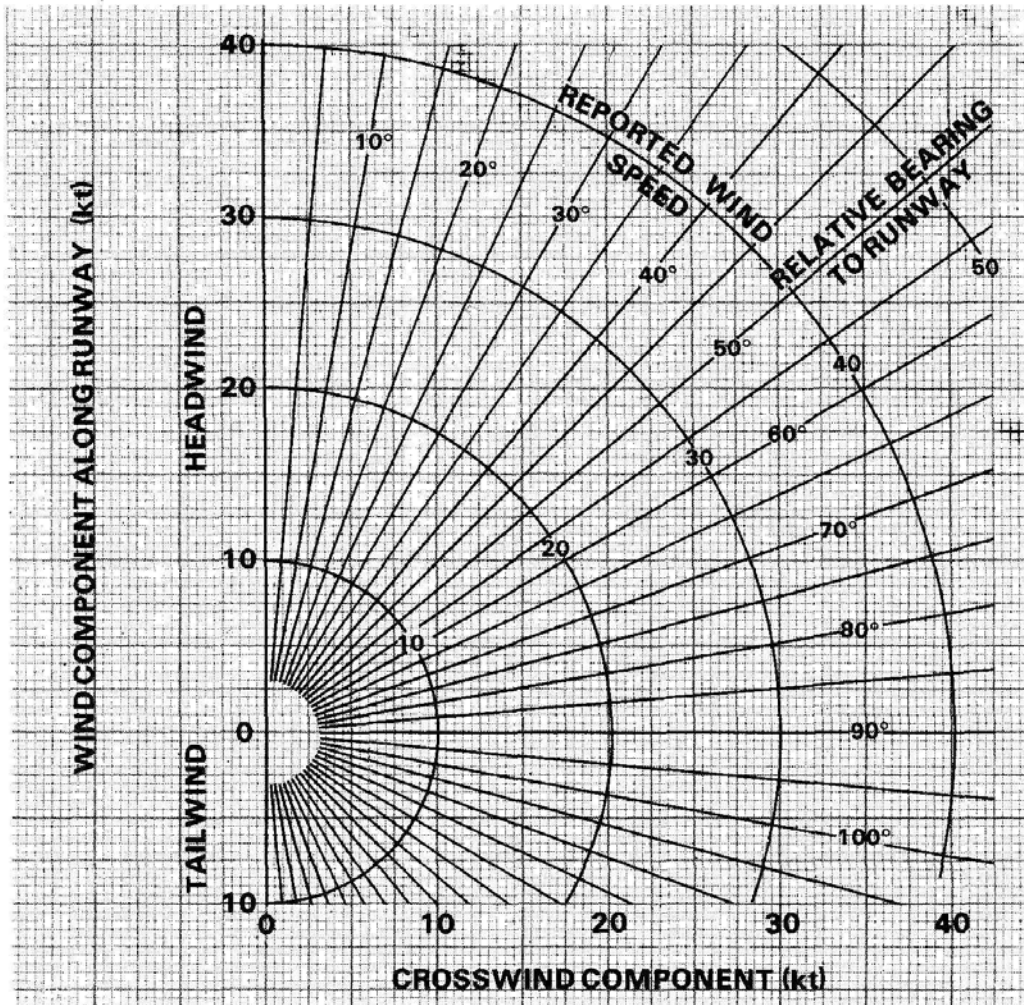
Vaisala MITRAS 18 Transmissometer sensor mast and array
 (Vaisala company Oyj, PO Box 26 00421 Helsinki, Finland)



Dual sensor Transmissometers by Dual Technology
 RVR Sensor developed by *All Weather, Inc.*
 Sacramento, CA 95834 USA)
 (1165 National Drive, Sacramento CA 95834 USA)

1.8 RELATIVE WIND VECTOR DIAGRAM EXAMPLE
 With Cross Wind Limits Relating To B747-200 Series Aircraft

**COMPARE MAGNETIC WIND DIRECTION WITH RUNWAY
 DIRECTION WHEN FINDING RELATIVE BEARING**



MAXIMUM CROSSWIND COMPONENT:

TAKE-OFF: Normal – 30kt gusting to 40kt
 Slippery – 10kt

LANDING: Icy/Slush – 10kt)
 Wet – 25kt) Inclusive
 Dry – 40kt) of gusts
 Autoland – 15kt)

END OF SECTION 1

2. LIGHTING ARRAYS AND LANDING REFERENCES ILLUSTRATIONS

2.1 CALVERT PRECISION APPROACH & RUNWAY LIGHTING

2.1.1 Note White flush TDZ carpet 'barrettes' & Red/White Supplementary Approach lights



2.1.2 (Below) AWOPS Runway with Calvert & Supplementary Approach Lighting in last 1000 feet



Siemens AFL photo

Note the *Supplementary Approach Lighting* with enhanced White barrettes centreline lights in the last 1,000 feet of the 3,000 feet approach lighting array. Centreline white barrettes are flanked by extended Red lights barrettes, in line with and leading to the flush White runway TDZ lighting carpet.

2.1.3 Crossing the threshold at night. - Note runway markings, TDZ 'carpet' lights & PAPI on both sides



2.1.4 Boeing 737 Night Landings & a Take-off, in Fog

For views of approach/runway lighting visible when on an autoland approach and a night take-off see <http://www.youtube.com/watch?v=PfCayaMNqrA>

2.1.5 Over the TDZ in haze



Note: See 2.4 to 2.7 in this Section 2, for examples of visual segments in reduced RVR at various stages of an approach in Cat 1, Cat 2 and Cat 3 conditions.

2.2 VISUAL REFERENCE AT TAKE-OFF IN LOW VISIBILITY

The number of runway centre-line lights that may be seen when lined-up for take-off in low visibility conditions varies, depending upon the spacing of the lights, the aircraft type and the RVR. The table that follows offers an indication of how many lights might be visible to the pilots looking ahead from the flight deck windows and for airliners of different sizes, thus causing variations in the eye-height of the viewer. The table assumes that the pilot's eye is where it is designed to be, provided that the seat is adjusted so as to place the eye in the best position according to the markings on the sidewalls of the flight deck. On some aircraft, a sighting device is provided to help the pilot align the position of his eye to the designed optimum location setting.

2.2.1 Take-off centre-line lights visual reference table
 (When Lined-Up for Take-off in 150 Metres RVR)

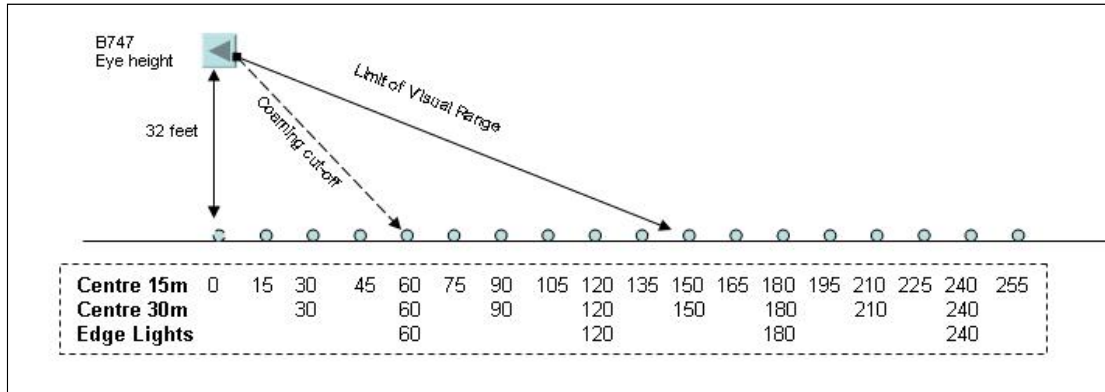
Runway C/L lights spacing	AIRCRAFT					
	B747	B777	A300	A310	A320	A340
30 metres	4	4	5	5	5	5
15 metres	7	9	9	10	10	9

Runway C/L lights spacing	AIRCRAFT					
	B737	B757 *	B767	DC10-30/ MD11	L1011	BAC 1-11
30 metres	5	5	5	5	5	5
15 metres	10	9	9	9	9	10

The pilot's eye view from a B747 flight deck in the illustration, see 2.2.2 below, shows the number of visible lights that can be seen by an eye positioned at the optimum viewing design-spot; as limited by the coaming cut-off effect, that denies sight of the nearest lights.

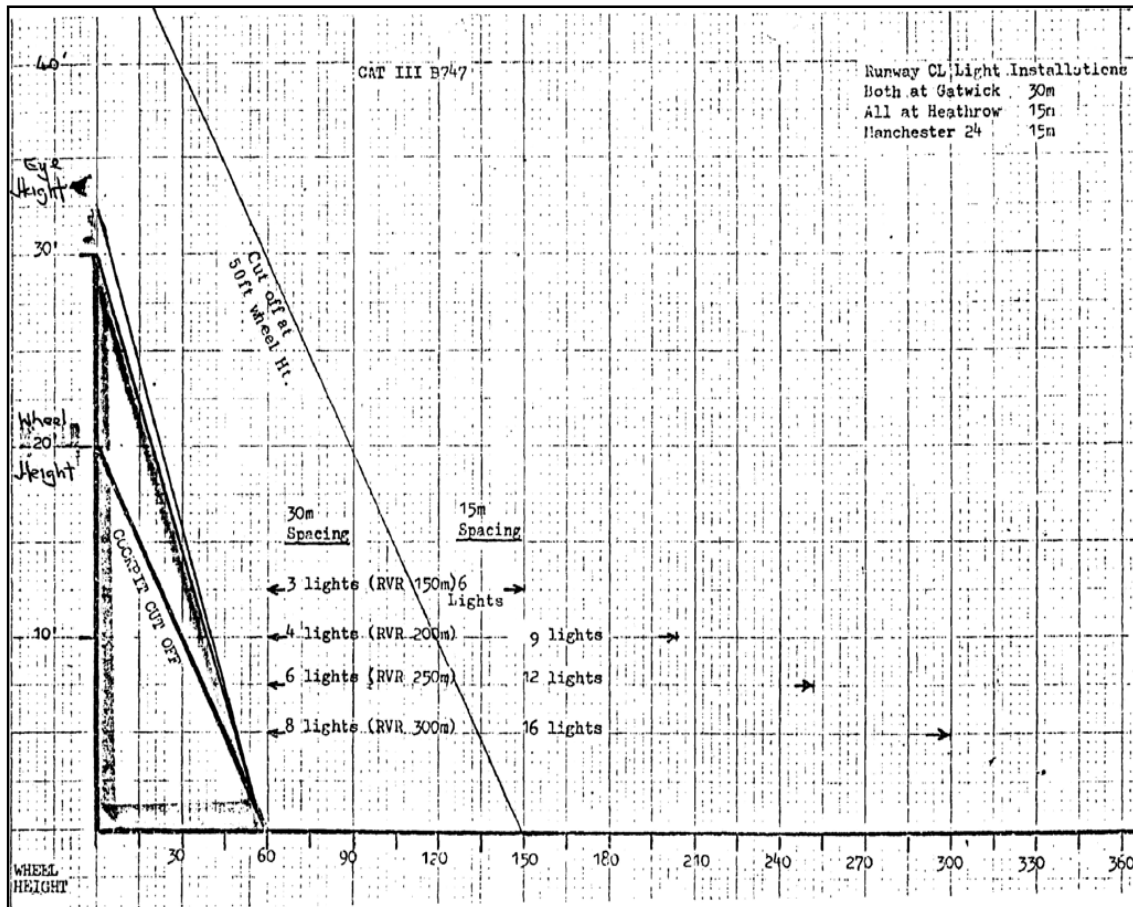
2.2.2 Runway centreline lights take-off visual reference (150m RVR)

B747 Take-off Visual Reference in 150m RVR



Visible Runway Centreline lights at 15 metres spacing (Heathrow, LHR) or 30 metres spacing Gatwick). For B757 in 75m RVR, only 4 lights are visible at the LHR 15m spacing arrangement; that is, a loss of 5 lights overall.

2.2.3 Visible lights for various eye and wheel heights in Cat 3a RVR (UK CAA SRG Graphic)

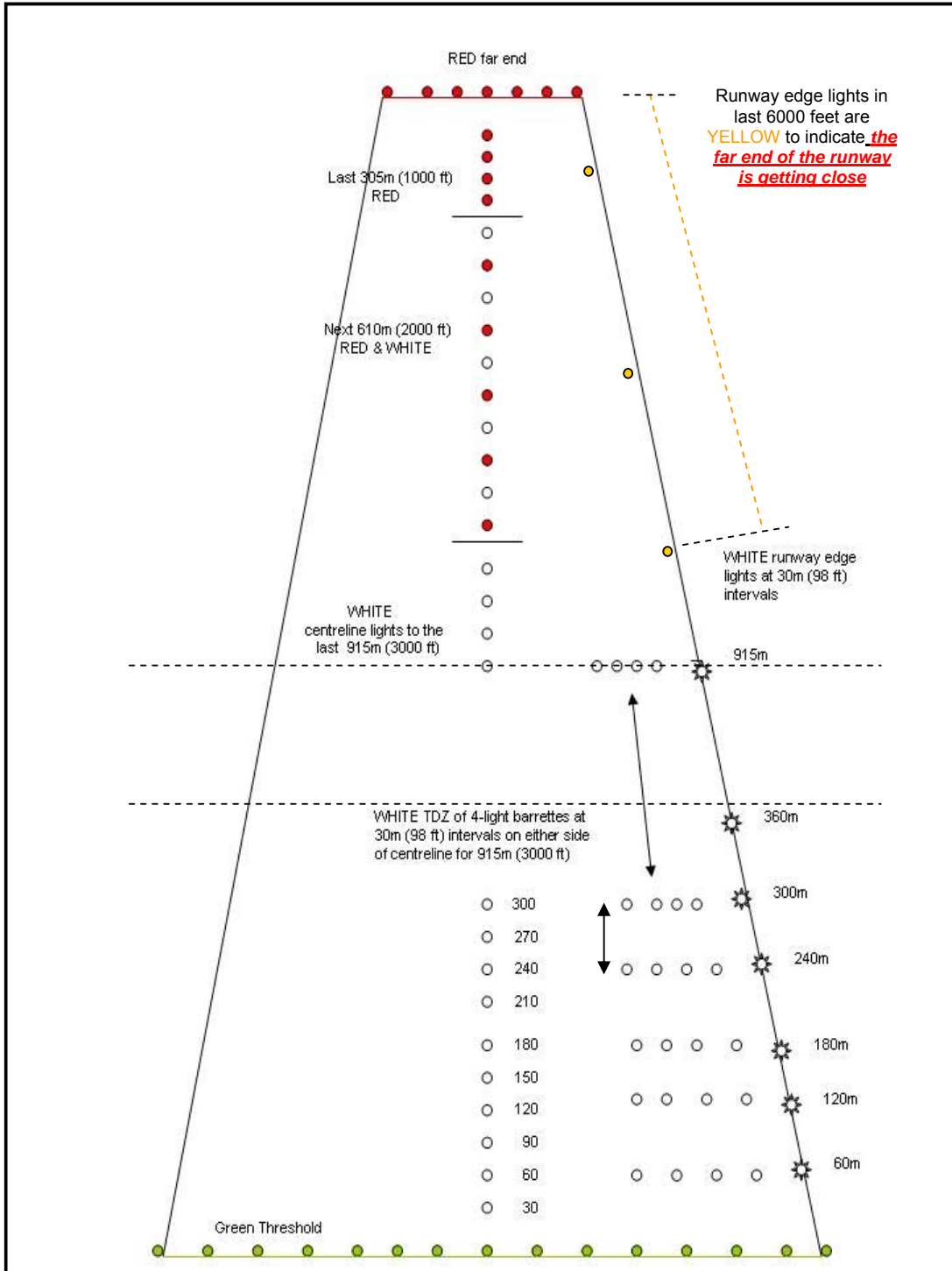


A similar graph may be constructed for each aircraft type, to calculate the expected forward visibility depending upon the position of the coaming and its cut-off characteristics, when lined-up for take-off. In this case, the predicted number of centreline lights at different spacing that would be seen, is calculated for a B747 from this graph.

2.3 CALVERT Cat 2 & Cat 3 RUNWAY LIGHTING

2.3.1 Runway lights diagram with TDZ carpet lighting and far-end colour-coded centreline lights at 30m spacing in this installation. The last 3,000 ft centre-lights are coded red/white, turning to red for the last 1,000 ft.

Note that the last 6000 feet of Runway-edge lighting is **YELLOW**



© Drawn by Capt Ralph Kohn FRAeS

Runway not to scale – Only the first 915m (3,000 ft) and last 1830m (6000 ft) of runway lighting is shown. The White flush-mounted TDZ carpet barrettes are spaced at 60m with centre and edge lighting at 30m intervals. Middle segment (not shown): has white runway-edge lights & white centre-line lighting, all at 30m intervals.

2.4 VISUAL SEGMENTS ON APPROACH

The pages that follow illustrate Visual Segments that can be expected during Cat 1, Cat 2 & Cat 3 approaches, for various RVRs in paragraphs numbered as follows:

2.4.1 Cat 1 VISUAL SEGMENTS - Cat 1 conditions - DH 200 feet

- 2.4.1a at 400ft in 1,000m RVR
- 2.4.1b at 315ft in 1,000m RVR
- 2.4.1c at 300 ft in 800 m RVR
- 2.4.1d at 200 ft in 800m RVR
- 2.4.1e at 120 ft in 800m RVR
- 2.4.1f at 200 ft in 600m RVR
- 2.4.1g at 160 ft in 600m RVR
- 2.4.1h at 90 ft in 600m RVR

2.4.2 Cat 2 VISUAL SEGMENTS - Cat 2 conditions - DH 100 feet

- 2.4.2a at DH 100 feet, 80 feet & 45 feet in 400m RVR

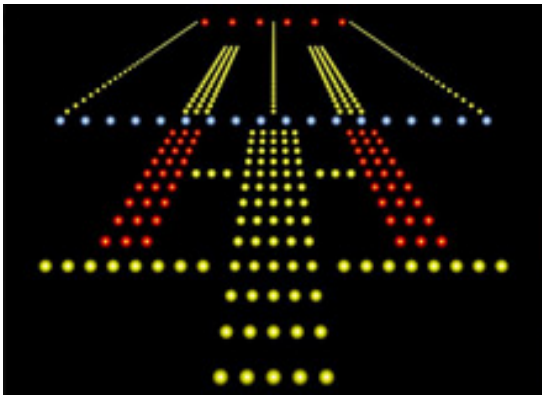
2.4.3 Cat 3a VISUAL SEGMENTS - Cat 3a conditions - DH below 100 feet

- 2.4.3a at DH 50 feet & in 300m RVR

2.4.4 Cat 3b VISUAL SEGMENTS - Cat 3b conditions - DH below 50 feet

- 2.4.4a at 65ft & DH 20 feet in 200m RVR

Calvert Precision Approach Runway lighting is normally preceded by a 915m (3,000 feet) long 'centre line with crossbars' approach-lights system plus, for Cat 2 & 3 Operations, '**supplementary lighting**' for the last 305 m (1,000 feet) of the approach lighting array. The red approach lighting barrettes continue as white flush-mounted barrettes on the runway.



Wellington International Airport, New Zealand

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2.4. Cat 1 VISUAL SEGMENT

2.4.1a Cat 1 - DH 200 feet
View at 400 feet in 1,000m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White for 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

Coded centreline (3000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 400 feet almost half the centreline lights and two crossbars are visible.

Category 1 Precision Approach

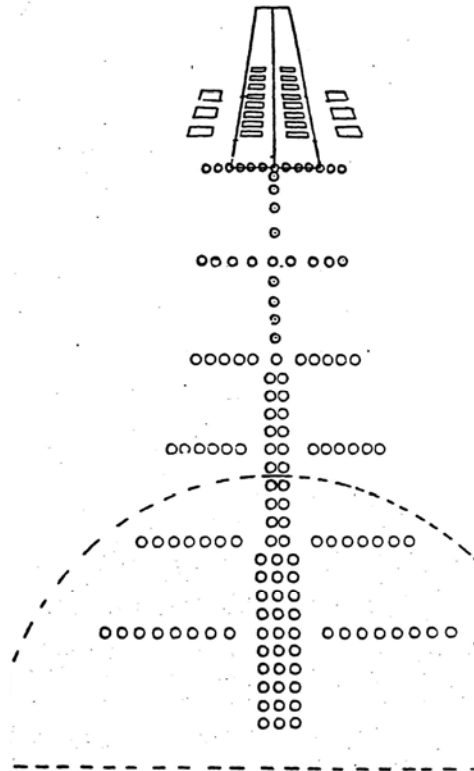
Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

RVR 1000M (3,280 feet)
 Visual segment at 400 feet

UNIFORM FOG

Expect initial contact with approach lights at 470 feet

Cat 1 Visual Segment
(No supplementary approach lighting)



400 feet

2.4.1a Visual segment at 400 feet in 1,000m RVR

2.4.1b Cat 1 - DH 200 feet
View at 315 feet in 1,000m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White for 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 315 feet, the whole of the Approach lighting system is visible up to the runway threshold.

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

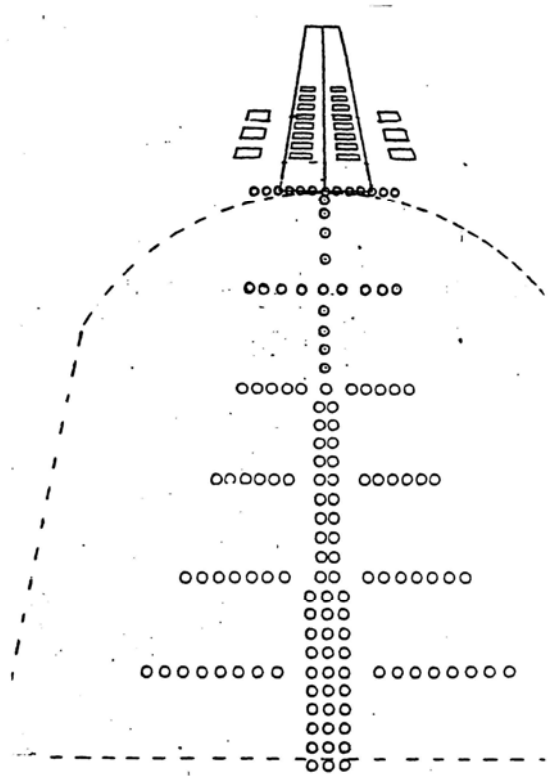
RVR 1000M (3,280 feet)

Visual segment at 315 feet

UNIFORM FOG

Expect Initial Contact with Approach Lights at 315 ft

Cat 1 Visual Segment
(No supplementary approach lighting)



2.4.1b Visual segment at 315 feet in 1000m RVR

2.4.1c Cat 1 - DH 200 feet
View at 300 feet in 800 RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 300 feet the first 1,000 feet of the approach lights centreline and one cross bar should be visible.

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

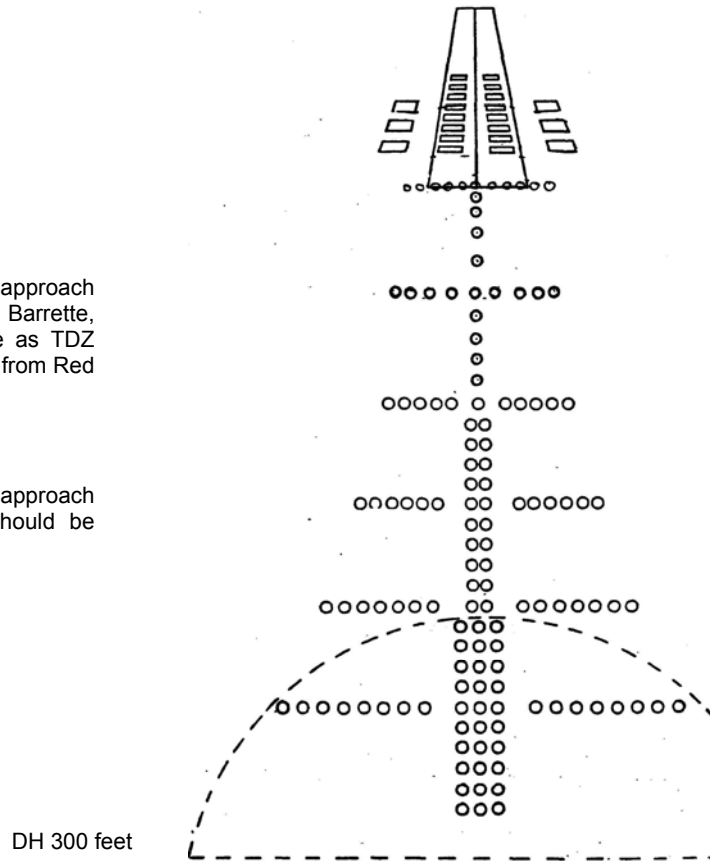
RVR 800m (2,625 feet)

Visual segment at **300 feet**

50% probability
 2:1 Fog Gradient

Expect Initial Contact with Approach Lights at 300 ft

Cat 1 Visual Segment
(No supplementary approach lighting)



2.4.1c Visual segment at 300 feet in 800m RVR

2.4.1d Cat 1 - DH 200 feet
View at 200 feet in 800m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 200 feet, part of the centreline lights plus 4 crossbars come into view.

DH 200 feet

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

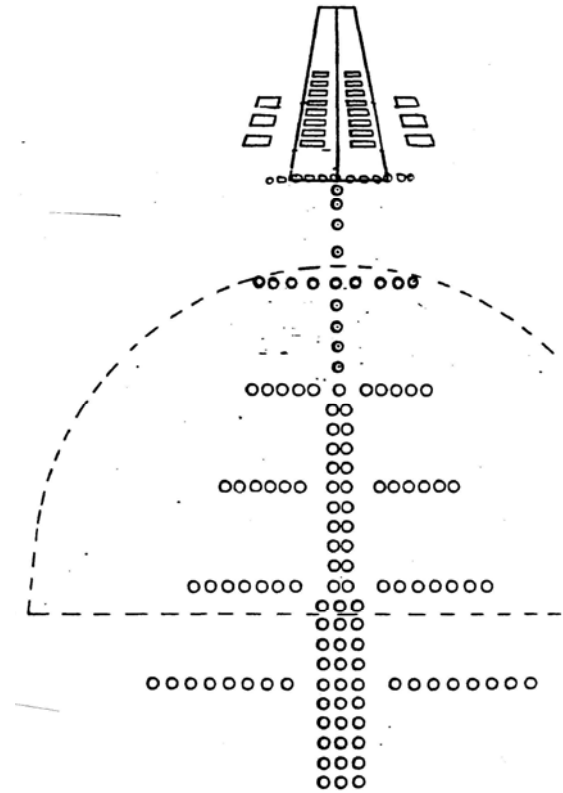
RVR 800M (2,625 feet)

Visual segment at DH 200 feet

50% probability
 2:1 FOG Gradient

Expect Initial Contact with Approach Lights at 200 ft

Cat 1 Visual Segment
(No supplementary approach lighting)



2.4.1d Visual segment at 200 feet in 800m RVR

**2.4.1e Cat 1 - DH 200 feet
 View at 120 feet in 800m RVR**

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 120 feet, one crossbar and the first part of the runway lighting system come into sight, with PAPIs and some of the landing area white barrette lights carpet.

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

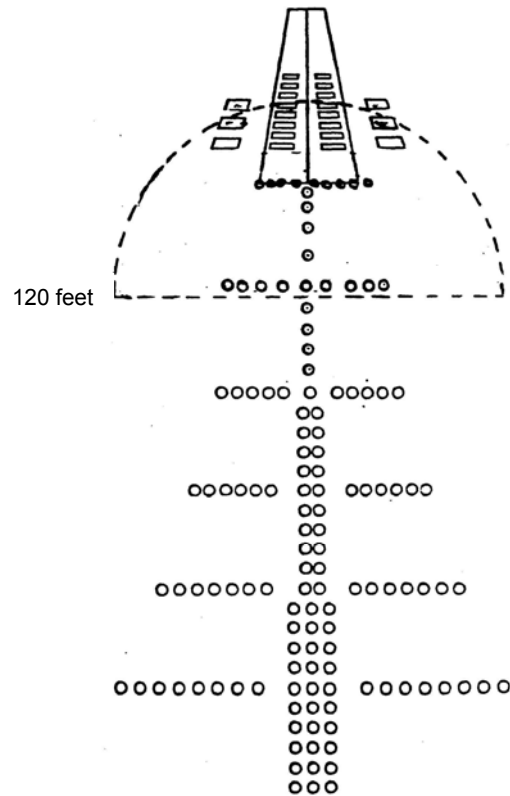
RVR 800M (2,625 feet)

Visual segment at 120 feet

50% probability
 2:1 Fog gradient

Expect Initial Contact with Approach Lights at 120 ft

**Cat 1 Visual Segment
 (No supplementary approach lighting)**



2.4.1e Visual segment at 120 feet in 800m RVR

2.4.1f Cat 1 - DH 200 feet
View at 200 feet in 600m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 200ft DH, almost 3 cross-bars with some of the centreline lighting will come into view.

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

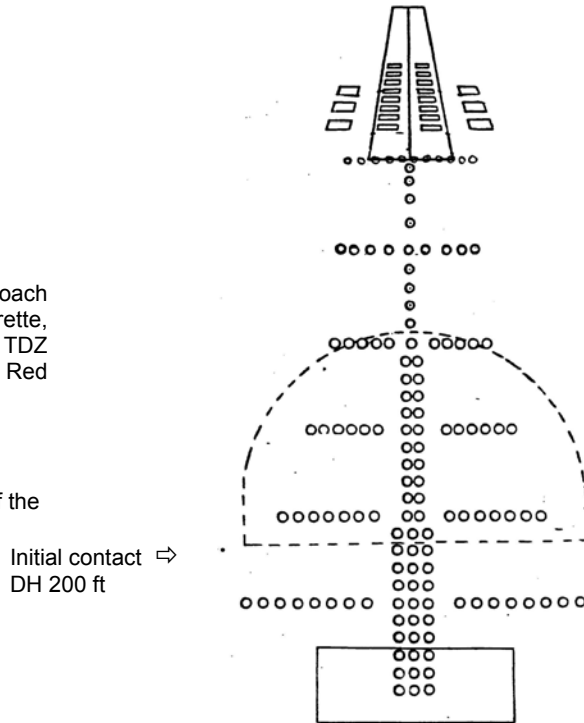
RVR 600M (1,969 feet)

Visual segment at DH 200 feet

50% Probability
 2:1 Fog gradient

Expect Initial Contact with Approach Lights at 200 ft

Cat 1 Visual Segments
(No supplementary approach lighting)



2.4.1f Visual segment at DH 200 feet in 600m RVR

**2.4.1g Cat 1 - DH 200 feet
 View at 160 feet in 600m RVR**

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 160 feet, White approach centreline lights should be seen, with two crossbars and the Green runway threshold lights.

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

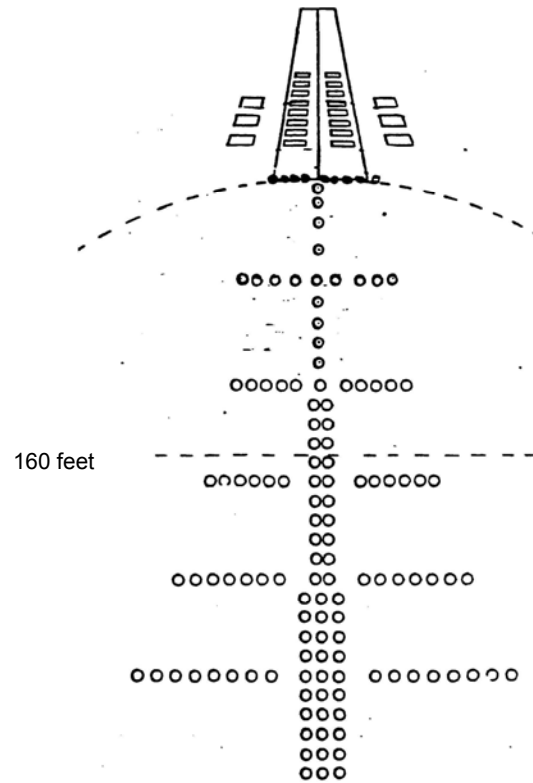
RVR 600M (1,969 feet)

Visual segment at **160 feet**

50% Probability
 2:1 Fog gradient

Expect Initial Contact with Approach Lights at 160 ft

**Cat 1 Visual Segment
 (No supplementary approach lighting)**



2.4.1g Visual segment at 160 feet in 600m RVR

2.4.1h Cat 1 - DH 200 feet
View at 90 feet in 600m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

- At 90 feet, the Green runway threshold lights and almost 2/3 of the white landing area barrettes carpet lighting, plus PAPIs will be visible.

Category 1 Precision Approach

Cat 1 DH not less than 200 feet
 Visibility not less than 800m
 or RVR not less than 550m

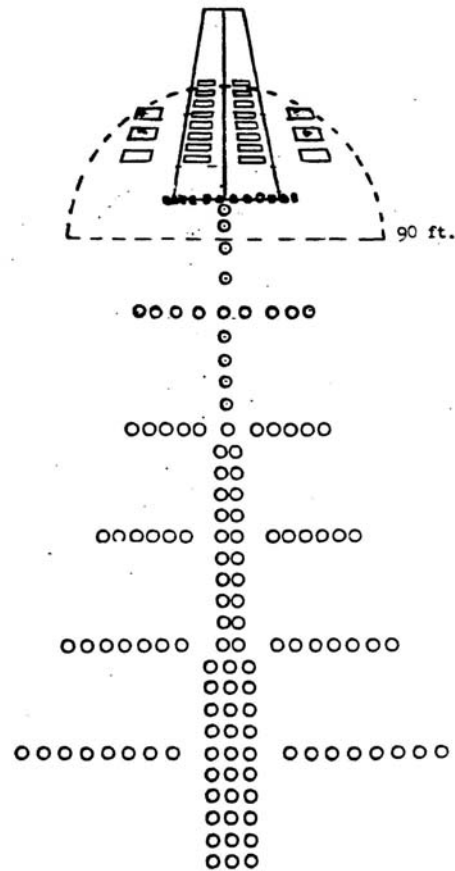
RVR 600M (1,969 feet)

Visual segment at **90 feet**

50% Probability
 2:1 Fog gradient

Expect Initial Contact with Approach Lights at 90 ft

Cat 1 Visual Segment
(No supplementary approach lighting)



2.4.1h Visual segment at 90 feet in 600m RVR

2.4.2 Cat 2 VISUAL SEGMENTS

2.4.2a **Cat 2 - DH 100 feet**
View at 100, 80 & 45 feet in 400m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

1. At 100 feet RA (DH) about three sets of the augmented approach lights Red barrettes array may be seen.
2. At 80 feet RA, the second half of the Red barrettes augmented approach lights system will come into view with a few Green threshold lights.
3. At 45 feet RA, most of the runway White barrettes landing area carpet is visible, with the 'aiming point' and most of the PAPI lights.

Category 2 Precision Approach

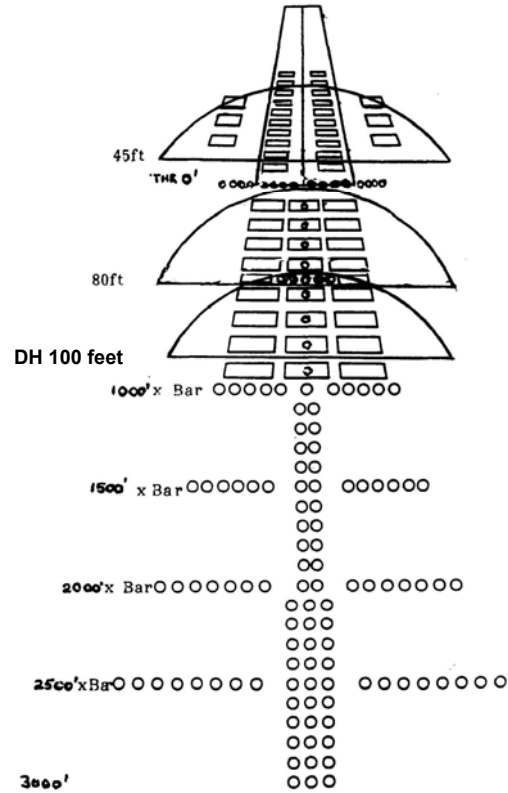
Cat 2 RVR not less than 350m (1,148 feet)
 DH between 200 & 100 feet

RVR 400M (1,312 feet)

DH 100 feet RA
 Visual segments at 100, 80 & 45 feet

Expect Initial Contact with Approach Lights at 100 ft

**Cat 2 Visual Segments
 (With supplementary approach lighting)**



2.4.2a Visual segments at DH 100, 80 & 45 feet in 400m RVR

2.4.3 Cat 3a VISUAL SEGMENTS

2.4.3a **Cat 3a - DH 50 feet**
View at 50 feet in 300m RVR

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3,000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

1. Not less than TWO auto-pilots must be engaged for Cat 3a approaches.
2. At 50 feet RA, the visual segment is 150m long; allowing sight of the aiming point and about 500 feet of landing area barrettes lighting, but only one PAPI light.

Category 3a Precision Approach for autoland

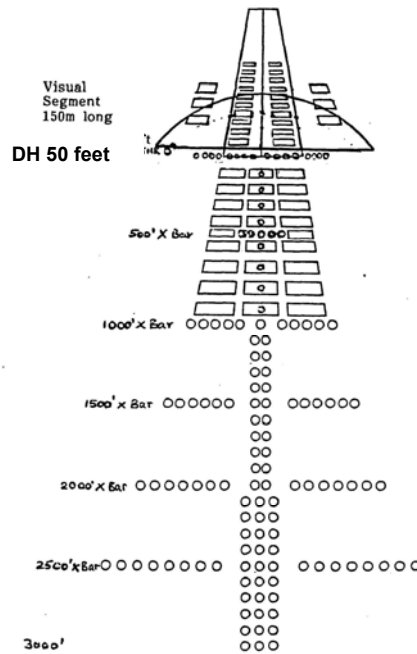
Cat 3a RVR not less than 200m (656 feet)
 DH below 100 feet or No DH

RVR 300M (984 feet)
DH 50 feet RA

Visual segment from a long-body aircraft flight deck (A340/B747)

Expect Initial Contact with Approach Lights at 50 ft

Cat 3a Visual Segment
(With supplementary approach lighting)



2.4.3a Visual segment at DH 50 feet in 300m RVR

2.4.4 Cat 3b VISUAL SEGMENTS

**2.4.4a Cat 3b – DH below 50 feet
View at 65 & 20 feet in 200m RVR**

Calvert Precision Approach lighting system

RUNWAY LIGHTING

Lights	Spacing
Edge	60 metres
TDZ barrettes	60 metres
Centreline	30m (Cat 1 & 2)
	15m (Cat 3B)
	7.5m (France, Cat 3)

Colour Coded White up to last 910m (3,000 ft)
 then Red and White 610m (2,000 ft)
 then All Red for last 300m (1,000 ft)

TDZ length First 900m or 50% of runway
 (White 4-light barrettes on either side of centreline)

APPROACH LIGHTING

Coded centreline (3000ft)
 Cross Bars (5) at 152m (500ft)
 & 305m (1,000ft)
 + 457m (1,500ft)
 + 610m (2,000ft)
 + 762m (2,500ft)

SUPPLEMENTARY APPROACH LIGHTING

For the last 300m (1,000 feet), the single White approach centreline lights are upgraded to a White Barrette, flanked by Red Barrettes (of the same gauge as TDZ lights) to form a continuous carpet that changes from Red to All White in the TDZ.

Notes:

1. Not less than TWO auto-pilots must be engaged for Cat 3b approaches.
2. Expect initial visual contact at 65 feet when over the end of the Red approach lighting barrettes carpet and in sight of Green threshold lights
3. At DH 20 ft RA, the visual segment is 140m long where 9 centre lights at 15m intervals or 4 lights at 30m spacing are visible, close to the aiming point. A few White landing area barrettes lights and the furthest PAPI light are also visible.

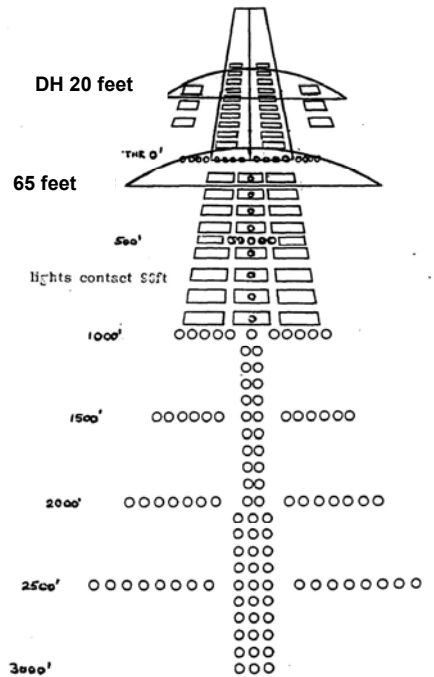
Category 3b Precision Approach for autoland
 Cat 3b RVR between 200m & 50m (656 ft & 164 ft)
 DH below 50 feet or No DH

**RVR 200M (656 feet)
DH 20 feet RA**

Visual segments at 65 and DH 20 feet RA from a long-body aircraft flight deck (A340/B747)

Expect Initial Contact with Approach Lights at 65 ft

**Cat 3b Visual Segments
(With supplementary approach lighting)**



**2.4.4a Visual segments at 65 & DH 20 ft RA
in 200m RVR**

ACKNOWLEDGEMENTS

The author is indebted to the following Organisations for some text extracts and illustrations.

1 AIDU (RAF)
British Airways
Jeppesen Inc
Navtech Inc (AERAD)
UK CAA



Something to avoid

© Captain Philip Phil H.S. Smith, MRAeS

END OF SECTION 2

SECTION 3 - OVERVIEW OF AIRPORT ALL WEATHER OPERATIONS (AWOPS) REQUIREMENTS

This Section 3 of PART 3 outlines Airport Requirements for Low Visibility Operations (LVO) and the Rules particular to the application of AOM, as well as how pilots are to operate within them and how to calculate appropriate AOM, if necessary. Proprietary Flight Guides such as Jeppesen & Aerad, contain guidance that deals with said calculations, but the subject is covered here nonetheless, for ease of reference. It will be noted that AOM limitations are not only applicable to EC Commercial Air Transport (CAT) operations, but they are also applicable to all other aircraft, including non-EC registered aircraft operated into and out of EC aerodromes.

It should be clearly understood that where reference to current EU-OPS 1 Requirements are made throughout this document, these will be replaced by EASA-developed texts, coming into force in 2012.

NOTE: Throughout this Section, the References to AERAD mean the charting product of Navtech Inc." European producers of "Aerad Flight Guides and Supplements that contain airport data and instrument approach let-down plates"; and

References to *Jeppesen*, mean the North American **Jeppesen Inc**, Flight Guide providers. Jeppesen is headquartered in Englewood, Colorado and has offices located around the world. Jeppesen is a subsidiary of Boeing Commercial Aviation Services, a unit of Boeing Commercial Airplanes.

3.1 GENERAL AIRPORT & OPERATIONAL REQUIREMENTS -SUMMARY

3.1.1 Introduction

The procedures and items listed below are basic information for operators and pilots concerning specific rules and regulations for low visibility operations, including Cat 2 approaches with or without autoland & Cat 3 arrivals with autoland, or low visibility take-offs. ATC applies special safeguards and procedures for LVO that become effective in relation to specified weather conditions. These procedures are intended to provide protection for aircraft operating in low visibility and to avoid disturbances to the ILS signals.

3.1.2 Categories of Precision Operations (See 4.1 & 4.2 for details)

Category 1 (Cat 1) ILS Operation - (ILSC1)
Category 2 (Cat 2) ILS Operation - (ILSC2)
Category 3a (CAT 3a) ILS Operation - (ILSC3)
Category 3b (CAT 3b) ILS Operation - (ILSC3)
Low visibility take-off (LVTO)

3.1.3 Airport Fire & rescue Services

An airport designed for all weather operations should have a fully operational Fire and Rescue Service capable of operating in CAT III operations. (ICAO annex 14)

3.2 APPLICABLE ICAO DOCUMENTS & SIGNIFICANT PROVISIONS

ICAO Annex 6 - Operation of Aircraft
ICAO Annex 10, Volume I - Aeronautical Telecommunications
ICAO Annex 14 - Aerodromes
ICAO Document 4444 - Rules of the Air & Air Traffic Services
ICAO Document 8168 PANS-OPS - Aircraft Operations
ICAO Document 8071 - Manual on Testing of Radio-Navigation Aids
ICAO Document 9365-AN/910 - Manual of All Weather Operations.
ICAO Document 9476-AN/927 - Manual of Surface Movement Guidance & Control System
ECAC Document 17 - Common European Procedures for Cat 2 & Cat 3 ILS Operations

The most significant requirements, procedures and additional regulations therein are summarised below

3.3 AIRPORT INFRASTRUCTURE

3.3.1 Physical Characteristics

Runways and taxiways of aerodromes must be designed and operated according to the *ICAO Annex 14 Standards and Recommended Practices* appropriate to the category of their certified operation:

- a. for Cat 2 & 3 approach and landing, or auto landing on each suitable runway; and
- b. for Low visibility take-off movements from each suitable runway

3.3.2 Obstacle Clearance Criteria and Obstacle Free Zone (OFZ)

The aerodromes and the airspace around the aerodromes shall be kept free of obstacles rising above the precision approach obstacle limitation surfaces, as defined in *ICAO Annex 14, Section 4 and Document 8168 PANS-OPS, Volume II*. An object which penetrates one of the obstacle limitation surfaces becomes the controlling obstacle for calculating the OCA/OCH.

During Cat 2 and Cat 3 Operations, the Obstacle Free Zone (OFZ) shall be kept clear of all obstacles, such as vehicles, persons and aircraft, at all times when an aircraft making an approach is below 200 feet. Essential equipment and installations in the vicinity of the runway which are necessary because of their function for air navigation purposes (GP antenna, RVR assessment units, etc.), must be situated clear of the OFZ. The equipment and installations must be of minimum mass and frangibly mounted.

3.3.3 Pre-threshold Terrain

A Precision Approach Terrain Chart according to the *Standards and Recommended Practices of ICAO Annex 4 and Annex 14*, is to be provided for each runway certified for Cat 2 and Cat 3 ILS Operations.

3.4 AIRPORT VISUAL AIDS

Airport Visual aids are explained in greater detail in Section 1. See

- 1.2 Runway markings
- 1.3 Airport lighting & Surface movements signs
- 1.4 Approach lighting in
- 1.5 Approach Path guidance lights

3.4.1 Secondary Power Supply

Secondary power supply (switch over time of 1 second) for the Visual Aids will be provided in accordance with the requirements of *ICAO Annex 14*. Any failure of the secondary power supply equipment will result in a down-grading of ILS Operations.

Photos in 3.4 & 3.5 are from the Luxembourg Airport Authority (Administration de la Navigation Aérienne) web-site



Luxembourg Findel Airport Lighting control panel

(Photos: Luxembourg Airport Authority (Administration de la Navigation Aérienne))



Approach lighting Luxembourg Runway 24

Airport lighting control panel is in the hands of the controllers in the control tower, using a console connected to a cabinet containing programmable logic controllers and modules ensuring output circuit redundancy.

3.4.2 Luxembourg Airport lighting power supply

All the runway lights, the lights in the approach sectors and the main taxiway lights are powered by a serial system with 3 or 5 brightness settings by current regulators and insulation transformers.

To ensure the continuous operation of the approach, runway and taxiway lights, power is provided by at least 2 two different circuits.

3.4.3 Distribution of electric power

CEGEDEL supplies the main medium voltage substation, equipped with 2 transformers having an individual power of 630 kVA, with 20kV. At present, there are 10 substations supplied with 3 kV by the internal network.



Luxembourg Findel Airport - Medium voltage distribution cabinets

3.5. NON-VISUAL AIDS

These include all approach radio aids such as ILS/MLS and VOR/DME, also locator beacons and fan markers both of which are now being gradually withdrawn.

3.5.1 Equipment

ILS ground equipment serving instrument runways must have no-break power supplied by dual systems located and operated according to *ICAO Annex 10, Volume 1 Standards and Recommended Practices*. Automatic monitor systems according to the requirements of *Annex 10, Volume 1, Part 1*, are to be provided for all ILS ground systems components. Localisers (LLZ) certified for Cat 2 and/or Cat 3 operations are to be additionally monitored by a far-field monitor. Pilots will be informed without delay of any deficiency.

3.5.2 Equipment Inspections

Flight inspections shall be conducted at regular intervals according to *ICAO Document 8071* guidelines.

3.5.3 ILS Sensitive Areas

A sensitive area for localizer protection must be established. For ATC purposes, the LLZ sensitive area is defined as a rectangular area which is located within parallel lines, 150m from the runway centre line on both sides, between the localizer aerial and the beginning of the runway.

During Cat 2 and Cat 3 operations, the ILS sensitive area must be kept clear of all vehicles and aircraft, at all times from when an approaching aircraft is 2 nm from the threshold until it has completed its landing run and, at all times that an aircraft takes-off using the ILS localizer for guidance during the take-off run.



Luxembourg Findel Airport – ILS aerial

3.5.4 Secondary Power Supply

All radio navigation aids, essential communication equipment and the RVR assessment system must be supplied with 'no-break' power.

3.6 SERVICES AT AERODROMES

3.6.1 Aerodrome services

Maintenance and inspection of the visual aids, runways and taxiways must be carried out at regular intervals by the aerodrome operator. Maintenance and inspection of visual and non-visual aids must be carried out by a specialist calibration unit.

3.6.2 Aeronautical Information Services

Under normal circumstances, pilots must expect that facilities provided for all-weather operations to the particular runway are operative. Any change in operational status or any other deficiency, if caused by a failure expected to last more than one hour, will be promulgated by NOTAM; pilots will be informed accordingly by ATC and/or via the ATIS.

3.6.3 Meteorological Service

Accurate and timely reporting of meteorological conditions according to *ICAO Annex 3* must be provided at the aerodrome concerned.

- a. Runway Visual Range (RVR) is normally assessed by electronic 'Transmissometers' whose position must be abeam the touch-down zone, mid-point and stop-end of instrument runways.
- b. If the TDZ RVR assessment unit fails, the RVR value from the mid-point will be transmitted.

3.7 REQUIREMENTS FOR AIRCRAFT AND FLIGHT CREW

3.7.1 Aircraft and Equipment

Basic requirements for an aircraft and its equipment for Cat 2 and Cat 3 operations are described in *ICAO Doc. 9365-AN/10 - Manual of All Weather Operations*.

3.7.2 Flight Crews

Training and experience requirements for flight crews to operate at low minima are described in *ICAO Doc. 9365-AN/10 - Manual of All Weather Operations*.

3.8 FLIGHT TRAINING AND PRACTICE APPROACH

3.8.1 General

Training flights simulating low minima approaches must be announced on initial contact with "Approach control" using the phrase "REQUEST PRACTICE Cat 2 or Cat 3". Depending on the traffic situation, permission will be granted whenever possible. LVO Procedures will only be applied if traffic permits. Departing or preceding landing traffic may disturb ILS signals. Under weather conditions better than Cat 2 and Cat 3, the secondary power supply will not be operated for the visual approach aids prescribed for Cat 2 and Cat 3 operations.

3.9 AUTHORISATION FOR CAT 2 AND CAT 3 OPERATIONS

3.9.1 Domestic Operations

ALL aircraft owners and operators wanting to carry out domestic Cat 2 and Cat 3 operations shall apply in writing to the Local State NAA, for permission to carry out such operations in its airspace; and also to the State of aircraft Registry if different.

3.9.2 Foreign Operations

For All Weather Operations at destinations outside a State, aircraft owners and operators must ask the destination State NAA for the necessary All Weather Operations Permit. A permit for LVO at a 'foreign' destination will be granted by the Local NAA only after submitting a copy of the AWO Approval given by the State of AOC-issue for Public Transport operators **and** the State of Registry if different; and by the State of Registry for all other aircraft.



Air Force 1 (B747) in Fog at Stansted airport (England)

© Copyright: US Government Works

3.10 EFFECT ON LANDING MINIMA OF TEMPORARILY FAILED OR DOWNGRADED GROUND EQUIPMENT

3.10.1 General

These instructions are intended for use both pre-flight and in-flight. It is not expected however that the commander would consult such instructions 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 Tables 1A and 1B below, and the approach may have to be abandoned to allow this to happen; with a possible Diversion, or a Holding facility used.

3.10.2 Operations with no Decision Height (DH)

An operator should ensure that, for aeroplanes authorised to conduct no DH operations with the lowest RVR limitations, the following applies in addition to the content of Tables 1A and 1B, below:

- a. RVR. At least one RVR value must be available at the aerodrome;
- b. Runway lights
 - i. No runway edge lights or no centre lights – Day – RVR 200 m; Night – Not allowed;
 - ii. No TDZ lights – No restrictions; and
 - iii. No standby power to runway lights – Day – RVR 200 m; Night – not allowed.

3.10.3 Conditions applicable to Tables 1A & 1B

- a. Multiple failures of runway lights other than indicated in Table 1B are not acceptable.
- b. Deficiencies of approach and runway lights are treated separately.
- c. Category II or III operations. A combination of deficiencies in runway lights and RVR assessment equipment is not allowed.
- d. Failures other than ILS affect RVR only and not DH.

TABLE 1A - Failed or downgraded equipment - effect on landing minima

FAILED OR DOWNGRADED EQUIPMENT	EFFECT ON LANDING MINIMA EQUIPMENT				
	CAT III B (Note 1)	CAT III A	CAT II	CAT I	NON PRECISION
ILS stand-by 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 assessment system	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 Stop-end RVR	No effect				
Anemometer for R/W in use	No effect if other ground source available				
Celiometer	No effect				

Note 1: For Cat III B operations with no DH see also paragraph 3.10.2 above.

TABLE 1B - Failed or downgraded lighting equipment - effect on landing minima

FAILED OR DOWNGRADED EQUIPMENT	EFFECT ON LANDING MINIMA EQUIPMENT				
	CAT III B (Note 1)	CAT III A	CAT II	CAT I	NON PRECISION
Approach lights	Not allowed for operations with DH > 50ft		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				
Whole runway light system	Not allowed			Day - AOM as for nil facilities Night - not allowed	
Edge lights	Day only; Night not allowed				
Centreline lights	Day - RVR 300m Night - not allowed		Day - RVR 300m Night - 550m	No effect	
Centreline lights spacing increased to 30 m	RVR 150m	No effect			
Touch Down Zone lights	Day - RVR 200m Night - 300m	Day - RVR 300m Night - 550m		No effect	
Standby power for runway lights	Not allowed			No effect	
Taxiway light system	No effect - except delays due to reduced movement rate				

Note 1: For Cat III B operations with no DH see also paragraph 3.10.2 above.

SECTION 4 - AERODROME OPERATING MINIMA (AOM)

In accordance with EU-OPS 1 – Sub-part E & its Approved Means of Compliance (AMC)

4.1 AOM DEFINITIONS

(a) Terms used in this Subpart have the following meaning:

1. **Circling:** The visual phase of an instrument approach to bring an aircraft into position for landing on a runway which is not suitably located for a straight-in approach.
2. **Low Visibility Procedures (LVP):** Procedures applied at an aerodrome for the purpose of ensuring safe operations during Lower than Standard Category I, Other than Standard Category II, Category II and III approaches and low visibility take-offs.
3. **Low Visibility Take-Off (LVTO):** A take-off where the Runway Visual Range (RVR) is less than 400m.
4. **Flight control system:** A system which includes an automatic landing system and/or a hybrid landing system.
5. **Fail-Passive flight control system:** A flight control 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 flight control system the pilot assumes control of the aeroplane after a failure.
6. **Fail-Operational flight control system:** A flight control system is fail-operational if, in the event of a failure below alert height, the approach, flare and landing, can be completed automatically. In the event of a failure, the automatic landing system will operate as a fail-passive system.
7. **Fail-Operational hybrid landing system:** A system which consists of a primary fail-passive automatic landing system and a secondary independent guidance system enabling the pilot to complete a landing manually after failure of the primary system.
Note: A typical secondary independent guidance system consists of a monitored head-up display providing guidance which normally takes the form of command information but it may alternatively be situation (or deviation) information.
8. **Visual Approach:** An approach when either part or all of an instrument approach procedure is not completed and the approach is executed with visual reference to the terrain.
9. **Continuous descent final approach (CDFA):** A specific technique for flying the final-approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off. This commences from an altitude/height at or above the Final Approach Fix altitude / height to a point approximately 15 m (50 feet) above the landing runway threshold, or the point where the flare manoeuvre should begin for the type of aeroplane flown.
10. **Stabilised approach (SAp):** An approach which is flown in a controlled and appropriate manner in terms of configuration, energy and control of the flight path from a pre-determined point or

altitude/height, down to a point 50 feet above the **threshold**, or the point where the flare manoeuvre is initiated if higher.

11. **Head-up display (HUD):** A display system which presents flight information into the pilot's forward external field of view and which does not significantly restrict the external view.
12. **Head-up guidance landing system (HUDLS):** The total airborne system which provides head-up guidance to the pilot during the approach and landing and/or go-around. It includes all sensors, computers, power supplies, indications and controls. A HUDLS is typically used for primary **approach guidance to decision heights of 50 ft.**
13. **Hybrid head-up display landing system (hybrid HUDLS):** A system which consists of a primary fail-passive automatic landing system and a secondary independent HUD/HUDLS, enabling the pilot to complete a landing manually after failure of the primary system.
Note: Typically, the secondary independent HUD/HUDLS provides guidance which normally takes the form of command information, but it may alternatively be situation (or deviation) information.
14. **Enhanced vision system (EVS):** An electronic means of displaying a real-time image of the external scene, through the use of imaging sensors.
15. **Converted meteorological visibility (CMV):** A value (equivalent to an RVR) which is derived from the reported meteorological visibility, as converted in accordance with the requirements in this subpart.
16. **Lower than Standard Category I Operation:** A Category I Instrument Approach and Landing Operation using Category I DH, with an RVR lower than would normally be associated with the applicable DH.
17. **Other than Standard Category II Operation:** A Category II Instrument Approach and Landing Operation to a runway where some or all of the elements of the ICAO Annex 14 Precision Approach Category II lighting system are not available.
18. **GNSS landing system (GLS):** An approach operation using augmented GNSS information to provide guidance to the aircraft based on its lateral and vertical GNSS position. (It uses geometric altitude reference for its final approach slope).

4.2 OTHER TERMS & EXPRESSIONS USED (Alphabetically)

Approach Ban means that an aircraft is not to be descended below 1,000 feet AAL if the RVR falls below the prescribed figure before the aircraft passes 1,000 feet. If the aircraft has passed 1000 feet during an approach and the pilot is then advised that the RVR is now below 'Minimums', he may continue the approach down to DA/DH and land if the visual segment that presents itself is sufficient for him to land safely.

Category 1 (Cat 1) ILS operation - (ILSC1) means a precision instrument approach for landing with a decision height not lower than 60m (200 ft) and with either a visibility not less than 800m, or a runway visual range (RVR) not less than 550m, for a manual or auto-coupled approach. (According to *ICAO Annex 10 and Annex 14*)

Category 2 (Cat 2) ILS operation - (ILSC2) means a precision instrument approach for landing with a decision height lower than 60m (200 ft), but not lower than 30m (100 ft) and a runway visual range (RVR) not less than 350m (auto-approach for a manual or auto-land).

Category 3a (Cat 3a) ILS operation - (ILSC3) means a precision instrument approach for landing with : a decision height lower than 30m (100 ft), or without decision height and a runway visual range not less than 200 m. (auto-approach to auto-land).

Category 3b (Cat 3b) ILS operation - (ILSC3) means a precision instrument approach and landing with a decision height lower than 15m (50 ft), or no decision height and a runway visual range less than 200m but not less than 50m (Auto-approach to auto-land).

Category 3c (Cat 3c) ILS operation - (ILSC3) used to mean a precision instrument approach with no DH and no RVR limitations (Auto-approach to auto-land). The term Cat 3c has been set aside in EASA terminology.

Note: Where decision height (DH) and runway visual range (RVR) fall into different categories of operation, the instrument approach and landing operation is to be conducted in accordance with the requirements of the most demanding category. For example, an operation with a DH in the range of Cat 3a but with an RVR in the range of Cat 3b would be considered a Cat 3b operation. Similarly, an operation with a DH in the range of Cat 2 but with an RVR in the range of Cat 1 would be considered a Cat 2 operation).

Decision Altitude (DA) or Decision Height (DH): A specified altitude or height in the precision approach, or approach with vertical guidance, at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

Note 1: Decision altitude (DA) is referenced to mean sea level (MSL) and decision height (DH) is referenced to the runway threshold elevation.

Note 2: The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In Category 3 operations with a decision height, the required visual reference is that specified for the particular procedure and operation.

Note 3: For convenience, where both expressions are used, they may be written in the form "decision altitude/height" and abbreviated "DA/H".

The table shows the relationships of these terms.

EVENT	Precision Approach (ILS, MLS etc)	Non Precision Approach (Loc, VOR, NDB, SRA etc)
Aircraft descends to ...	DH Decision Height DA Decision Altitude	MDH Minimum Descent Height MDA Minimum Descent Altitude
Aircraft goes around at ...	DH Decision Height DA Decision Altitude	MDA/H or Missed Approach Point (MAPt)

Minima used to be shown on UK CAA approach plates. The UK CAA has currently removed these minima from their AIP charts that now only show Obstacle Clearance Heights/Altitudes, used to calculate AOM. Proprietary let-down plates produced by 'Aerad' and 'Jeppesen', continue to offer the calculated AOM for the aid depicted, for ease of pilot reference. - see the old Frankfurt plate that shows both the Decision Altitude as it was called and the Missed Approach Procedure, with other Illustrations at the end of this Part.

The UK Air Pilot contains a descriptive in words of every approved let-down for every airport in the UK in its Section 2. This is where may be found the only Legal detail descriptive for every type of let down permitted in the UK, based on Internationally agreed formulae for instrument approach procedures. From this information, proprietary let-down [plates' information](#) providers, UK Public Transport Operators, those from elsewhere and from the General Aviation or Private flying sectors, derive the AOM for use by the pilots concerned.

All aircraft operating in European airspace must operate within the AOM limits described for their Class of operation.

Final approach fix or point: That 'Fix', or point of an instrument approach procedure where the final approach segment commences and which is incomplete without a Final Approach segment (ICAO Annex 4).

Final approach segment: That segment of an instrument approach procedure in which alignment and descent for landing are accomplished. (ICAO Annex 4)

ILS critical area: An area of defined dimensions around the localiser 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 its 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 movements of vehicles, including aircraft, are 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 will still normally be within the airfield boundary.

Intermediate holding position: A designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower.

Low Visibility Conditions (LVC): Weather conditions under which Category 2 and 3 approach and landing operations are conducted.

Low Visibility Procedures (LVP): Specific procedures applied at an aerodrome for the purpose of ensuring safe operations during Category 2 and 3 approaches and/or Low Visibility Take-offs.

Low Visibility Take-Off (LVTO): A term used by the **EC Joint Aviation Authority** in relation to flight operations referring to a take-off on a runway where the RVR is less than 400 m.

Minimum descent altitude (MDA) or minimum descent height (MDH): A specified altitude or height in a non-precision approach, or circling approach below which descent must not be made without the required visual reference.

Note 1: Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation, or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. Note that, the *Minimum Descent Height* is referenced to the *aerodrome elevation* for a circling approach.

Note 2: The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. For a circling approach, the required visual reference is the runway environment.

Note 3: For convenience, when both expressions are used, they may be written in the form "minimum descent altitude/height" and abbreviated "MDA/H" (ICAO Annex 6).

Missed Approach Point (MAPt): That point in an instrument approach procedure at or before which the prescribed missed approach procedure must be initiated in order to ensure that the minimum obstacle clearance is not infringed. On reaching the MAPt, if the aircraft is not in a position to land or the runway is not seen, a go around **MUST** be initiated immediately and a missed approach carried out.

The MAPt is only shown for non-precision approaches on let-down plates because the DA/DH is, in effect, the missed approach point for a precision approach.

Non-Precision Approach (NPA), means a let-down providing horizontal course guidance without vertical or Glideslope guidance. 'NPAs' are pilot-interpreted, using a stop-watch and flight deck instruments such as RMI needles pointing to and/or from an NDB, or a Locator beacon located at a known distance on the extended runway centreline, to establish the required Track to its threshold. An in-line VOR/DME distance Fix could also establish the start of the NPA descent and a radial to track.

The pilot is responsible for controlling the rate of descent on the approach path down to the MDA/MDH, to establish as nearly as possible that of an ILS approach glideslope; for a stabilised, continuous descent to a point where a decision must be made to either land or Go around. Non-precision approaches include all of the following:

ILS (no glide path)	ILS back beam (no glide path)	PAR (no glide path)
SRA terminating at 1.0 nm	SRA terminating at 0.5 nm	SRA terminating at 2.0 nm
NDB or L	VOR / DME	VDF

4.3. APPROACH TO LAND & 'HOLDING' PROCEDURES AT INDIVIDUAL AERODROMES

Applies irrespective of whether the aerodrome is situated inside or outside Controlled Airspace.

4.3.1 Operational Notes

- a. For precision approach procedures (ILS) QFE values are above threshold elevation of the runway direction to which the procedure applies. For non-precision approach procedures QFE values are above aerodrome elevation except for those approaches indicated on the IAC by '†' which are above threshold elevation of the runway direction to which the procedure applies. QNH and amsl values are shown in **bold** and QFE values (other than OCHs) are in parentheses ().
- b. In the missed approach procedure, the altitudes given are those to be attained on Go-Around in the absence of ATC instructions and should normally be flown using QNH altimeter setting for the aerodrome. If using QFE, Pilots must remember to change their altimeter settings during this dynamic manoeuvre.
- c. Where the term '*straight ahead*' is used in missed approach procedures, pilots should maintain the Final Approach Track (FAT) unless a different track is given.
- d. There are two types of VDF procedure, QDM and QGH. In the QDM procedure, the pilot calls for a series of QDM and uses them to follow the published approach pattern, making his own adjustment to heading and height. In the QGH procedure the controller obtains bearing from the aircrafts transmissions, interprets this information and passes to the pilot headings and heights to fly at, that are designed to keep the aircraft in the published pattern. Normally, at civil aerodromes, only the QDM procedure is available. In some cases however, there will be provision for a QGH procedure for specific operational reasons. Those aerodromes that have been approved to carry out both types of VDF procedure will have this provision shown against the procedure. Pilots are reminded that it is their responsibility to ensure with ATC that the correct procedure is being flown.
- e. These procedures have been established in accordance with the ICAO PANS-OPS, except for those UK differences shown at GEN 1.7. While certain specified allowances for wind effect have been made in determining the areas which will contain the various procedures, it is emphasized that these Holding and Approach to Land procedures are based on still air conditions and in practice due allowances must be made for wind.
- f. A *Shuttle Procedure* is a procedure designed to allow for descent and/or positioning after arrival and prior to the commencement of the instrument descent procedure.
- g. Those procedures at aerodromes which lie within Controlled Airspace are notified for the purposes of Rule 31(3)(a)(ii) of the Rules of the Air Regulations 1996. Those procedures at aerodromes which do not lie within Controlled Airspace are notified for the purposes of Rule 40 of those Rules. These Rules require that, where an aerodrome is provided with one or more notified Instrument Approach Procedures, unless otherwise authorized by ATC, pilots requiring the use of an Instrument Approach Procedure shall use only such notified procedures.
- h. Pilots should be aware that, within Controlled Airspace, ATC provide separation between aircraft carrying out Instrument Approach Procedures and other IFR or Special VFR traffic within that Airspace and will pass pertinent traffic information on known VFR flights. However, in certain Controlled Airspaces there may be VFR traffic of which ATC has no knowledge. At aerodromes situated outside Controlled Airspace separation can only be provided between known IFR flights and pertinent traffic information will be given on known VFR flights.

4.4. LOW VISIBILITY PROCEDURES (LVP) & CAT 2 & 3 OPERATIONS

Low Visibility Procedures are procedures applied at an aerodrome for the purpose of ensuring safe operations during a Low Visibility take-off and Cat 2 or Cat 3 approaches.

Cat 2 & Cat 3 operations are only permitted at specified aerodromes. Operators must ensure they have obtained authorisation from the National Aviation Authority (NAA) of the State to which they are operating and their own NAA and the NAA of the State of Registration of their aircraft, if different.

4.4.1 Runway Visual Range (RVR)

The visibilities given for landing minima may be in statute miles or hundreds of feet. Where the runway visibility is less than 300 metres (m) it must be measured by a Transmissometer and reported as RVR. The RVR is a term used in aviation meteorology to define the distance over which a pilot of an aircraft on the centreline of the runway can see the runway surface markings delineating the runway, or identifying its centre line. It is normally expressed in feet or metres. Generally, visibility which is given in hundreds of meters is based on measurements by special equipment and it is known as RVR, or runway visual range.

RVR is used as one of the main criteria for minima on instrument approaches, as in most cases a pilot must obtain visual reference of the runway to land an aircraft. The maximum RVR reading is 2,000 metres or 6,500 feet, above which it is not significant and thus does not need to be reported. RVRs are provided in METARs and are transmitted by air traffic controllers to aircraft making approaches, to allow pilots to assess whether it is prudent and legal to make an approach.

RVR should be measured by automatic instruments at three positions along the runway, covering the **Touchdown Zone** (TDZ), the **Mid Point** (MID) and the **Stop End** (STP). Automatic displays should be provided to enable RVR to be passed to the pilot within 15 seconds of any change.

The TDZ RVR should always be passed, but the values for other positions should only be passed either on request, or when either or both values are

- a. Less than TDZ and less than 800m; or
- b. Less than 400m.

The TDZ RVR is the governing value. In the event of a measuring equipment component failure, any RVR passed should be identified by position. Failure of the TDZ transmissometer instrument should be specifically reported. Cat 3b 'NO DH' operations may continue in the absence of RVR information.

Originally RVR was measured by a person, either by viewing the runway lights from the top of a vehicle parked on the runway threshold, or by viewing special angled runway lights from a tower at one side of the runway. The number of lights visible could then be converted to a distance to give the RVR. This is known as the human observer method and can still be used as a fall-back. Exceptionally, an observer's report covering the TDZ RVR and the MID RVR may be acceptable for Cat 2 operations, providing the RVR can be passed to the pilot within 30 seconds of the observations.

To-day, most airports use Instrumented Runway Visual Range or IRVR, which is measured by devices called *transmissometers* (See also 1.7.3). A transmissometer compares the amount of light transmitted from one location to that received at a second location in close proximity to the runway. These units are installed at one side of a runway relatively close to its edge. Normally three are provided, one at each end of the runway and one at the mid-point.

A transmissometer projects a beam of light at a receiving point, through the existing meteorological phenomenon and measures the amount of light scattered by atmospheric particles of precipitation, dust, or fog.

A new dual-tech unit consists of four sensor heads: two infrared emitters and two solid-state photo-detectors. The detectors measure the light transmitted directly through the sample volume between the sensors, as well as the light scattered by particles in the sample volume. Scattered light is measured at a preset detection angle that provides the most linear intensity for particles of fog, dust, rain, and snow. The subject of transmissometers is covered in more detail in Section 1 of this PART 2 (see 1.7).

4.5 CALCULATION OF AERODROME OPERATING MINIMA (AOM)

4.5.1 Aerodrome Operating Minima (During Low Visibility Operations)

Requirements for LVP originate from **ECAC Document 17 (Common European Procedures for CAT 2 and CAT 3 ILS Operations)** which satisfies current ICAO Standards guidance for LVP that require special precautions when low visibility operations are in progress. In addition to the need to protect the ILS signal from interference, there is also a need to protect the aircraft manoeuvring area from unwarranted vehicle intrusions. This effectively restricts the use of 125m RVR take-off minima to those aerodromes currently approved for Cat 2 and 3 operations.

Operators wishing to use take-off minima below 150m RVR, require formal NAA approval to use a take off RVR of not less than 125m RVR. Take off minima of 125m RVR shall only be used when the following requirements have been satisfied:

- Low Visibility Procedures (LVP) are in force;
- The mid-point RVR must be available and shall not be less than 125m;

- Crews shall have satisfactorily completed appropriate simulator training;
- High intensity runway centre line lights spaced 15m or less and high intensity runway edge lighting spaced 60m or less are installed.

Take-off minima must be expressed as visibility or RVR, taking into account all relevant factors for each aerodrome planned to be used and the aeroplane's technical characteristics. Additional conditions must be specified where there is a specific need to see and avoid obstacles on departure and/or for forced landings; for example a minimum ceiling height. Take-off shall not be commenced unless the weather conditions at the aerodrome of departure are equal to, or better than, the applicable minima for landing at that aerodrome, unless a suitable take-off alternate aerodrome is available. When the reported meteorological visibility is less than that required for take-off, or when meteorological visibility reports or RVR are not available, a take-off may only be commenced if the commander can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.

Take-off minima must be selected to ensure sufficient guidance, to allow control of the aeroplane in the event of both a discontinued take-off in adverse circumstances, or continuing the take-off after a failure of the critical power unit.

4.6 EU-OPS 1 – Sub Part E – ALL WEATHER OPERATIONS - (AERODROME OPERATING MINIMA (AOM))

An operator must ensure that either Appendix 1 (Old) or Appendix 1 (New) to OPS 1.430 is applied. However, an operator must ensure that Appendix 1 (New) to OPS 1.430 is applied not later than three years after publication date.

Notwithstanding the requirement above, an Authority may exempt an operator from the requirement to increase the RVR above 1,500m (Cat A/B aeroplanes) or above 2,400m (Cat C/D aeroplanes), when approving an operation to a particular runway where it is not practicable to fly an approach using the CDFA technique or where the criteria in paragraph (c) of Appendix 1 (New) to OPS 1.430 cannot be met.

Refer to 'Appendix A' of this All Weather Operations Guide for the calculation of EASA Aerodrome Operating Minima (AOM) held in EU-OPS 1 - Subpart E and for general details on All Weather Operations, as follows.

2. APPENDIX 1 (Old) to OPS 1.430 - AERODROME OPERATING MINIMA; and

3. APPENDIX 1 (New) to OPS 1.430 - AERODROME OPERATING MINIMA

COMMANDER'S DISCRETION TO APPLY HIGHER MINIMA

Operators are reminded that in accordance with certain National Regulations, a Commander is authorised to exercise discretion and apply minima higher than those published for both take-off and landing, if it is necessary in his opinion to do so in order to secure the safety of his aircraft.

4.7 AEROPLANE CATEGORIES – ALL WEATHER OPERATIONS

Also see 'Appendix A' - EASA-OPS 1.430 (c) - Aeroplane Categories — All Weather Operations

4.7.1 Classification of aeroplanes

The criteria taken into consideration for the classification of aeroplanes by categories is the indicated airspeed at threshold (VAT) which is equal to the stalling speed (VSO) multiplied by 1.3 or VS1G multiplied by 1.23 in the landing configuration while at the maximum certificated landing mass. If both VSO and VS1G are available, the higher resulting VAT shall be used. The aeroplane categories corresponding to VAT values are in the Table below:

AEROPLANE CATEGORY	VAT	Examples
A	Less than 91 kt	All helicopters
B	From 91 to 120 kt	Fk50
C	From 121 to 140 kt	A340, B737, B757, A320
D	From 141 to 165 kt	B747, MD11
E	From 166 to 210 kt	was Concorde

The landing configuration which is to be taken into consideration shall be defined by the operator or by the aeroplane manufacturer

If it is necessary to manoeuvre at speeds in excess of the upper limit of a speed range for an *approach category*, the AOM for the next higher category should be used. For example, an aircraft which falls into *Approach Category A*, but is circling to land at a speed in excess of 91 knots, should use *Approach Category B* AOM when circling to land.

4.7.2 Permanent change of category (maximum landing mass)

- (1) An operator may impose a permanent, lower, landing mass, and use this mass for determining the VAT if approved by the Authority.

- (2) The category defined for a given aeroplane shall be a permanent value and thus independent of the changing conditions of day-to-day operations.

SECTION 5 - AWOPS GENERAL

5.1 PRECISION APPROACH & ABSOLUTE LANDING MINIMA RELATIVE TO APPROACH CATEGORY

Approach Category	Decision Height Minimum (Feet)	Minimum RVR (Metres)	Approach Type & Landing method
Cat 1 ILS	200 ft	550 m RVR or 800m visibility	Manual or auto - to a landing (manual or auto)
Cat 2 ILS	Between 100 ft – 200 ft	350 m RVR *	Auto for manual landing or autoland
Cat 3a ILS	Less than 100 ft	200 m RVR *	Auto to Autoland
Cat 3b ILS	Less than 50 ft	Less than 200 m RVR * but not less than 50 m	Auto to Autoland
Cat 3b ILS - Nil DH	0 ft wheels on ground	0 metres	Auto to Autoland

* Note that the RVR limitation varies depending upon Approach lighting

5.2 LOW VISIBILITY OPERATIONS – OPERATING PROCEDURES

Also see 'Appendix A' - EASA-OPS 1.440 - Low Visibility Operations - Operating Rules; and 'Appendix A' - EASA-OPS 1.455 - Low Visibility Operations - Operating Procedures

(a) General

Low Visibility Operations include:

- (1) Manual take-off (with or without electronic guidance systems);
- (2) Auto-coupled approach to below DH, with manual flare, landing and roll-out;
- (3) Auto-coupled approach followed by auto-flare, autoland and manual roll-out; and
- (4) Auto-coupled approach followed by auto-flare, autoland and auto-roll-out, when the applicable RVR is less than 400 m.

Note 1: A hybrid system may be used with any of these modes of operations.

Note 2: Other forms of guidance systems or displays may be certificated and approved.

(b) Procedures and Operating Instructions

- (1) The precise nature and scope of procedures and instructions given depend upon the airborne equipment used and the flight deck procedures followed. An operator must clearly define flight crew member duties during take-off, approach, flare, roll-out and missed approach in the Operations Manual. Particular emphasis must be placed on flight crew responsibilities during transition from non-visual conditions to visual conditions and on the procedures to be used in deteriorating visibility, or when failures occur. Special attention must be paid to the distribution of flight deck duties so as to ensure that the workload of the pilot making the decision to land, or execute a missed approach, enables him to devote himself to supervision and the decision making process.
- (2) An operator must specify the detailed operating procedures and instructions in the Operations Manual. The instructions must be compatible with the limitations and mandatory procedures contained in the Aeroplane Flight Manual and cover the following items in particular:
 - (i) Checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight;
 - (ii) Effect on minima caused by changes in the status of the ground installations and airborne equipment;
 - (iii) Procedures for the take-off, approach, flare, landing, roll-out, vacating runway and missed approach;
 - (iv) Procedures to be followed in the event of failures, warnings and other non-normal situations;
 - (v) The minimum visual reference required;
 - (vi) The importance of correct seating and eye position;
 - (vii) Action which may be necessary arising from a deterioration of the visual reference;
 - (viii) Allocation of crew duties in the carrying out of the procedures according to sub-paragraphs (i) to (iv) and (vi) above, to allow the Commander to devote himself mainly to supervision and decision making;
 - (ix) The requirement for all height calls below 200 ft to be based on the radio altimeter and for one pilot to continue to monitor the aeroplane instruments until the landing is completed and for backing-up automated height calls if these fail;
 - (x) The requirement for the Localiser Sensitive Area to be protected;

- (xi) The use of information relating to wind velocity, windshear, turbulence, runway contamination and use of multiple RVR assessments;
- (xii) Procedures to be used for practice approaches and landing on runways at which the full Category II or Category III aerodrome procedures are not in force;
- (xiii) Operating limitations resulting from airworthiness certification; and
- (xiv) Information on the maximum deviation allowed from the ILS glide path and/or localiser.

5.3. ESTABLISHING DECISION HEIGHT (DH) FOR PRECISION APPROACH OPERATIONS

5.3.1 For operations in which a DH is used, an operator must ensure that the DH is no lower than the more limiting figure established at after comparing

- a. The minimum DH specified in the aircraft Flight Manual;
- b. The DH to which the flight crew is authorised to operate; and
- c. The minimum DH to which the Precision approach aid can be used without the required visual reference.

5.3.2 CAT 1 DECISION HEIGHT (ILSC1)

- a. 200 feet
- b. The minimum DH specified in the Aircraft Flight Manual (AFM)
- c. The published Cat 1 OCH for the Approach Category of Aircraft
- d. The minimum height to which the approach aid can be used without the required visual reference.

5.3.3 CAT 2 OPERATIONS (ILSC2)

For a Category 2 operation, the factors to be taken into account when establishing the DH are:

- a. The minimum DH authorised in the aircraft Airworthiness Certification for that operation, (normally 100 ft);
- b. The minimum DH for the particular operation, if one is promulgated by the appropriate NAA;
- c. The published OCL or OCH for the runway, as appropriate. (Obtain from NAA AIP – e.g. UK CAA 'Air Pilot' let down plates)

The minimum DH for Cat 2 operations is the highest of the values resulting from the application of the factors in (b) or (c) above.

5.3.4 CAT 3A DECISION HEIGHT (ILSC3)

- a. DH lower than 100ft.
- b. RVR not less than 200m.
- c. When RCL lights are not operating: RVR to 300m; Day hours only (HJ).
- d. When TDZ lights are not operating: RVR to 300m Day hours only (HJ); 550m Night hours (HN).

For a Category 3a operation, the minimum DH must not be less than any value specified in the Airworthiness Certification of the aircraft for such operations. For an operation utilising a Fail-Passive automatic landing system, the DH must not be less than 50ft. Category 2 AOM may be calculated by pilots and Operators, using the criteria set above

5.3.5 CAT 3B DECISION HEIGHT (ILSC3)

- a. DH lower than 50ft or no DH.
- b. RVR less than 200m but not less than 50m.
- c. When RCL lights are not operating: RVR to 300m, HJ only.
- d. When TDZ lights are not operating: RVR to 200m HJ; 300m HN.

5.3.6 CAT 3B 'NIL' DECISION HEIGHT (ILSC3)

'Nil DH' operations may only be conducted if:

- a. They are authorised in the aircraft Flight Manual.
- b. The approach aid and the aerodrome facilities can support operations without DH.
- c. The Operator has the appropriate authorisation

Category 3 AOM are promulgated on an individual runway-end basis by the NAA of the State where the aerodrome is located. Pilots or operators are not permitted to self- calculate any Cat 3 AOM. These must be obtained from the NAA responsible for the aerodrome. Some NAAs, such as the FAA in the USA, publish all AOM as State Minima for every type of approach and also for departures in Cat 1, 2 & 3 conditions. State Minima must be adhered to by all users of that State's aerodromes and cannot be changed by operators.

To obtain OCH/A data, the UK AIP aerodromes instrument let-down plates may be accessed on the CAA website at www.ais.org.uk which requires that the reader be registered. Registration is free and is almost instantly given by return, via e-mail. The data is held in the AIP Aerodromes section.

5.4 NECESSARY VISUAL REFERENCE TO COMPLETE CAT 2 & CAT 3 APPROACHES - INTRODUCTORY

Also see 'Appendix A' 2. APPENDIX 1 (Old) to OPS 1.430 - AERODROME OPERATING MINIMA; and
3. APPENDIX 1 (New) to OPS 1.430 - AERODROME OPERATING MINIMA

5.4.1 VISUAL REFERENCE CAT 2 OPERATIONS

For Category 2 operations, the primary factor determining minimum RVR is the visual reference required by the pilot to carry out the task dictated by the aeroplane mode of operation. In general, greater use of the automatic equipment implies a lesser visual reference; but to obtain the necessary visual reference from greater eye heights implies greater RVR. The converse is true in both cases.

A pilot may not continue an approach below the Cat 2 DH unless visual reference (containing a segment of at least three consecutive lights being the centre-line lights of the approach lights, touchdown zone lights, runway centre-line 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, for example, an approach lighting cross bar, the landing threshold, or a barrette of the touchdown zone lighting.

5.4.2 Visual Reference Cat 3a Operations

For Cat 3a operations involving the use of fail-passive automatic landing equipment, the minimum RVR which is normally acceptable for operations with small or medium size aircraft is 300 metres. If the aircraft system demonstrates an in-service record of high reliability, such that the probability of a system failure during the early part of the landing flare can be shown to be very low, consideration may be given to a reduction in the RVR.

For Cat 3a operations using fail-operational automatic landing equipment which does not include automatic roll-out control or guidance, the minimum RVR is 200 metres.

For Cat 3a operations using fail-operational automatic landing equipment, with fail-passive roll-out control or guidance, the minimum RVR is 150 metres.

A pilot may not continue an approach below the DH unless a visual reference segment containing at least three visible consecutive lights is established and can be maintained to touchdown; being the centre-line lights of the approach lights, touchdown zone lights, runway centre-line lights, runway edge lights, or a combination of these.

5.4.3 Visual Reference Cat 3b Operations

For Cat 3b operations using fail-operational automatic landing equipment with fail operational control or guidance during roll-out, there is NO requirement either for a DH to be specified, or for a minimum RVR. This applies unless a minimum visibility is required to facilitate taxiing.

- a. A pilot may not continue an approach below the DH unless visual reference containing at least one centre-line light is attained and can be maintained.
- b. For "No DH" operations there is no requirement for visual contact with the runway prior to touchdown.

Note: The generalised DH/RVR relationships given for Cat 3a & 3b above are subject to alteration for specific operations at the NAA's discretion (to take account of the characteristics of the particular runway and/or aeroplane).

5.4.4 Reversion to a Higher Minimum during Cat 2 & 3 Approaches

The Approach Ban prohibits descent below 1000ft Above Aerodrome Level (AAL) unless the reported RVR is equal to or better than the RVR specified for the approach. However, once the aircraft has started an approach and is below 1000ft AAL, the approach may continue down to the specified DH regardless of the reported RVR. The reason that the RVR may be ignored in this situation is to prevent unnecessary missed approaches being caused by a reduction in RVR which may well be temporary.

An aircraft carrying out a precision approach should not, in the event of aircraft equipment failure, revert to a higher minima once the aircraft has descended below 1,000ft AAL. The required action is to carry out an immediate go-around, except in the following circumstances:

- a. When a Category 3 approach is being made in Category 2 conditions, or when a Category 2 approach is being made in Category 1 conditions, as reported before the aircraft is descended below 1,000ft AAL and all the crew have been briefed for the reversion procedures for each approach, the approach may continue.
- b. During a Category 3 approach, when the aircraft is below the Alert Height, if a failure occurs in one of the aircraft's required redundant operational systems, it may be ignored; and if the required visual reference system exists, the landing may be completed.

Summarising:

Below 1000ft AAL, any equipment failure requiring reversion to higher minima requires a go-around unless:

- a. The RVR associated with a reversion to a higher minima existed before the aircraft descended below 1,000ft AAL; or
- b. The failure occurs below Alert Height.

5.5 AERODROMES WITHOUT APPROACH AIDS

Existing Regulations are intended to prohibit the use (by an aeroplane to which they apply), of any aerodrome for which there is no recognised instrument approach or let down procedure.

Other specific rules state that the commander of an aircraft shall not make use of any radio navigation aid, without complying with such restrictions and appropriate procedures as may be notified in relation to that aid, unless authorised by an Air Traffic Control unit.

Operators and aircraft owners wishing to develop an Instrument Approach Procedure for aerodromes without approach aids, must first contact for advice the NAA of the State issuing the AOC for Commercial Air Transport aircraft (and of Aircraft Registry if different). Operators of General Aviation, Fractional ownership, Corporate and Private aircraft, application must contact their State of aircraft Registry who will offer advice and grant any exemption(s) required from Regulations relative to the in-house development of Instrument Approach procedures.

5.6 ALTIMETER TEMPERATURE ERROR CORRECTION CHART

Pressure altimeters are calibrated to ISA conditions. Any deviation from ISA will result in error proportional to the deviation from ISA and the height of the aircraft above the aerodrome pressure datum. The error is approximately 4ft/1000ft per °C of difference. When temperature is LESS than ISA an aircraft will be LOWER than the altimeter reading. Table values should be ADDED to published/calculated altitudes or heights.

The error corrections in the table are properly a function of deviation from ISA but, for simplicity, the aerodrome temperature may safely be used for aerodromes up to 1000ft above sea level. (This will include almost all UK aerodromes). At higher aerodromes the ISA deviation should be used. The temperature at ISA is +15°C minus 2°C per 1,000ft above sea level. The ISA deviation is the ambient temperature minus the temperature at ISA. (e.g. an airfield 2,500ft above sea level at minus 30°C has ISA deviation of -30° - (+10°) = -40°C).

Aerodrome		HEIGHT ABOVE TOUCHDOWN OR HEIGHT ABOVE AERODROME IN FEET														
TEMP Sea level	ISA dev	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000	6000
°C	°C															
0	-15	20	20	20	40	40	40	40	60	60	100	120	180	240	300	360
-10	-25	20	40	40	60	60	80	80	100	100	160	200	300	400	500	600
-20	-35	20	40	60	80	80	100	120	120	140	220	280	420	560	700	840
-30	-45	40	60	80	100	100	120	140	160	180	280	360	540	720	900	1080
-40	-55	40	60	80	100	140	160	180	200	220	340	440	660	880	1100	1320
-50	-65	60	80	100	140	160	180	200	240	260	400	520	780	1040	1300	1560

5.6.1 When to Apply Corrections

When the aerodrome temperature is 0°C or colder, temperature error correction must be added to:

- a. DH/DA or MDH/MDA and step-down fixes inside the FAF.
- b. All low altitude approach procedure altitudes in mountainous regions (defined as terrain of 3,000ft amsl or higher).

When pilots intend to apply corrections to the FAF crossing altitude, procedure turn or missed approach altitude, they must advise ATC of their intention **and also** the correction to be applied. Pilots may refuse IFR assigned altitudes if altimeter temperature error will reduce obstacle clearance below acceptable minima. However, once an assigned altitude has been accepted, it must not subsequently be adjusted to compensate for temperature error.



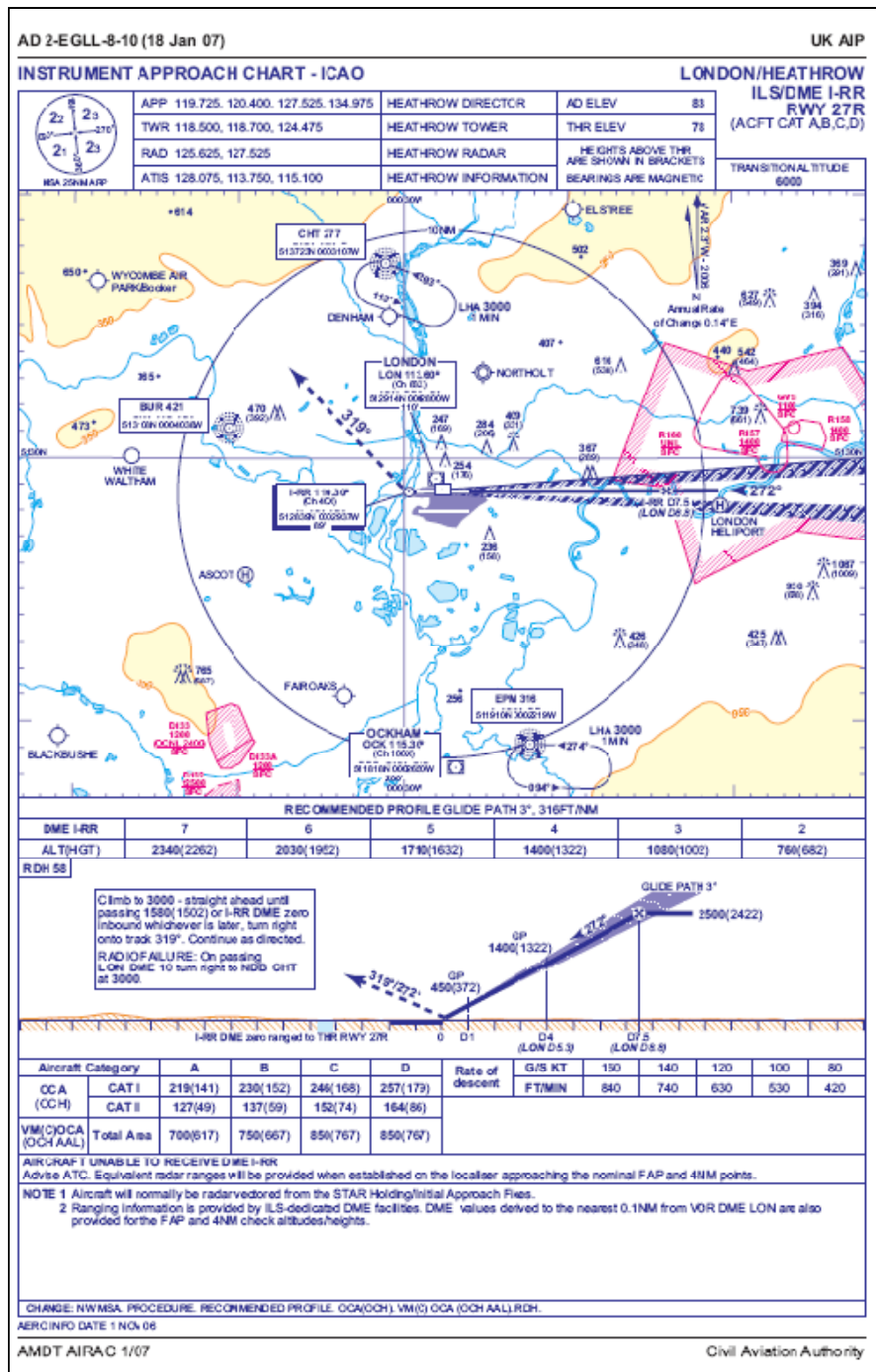
Public domain photo - NASA Langley Research Center (NASA-LaRC)

Boeing 737-100 in NASA test on 11 March 1985. NASA B737 test aircraft during braking test-run on snow-covered runway at Brunswick Naval Air Station, Maine. This test was part of joint NASA/FAA/Industry Winter Runway Friction Program which included FAA B727 test aircraft with seven different ground friction measuring devices.

5.7 LET-DOWN PLATE AERODROME OPERATING MINIMA (AOM) PRESENTATIONS

5.7.1 London (Heathrow) Runway 27R ILS with OCA(H) (UK AIP)

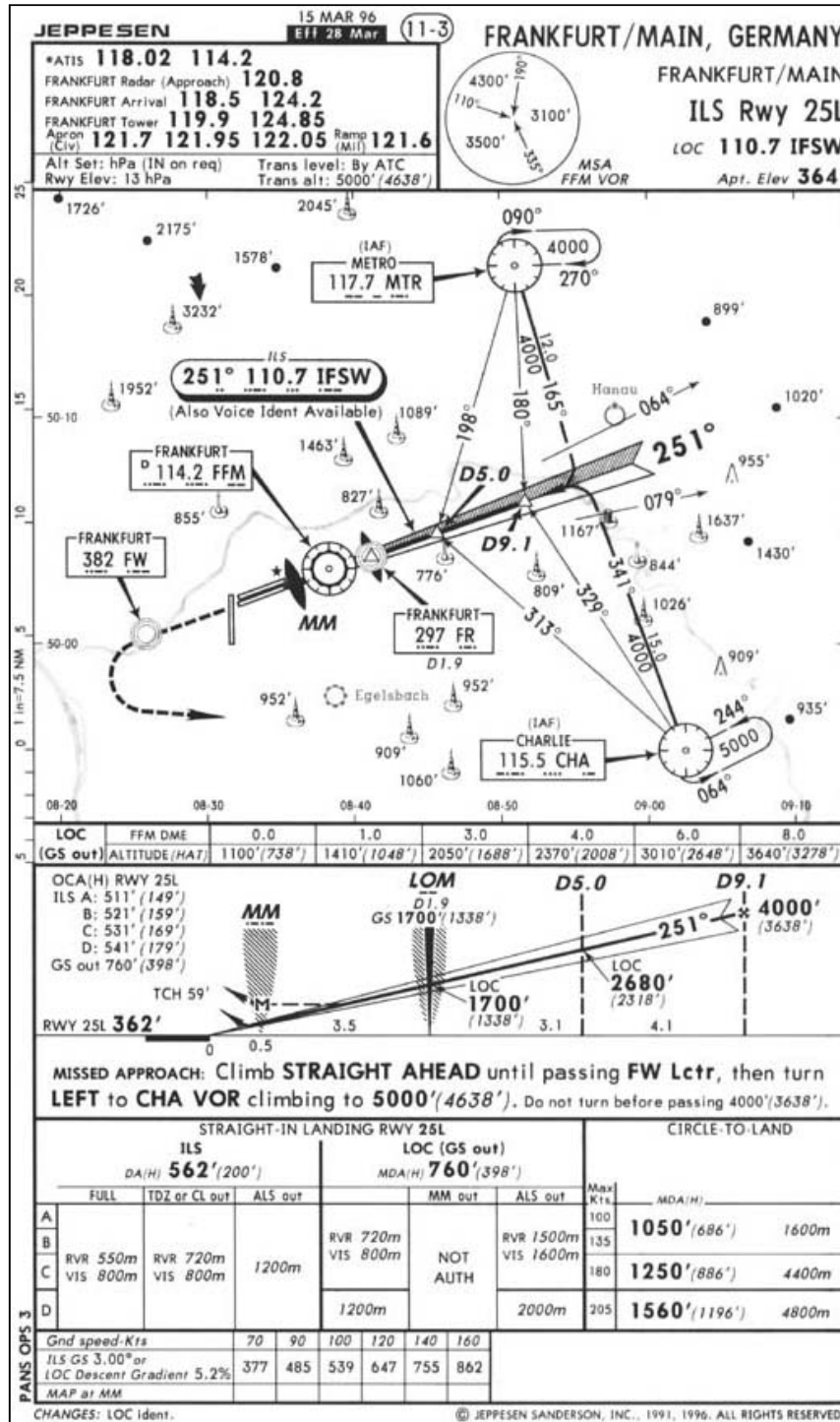
Sample chart - not to be used operationally



UK CAA let-down plate for the London Heathrow 27R ILS, taken from the UK AIP (Air Pilot). Note that it ONLY shows Obstacle Clearance data (OCA/H), from which are derived the appropriate AOM. It shows danger areas and spot heights only, leaving the pilot to work out his Minimum Safe Altitude inside the 25 n.miles radius, as addressed in the top left hand corner of the plate.

5.7.3 Frankfurt / Main Runway 25L ILS (Jeppesen) Let-down Plate (with AOM)

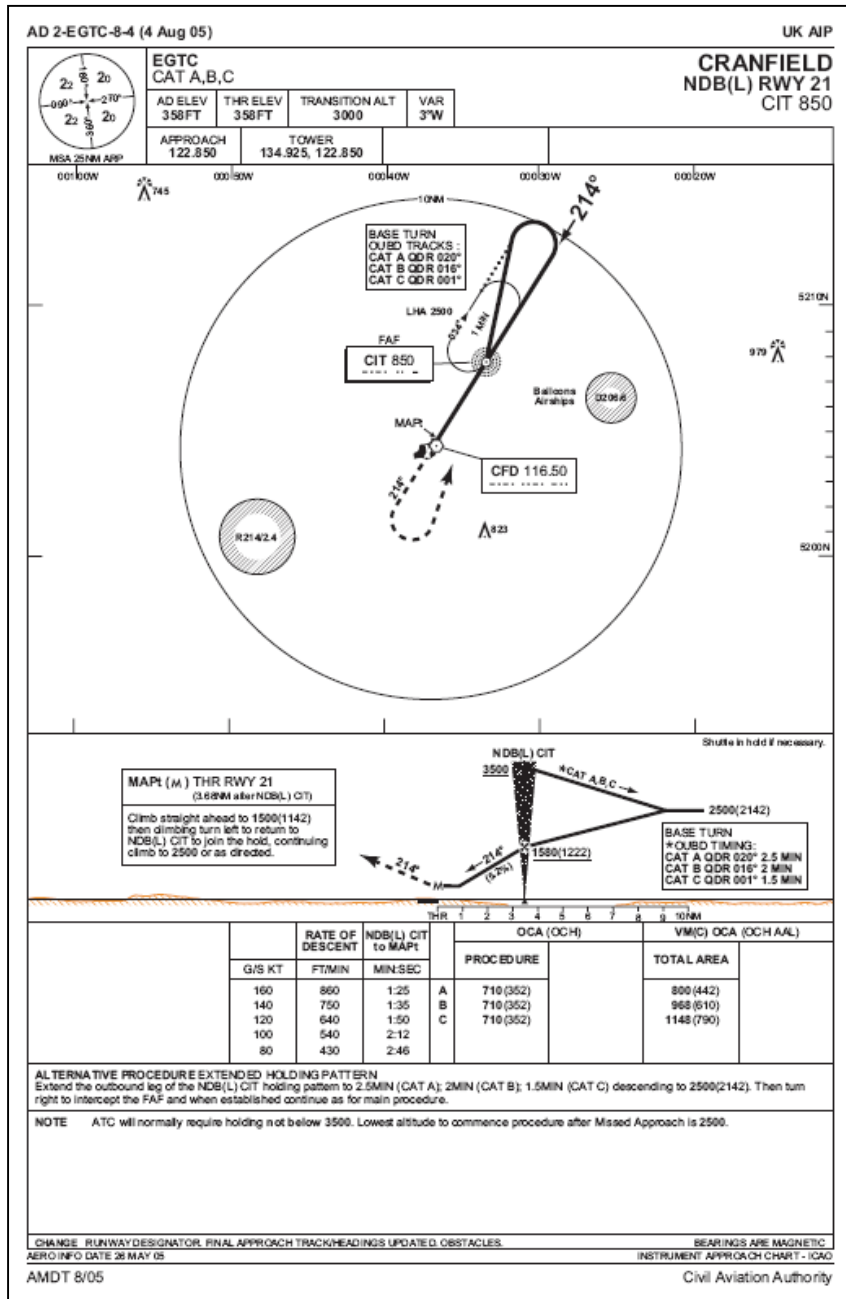
Sample chart - not to be used operationally



Black on White ILS let down plate Produced by Jeppesen Inc. from data provided by the German NAA (LBA). Note the inclusion of AOM and Missed Approach instructions and spot heights to mark terrain elevations.

5.7.4 Cranfield Runway 21 NDB (UK AIP) Let-down Plate (with AOM)

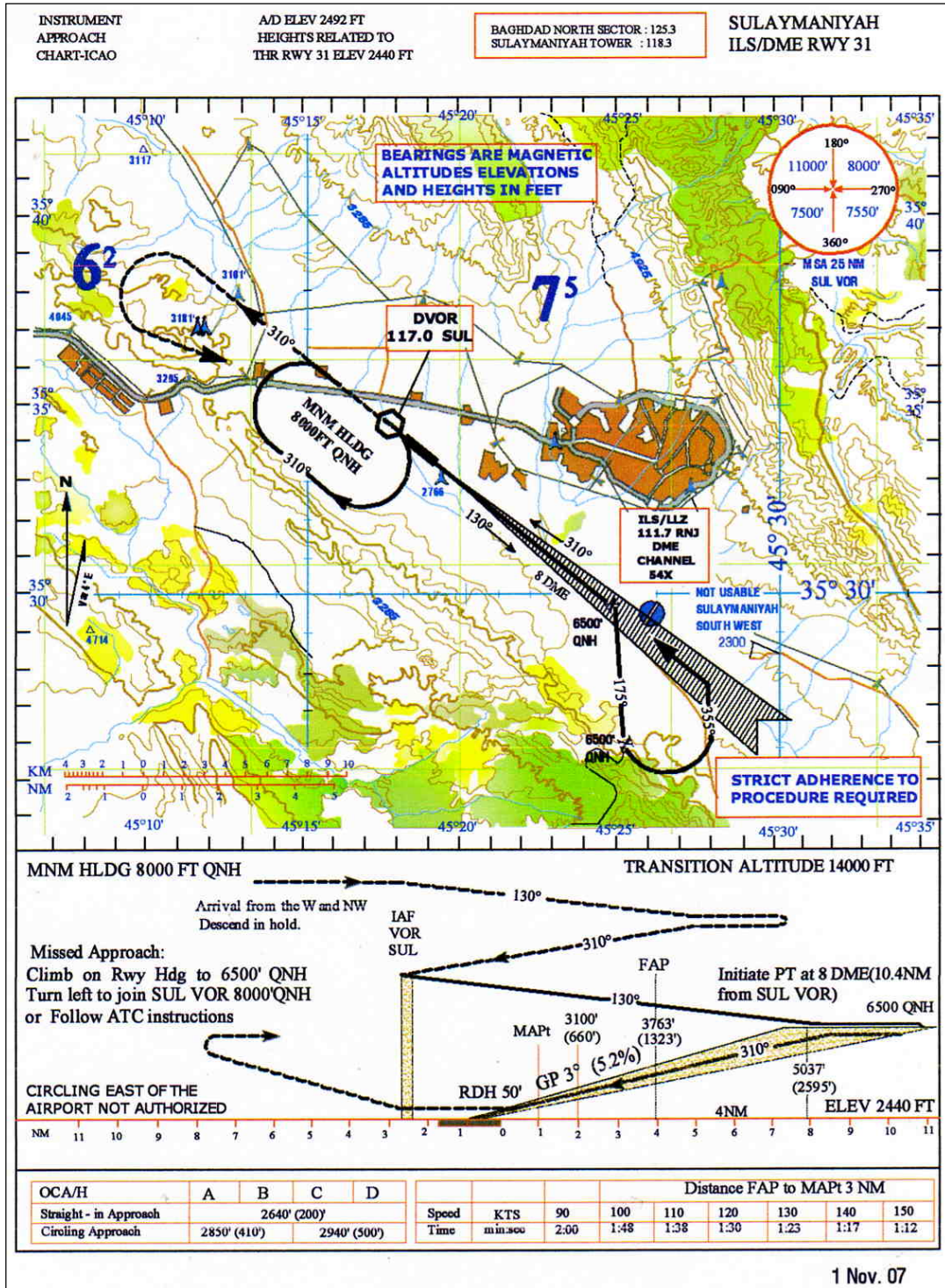
Sample chart - not to be used operationally



UK CAA let down plate for the Cranfield (England) NDB let down with danger areas to be avoided and the odd spot height, with terrain undulations shown on the elevation cross-section view. This NDB let down is not typical of the usual single NDB. The NDB is located about 5 n.miles on the approach, leaving the pilot to work out his descent depending on the groundspeed and rate of descent against time from overhead. In this case a second Locator beacon is on the airfield to assist lining-up by looking at the needle pointing ahead, rather than using a back-bearing. No AOM information is offered but OCH/A data is given instead, from which AOM can be self calculated or provided by proprietary producers of Let-down plates for the use of purchasers of their services.

5.7.5 Sulaymaniyah (Iraq) Runway 31 ILS / DME Approach Plate (with AOM)

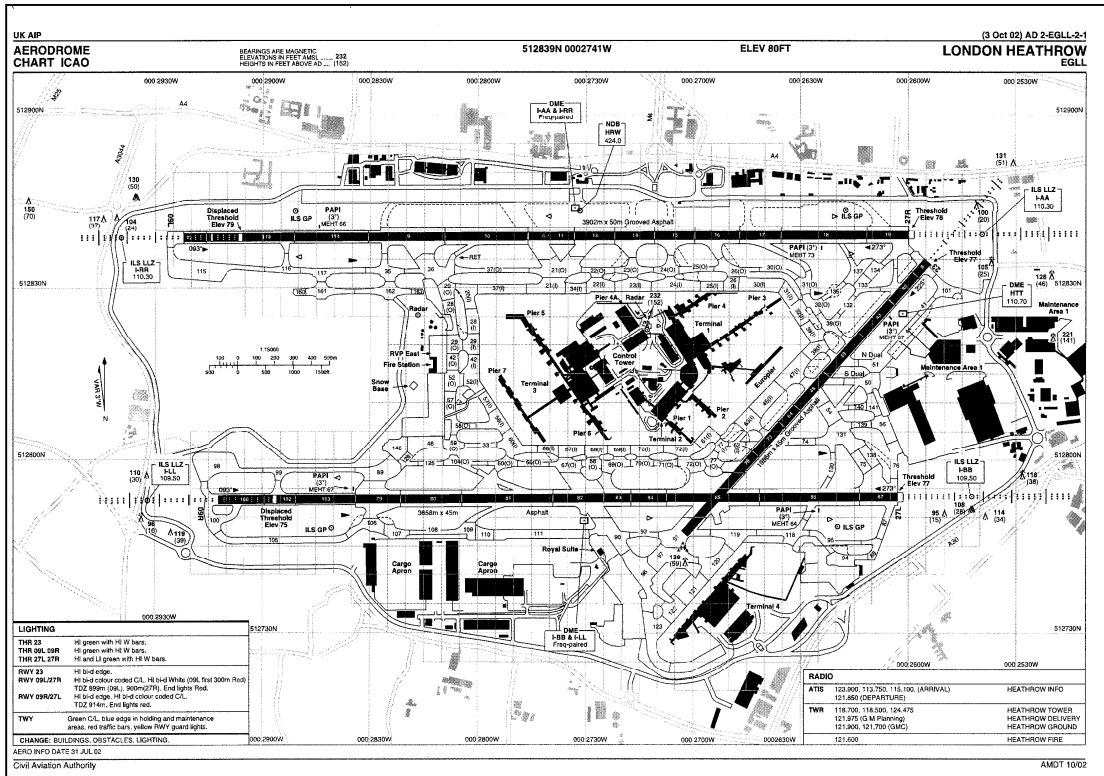
Sample chart - not to be used operationally



This full colour example of an ICAO chart produced by the Iraqi Regulatory Authority for its AIP, in one of the various alternative presentations permitted by Annex 4, (Cartographers' Appendix) and clearly shows the rising terrain on either side of the manoeuvring area. It also includes AOM.

5.7.6 London (Heathrow) Airport Surface Chart (UK AIP)

Sample chart - not to be used operationally



From UK CAA AIP

To illustrate the concept of combined DME installations serving both ends of the same runway, this is the London Heathrow Aerodrome Chart produced by the CAA for the UK AIP. It shows the position of the I-BB & ILL and I-AA & IRR Frequency-paired DME transmitters. They are located approximately midway from each end of 27R/09L (to the North of) and 27L/09R (to the South of), such that they can serve whichever ILS is selected on the flight-deck of an approaching aircraft. They are calibrated to show ZERO as the aircraft crosses the threshold of the runway served by the tuned ILS.



Boeing 717-100 on short finals

Boeing photo

PART 3 - AWOPS PROCEDURES & TRAINING

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SECTION 1 - PRE FLIGHT

1.1 GENERAL CONSIDERATIONS

The terms of reference for All-Weather Operations in Europe and the basis on which Low Visibility Procedures have been developed may be found in the ICAO Manual of All-Weather Operations (Doc No. 9365, as amended), in the current ECAC (CEAC) Doc Number 17 and in EU-OPS 1 Subpart E that will be replaced by EASA-developed texts.

This first Section deals with generalities applicable to All Weather Operations (AWO or AWOPS). Guidance applies to all aircraft that are type-certificated for AWO. Where illustrative examples are given, they refer to older generation aircraft that may have two or three autopilots and a 3-flight deck crew **complement**; such as the Classic B747-100/200 series aircraft that are used as examples, to illustrate certain autoland related variables and flight profiles. AWOPS related Company manuals will hold Type-specific descriptive and instructions for automatic landing operations, in dedicated sections.

Low visibility operations require the Captain to be the handling pilot, for both take-off and for landing. Flight Crew Orders often restrict co-pilots to a minimum for take-off of 600 metres RVR and, for landing, ILS Cat 1 (or non-precision AOM if appropriate), with a crosswind limit of two thirds the maximum permitted for the aircraft type as promulgated. Co-pilots are encouraged to carry out practice autolands on the line. However, any approach to limits below Cat 1 must be carried out with the Captain handling.

Pilots are encouraged to carry out practice automatic approaches to **autoland**, but these must be on all engines, whether the aircraft type is cleared to carry out asymmetric automatic landings or not. The electrics must always be split for a Cat 3 autoland, even if only for practice purposes, as this helps trouble-shooting in the event of an unsuccessful approach.

Should a practice autoland be unsuccessful, care should be taken before downgrading the autoland status of the aircraft as it may have been caused by factors not related to the aircraft **equipment**. For example, carrying out an approach without Cat 3 protection and with another aircraft at the Cat 1 holding point, so infringing the Cat 3 protected area. Failure in such a case would hardly be the fault of the autoland systems on board. In such a situation and with the autopilot incorrectly downgraded, operation of the following sector might be compromised if full Cat 3 capability were required for it to operate.

1.1.1 Aerodrome Operating Minima (AOM)

For Cat 2 Operations, published (or self calculated) AOM are normally used. Cat 3 AOM are only issued by the Regulatory State, for each individual runway end. These limits apply to the first third of the runway. In addition, the mid-point RVR must be 150 metres or better. The stop-end RVR figure is advisory only. Note that different rules apply in the USA and Canada.

For three autopilots Cat 3 auto-landings, Triple and Dual limits are always quoted. Dual limits are 'reversion' limits from Triple figures. However, for two autopilot aircraft, reversion from a Dual Cat 3 or a Cat 2 approach will be to ILS Cat 1.

Note 1: On some aircraft, only two autopilots can be physically selected to ON during an auto approach and landing, A third channel, if fitted, may engage automatically during the approach, after the other autopilots have been selected to ON and the appropriate Flight Mode selection has been made for the approach. When the aircraft **Flight Mode Annunciator (FMA)** is programmed for an automatic approach and landing, it will indicate the current autoland capability of the aircraft, such as Cat 2 or Cat 3; and

Note 2: Carrying-out an auto-coupled approach using every autopilot that is fitted to the aircraft, is not only for operations to Cat 3 limits. Auto-coupled approaches using all available autopilots are recommended whenever weather conditions indicate that the required visual reference might not be achieved by 1,000 feet above DA / DH; and

Note 3: Auto go-around is usually available (and automatically armed) on any auto-coupled approach at some point of the approach, such as after glide-slope capture on Classic B747 aircraft.

1.2 PRE FLIGHT CONSIDERATIONS AND ACTIONS

Before operating in low visibility, the following conditions must be fulfilled when flight planning:-

1.2.1 Crew Qualifications

All members of the crew must be All Weather Operations qualified **and current**.

1.2.2 Aircraft

This should be placarded "Dual" or "Triple" where applicable. The loss of an autopilot on aircraft fitted with two autopilots prevents autoland, whilst on three autopilot aircraft it can still be achieved. Consequently, the two autopilot system is described as "*Fail Passive*", whilst three autopilot aircraft are "*Fail Operational*".

If the aircraft should require a practice autoland to upgrade the autopilot, one should be carried out at the earliest opportunity. If the requirement is for a "Standard Approach", this means an autocoupled approach down to a minimum of 500 feet RA as if intending to autoland, with all autopilots engaged and no warnings or adverse comments.

1.2.3 Airfield

To carry out an approach in worse than Cat 1 conditions, an individual runway must be designated as suitable for autolandings in the appropriate Arrival Airfields Performance section/volume of the Operations Manual; for example ILS 24 (L). The suffix "(L)" against the ILS entry for that runway would indicate it is suitable for autoland operations. This must not be superseded by any information in the AIS briefing sheets, or any ATIS or ATC broadcast. Any entry showing that the runway is fitted with an ILS but without the (L) suffix, would indicate that it is not suitable for autoland. In addition, a listing of destinations and their runways suitable for **Autoland**s could be usefully included in a frontispiece to an/the Arrivals Performance volume for ease of quick-reference.

A runway lighting deficiency requires use of Cat 1 RVR, although Cat 2 or 3 Decision Height can still be used if published.

RVR measurements must be available for Cat 3 operation. Human observation is an acceptable alternative for Cat 2 but not for Cat 3.

Having fulfilled these three criteria, Meteorological aspects must also be considered.

1.3 METEOROLOGY

1.3.1 Departure Visibility

This is based on an ability to see a minimum of three runway lights throughout the take-off run. It is quoted for each individual runway on the appropriate page in the Performance Manual (Take-off), and applies to the beginning and mid-point readings. The stop end is, like for the approach case, advisory only. However, the Take-off Performance Manual should advise caution in this area for departures.

Additional requirements may apply in USA and Canada. These should be listed at the front of the Performance Manual (Take-off) and must be checked before flight.

1.3.2 Departure Alternate

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

When the weather at the take-off airfield is at or below landing minima, a **Return Alternate (Take-off alternate in EU-OPS 1 terms)** must be nominated.

The need for Take-off alternates applies when conditions at departure are below Cat 3a for aircraft authorised to carry out an asymmetric Cat 3a autoland and all other aircraft not cleared for asymmetric autoland operations, as indicated hereunder:

- a. For 2-engined aircraft, the **return** alternate must be within 60 minutes flying time at one-engine-inoperative cruising speed. As an example, for Airbus A320 aircraft, this equates to a radius of 400 nautical miles, when the weather at the departure airfield is below Cat 3a minima (Cat 3a limits being the minimum for a single engine auto approach and landing).
- b. For 3 and 4-engined aircraft with fuel dumping capability, when, respectively, a 2 or 3-engine automatic approach for autoland in Cat 3a conditions is not permitted by the Flight Manual, the **return** alternate must be within 120 minutes flying time at one-engine-inoperative cruise speed, that is 750 n.miles. AOM will be at least Cat 1 ILS, or above any non-precision approach limit as appropriate. On short sectors, this alternate can be the same as the Destination Alternate.
- c. The weather at these **return** alternates must be forecast to be at or above the Cat 1 ILS or non-precision approach minima if appropriate, for the runway expected to be available after diversion. The forecast must be for a period commencing one hour before the estimated arrival time to one hour after estimated arrival time at that airfield.

When the destination airfield is forecast to be at or above the appropriate landing minima at the estimated time of arrival, one destination alternate is required. However, if the forecast is below minima, two alternates must be selected.

These Alternates must be forecast to be at or above the Cat 1 ILS or non-precision approach minima if appropriate for the runway expected to be available after diversion.

When operating to an airfield approved for use without an alternate when carrying Island Reserve Fuel, the above condition does not apply. A suitable return alternate within 500nm must be available at which the weather

conditions are forecast to be at or above the specified Cat 1 ILS or non-precision minima, for the runway likely to be in use at the time of an expected approach. The departure airfield may be used as the return alternate.

In the USA and those other countries where Alternate Minima apply, the forecast weather for the nominated return alternate should be better than its own Alternate Minima at the time of the planned approach. This return alternate may not be further from the point of departure than 120 minutes flying time at the 3-engine cruise speed or 60 minutes at the one engine cruise speed.

1.3.3 Destination Weather

This must be good enough to expect to be able to carry out a successful approach at the forecast time of arrival. If the airfield is Cat 3 equipped, then Cat 3 conditions or better will suffice.

1.3.4 Alternate Weather

This must be forecast to be Cat 1 (or non-precision if appropriate) at the expected time of arrival at the alternate. This covers the case of aircraft performance being downgraded after getting airborne.

Typical Autoland approach limitations			
Max Wind	25 kts	Max Elevation	7,000 ft amsl
Max Crosswind	15 kts	Max Temperature	ISA + 35
Max Tailwind	05 kts	-	-

1.4 FLIGHT PLANNING & AIS BRIEFING

Check that, if the departure conditions require a PVD take-off when fitted, that the ILS is not downgraded from Cat 3. However, in the UK, a downgraded ILS may still be available for PVD take-off if it is promulgated as *'Suitable for take off guidance'*.

Check that there are no NOTAMs applicable for the destination such that a Cat 2 or 3 approaches are precluded.

1.5 CREW QUALIFICATIONS

The crew must be Qualified for LVO conditions, in order to operate in conditions below Cat 1. All crew members at the controls must have completed an Initial conversion course including an AWO module and/or be current in LVO Recency terms

1.5.1 AWO Qualification Renewal

This is automatically renewed on completion of the appropriate portion of the bi-annual simulator check.

1.6 FUEL ENDURANCE ASPECTS

Potential Cat 2 and Cat 3 landings may be lost if an early diversion is enforced due to insufficient holding fuel. It should also be borne in mind the ATC delays due to traffic back-log may continue for some time after fog clearance, especially in Europe during the period when Cat 3 traffic flow restrictions have been removed and yet the conditions are still Cat 2.

1.7 AT THE AIRCRAFT

In addition to normal PRE-FLIGHT checks:

1.7.1 Pre-Departure AWOPS considerations

On arrival at the aircraft, the Maintenance Log should be checked to ensure that it does not contain any 'ADD' superseding the information received at the Flight Planning stage. Some Performance 'ADDs' might preclude the use of autoland. Additionally, some may do so by default. Any defect requiring the use of Generalised Charts for landing preventing Autoland would be mentioned in notes at the start of the Generalised Charts Section in any 'Arrivals' Manual, when so included.

The 'placarding' of the Autopilot current capability status on the flight deck, should be confirmed.

At certain airfields such as at Home Base and at terminating stations, where there is a change of call-sign sign for example, the scan check on the aircraft should include the Autoland check. Note that this check must always be carried out using a dead ILS frequency. If any channel does not give the necessary indications, for example illuminating ½ amber on the B747 'Classic', it is indicative that it has failed the check and the autopilot placard should be amended accordingly.

Check that the autopilot is not downgraded in the Technical Log. Irrespective of lack of NO LAND 3 or NO AUTOLAND messages, or their equivalent on other aircraft, Autoland status is limited to the ADD declared status until the ADD is cleared.

Ensure that the aircraft DDM has no other defects which would affect approach capability.

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, inform ATC prior to start-up, of the intention of Cat 2 or Cat 3 landing at destination.

1.8 ACTIVE RUNWAY INFRINGEMENTS IN POOR VISIBILITY CONDITIONS

OF VITAL IMPORTANCE

It is most important for pilots to be particularly careful at all times, NOT to inadvertently stray on to operating runways, but particularly when visibility on the aerodrome is impaired by fog or low cloud. Great care must be taken to read and interpret correctly the marker boards that are placed to identify taxiways, intersections, approaches to runways (active or non-active and holding points) prior to entering the active runway. Very careful perusal of the aerodrome surface charts and maintaining a watchful look-out for taxiway identification and other marker boards is vital, if incursions on to an active runway are to be avoided.

If there is any doubt whatsoever about the position of the aircraft whilst taxiing before take-off or after landing, STOP and inform ATC immediately, for their information. Ask for guidance in Standard English ATC phraseology. ATC can then immediately give, the necessary urgent instructions to aircraft about to depart or land; to discontinue, take-off or approach as applicable, before taxiing assistance and guidance is offered to the 'lost' crew.



Beware – runway ahead

GAPAN photo – The Log



Boeing 717-200 taxiing to runway

Boeing Photo

END OF SECTION 1

SECTION 2 - FLIGHT PROFILE

2.1 DEPARTURE

2.1.1 Taxi Out

When in fog or low cloud, only use taxiing lights, particularly at night, to keep light pollution and reflection to a minimum; so as to see as much as possible ahead and to the sides.

The primary consideration is safe taxiing to the holding point. While the Captain taxis, the co-pilot may be best employed backing him/her up by checking taxiway headings, consulting aerodrome charts, helping with lookout etc. In this case, delay the *Before Take-off Checklist* until arrival at the holding point. Make sure you stop at the Cat 2 and 3 holding point. At many airfields this is set back from the normal Cat 1 holding point, and may be difficult to make out, especially if the green taxiway lights extend beyond the Cat 2 and 3 holding position. Pairs of alternately flashing Wig-Wag lights may be installed on either side of Cat 2 / Cat 3 stop-bars, in addition to the illuminated RED marker boards, to reinforce the position of the stop-bar.

Bear in mind that in poor visibility, e.g. 100m (380ft) 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, therefore taxi as slowly as safety demands.

Use of Ground Movement radar, the compass, an 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 & Cat 3 holding point. Green taxiways centreline lights may be illuminated beyond the Cat 2/3 holding point if it does not coincide with a taxiway stop-bar, or if a preceding aircraft is just lining up.

If carrying out a PVD takeoff, enter ILS (Frequency & runway QDM) on the appropriate FMC page (NAV RAD for B747-400) and switch on both PVDs before reaching the holding point. Identify the ILS as soon as possible and check that the appropriate Memo messages for the PVDs are displayed. The Take-off summary lists the minimum RVR for take-off for the intended runway.

2.1.2 General RVR requirements for take-off

The Minimum RVR for Take-off is as indicated in the table hereunder

Take-off	TDZ	Mid Point	Stop end
U.K.	Minimum	Minimum <i>If reported</i>	Advisory
USA & Canada	Minimum	Minimum	Minimum
	Any one RVR report may be unserviceable		

Prior to entering the runway, consider the runway state and braking action, especially when the RVR is 100m. 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.

If the PVD is being used, as the aircraft lines up and a valid localiser signal is received the PVD will un-shutter and the display brightness can be adjusted. Check that it is indicating correctly. Also check that the visible number of centreline lights is consistent with the reported RVR. The minimum number should be 4 or 2 for a spacing of 15m or 30m respectively, when the RVR is 100m.

2.1.3 Take-off

Do not use landing lights. Limit lighting to taxiing lights particularly at night, to keep light pollution and reflection to a minimum; so as to see as much as possible ahead and to the sides.

Use the centreline lights and/or markings as the primary directional guidance: as speed increases, the streaming effect of these improves guidance (offsetting somewhat the restricted view from the high flight deck). Also, the noise of the nose wheels running over the centreline lights is a confirmation that the take-off run is straight. If the PVD is being used, as visibility decreases the visible runway centre lighting lights move closer to the glare shield until sight of them is lost. At this point the handling pilot will be looking at the PVD and can then follow its demands.

2.1.4 Rejected Take-off

A rejected take-off presents additional problems in Cat 3 conditions when, by definition, the visual reference is very limited. Even if the runway is fitted with Cat 3 carpet lighting in the touchdown zone, any stop from high

speed will probably be initiated from a point further down the runway, with only the centre-line lighting for guidance. Additionally, any rejected take-off at weights approaching RTOW will use the last third of the runway in order to stop. So, although the stop-end RVR value is advisory only, it is recommended that it should be at or above minimum in these circumstances. The use of "full power" rather than "graduated" would accelerate the aircraft more quickly in such cases but give greater asymmetry in the event of an engine failure.

On many runways, the centre-line lights are colour coded, being alternate red and white for 600m (2000 feet) starting 915m (3,000 feet) from the far end, then changing to all red in the last 305m (1,000 feet). If the aircraft stops in this portion of the runway, the coded lighting gives at least some indication of the aircraft's position. If it stops beyond the Cat 3 light carpet, but short of the last 915 metres (3,000 feet), determining the aircraft's position may be extremely difficult. This uncertainty and the low visibility itself mean that it may take a considerable time for emergency services to reach the aircraft. They may initially be aided by the use of wing and landing lights or strobes as fitted.

With very limited visibility, directional control with reference to the centreline lights is difficult, particularly with the inherent swing of an engine failure, and loss of the "streaming effect", as IAS reduces, demands early corrections to maintain the centreline. If the PVD is being used, it will give immediate demands to correct any swing and to maintain the centreline.

Confirm AUTOBRAKE RTO operates and simultaneously apply full braking to ensure the aircraft stops before the end of the runway. Remember that at 915m (3,000ft) to go, the all white centreline lights change to alternating red/white and at 305m (1,000ft) to go, they again change to all red.

2.2 EN ROUTE

2.2.1 Considerations - on route to destination

- a. Monitor the trends in visibility at the destination and alternates.
- b. Keep a close eye on the fuel consumption, to ensure the necessary reserves are on board for the autoland approach at destination and calculate the latest time the aircraft can remain in the hold before diverting, based on the fuel available on arrival in the destination holding pattern. Consider diverting from cruise level, before descent if necessary.
- c. Advise ATC of the aircraft's latest approach time capability otherwise diversion will be required, so that ATC can prepare a re-clearance in ample time, if necessary.
- d. Consult the Landing Summary for the AOM and Regulated Landing Weight, particularly if the runway is contaminated, because the RLW is more restrictive than for a manual landing. When conducting the Cat 2 or Cat 3 briefing, remember that the use of autobrake ensures symmetrical braking and minimises the landing distance required in what may be progressively worsening visibility.

2.3 ARRIVAL

2.3.1 Before descent Cat 2 or Cat 3 Briefing

As autolands do not occur frequently on the line, always use the expanded checklist to carry-out the 'boxed' items of the Before Descent checklist. An example of a typical **Cat 2 & Cat 3 pre-descent crew briefing** may be found on the next page. It is for a B747-100/200 but it can be used as a template for any aircraft. It is followed by a sample **Top of Descent checklist** showing AWOPS-specific "boxed items" that must also be carried-out before descent is initiated, prior to an intended B747 autoland. Carrying-out these items at a quiet time, perhaps in the last hundred miles before Top of Descent, could affect the tactical planning of the operation, particularly if it were then discovered that the aircraft is restricted to Cat 1 for example. In consequence, consider running the AWO checklist earlier in the cruise. The Captain will read-out the Cat 3 briefing from the Aide-mémoire carried in the Normal Checklist binder.

Because the autopilot uses quite separate equipment for autoland operations, any problem with the cruise operation on a particular channel does not automatically rule out its use for autoland

Decoding data for the types of approach lighting given on the Aerodrome plate can be found in the Navigation Flight Bag Information Volume. Be advised that some airfields use specific turn-offs during Cat 3 operations, which may have colour-coded taxiway lighting. If this is the case, details are given on the 'Aerodrome' plate; not on the 'Let-down' plate.

2.3.2 Top of Descent (TOD) & Initial Airfield Approach

In addition to the normal checks prior to the start of an Approach,

The CREW:

- a. must be AWO (Cat 2 / Cat 3) qualified.
- b. must have completed Top of Descent checks and Cat 2 / Cat 3 LVO briefing and agree that a Cat 2 / Cat 3 Runway is available, as appropriate.
- c. The Captain must control the aircraft from not lower than 1,000 feet (on the Radio Altimeter).

The AIRFIELD: must have

- a. The Runway in use approved for Cat 2 and /or Cat 3.
- b. Listed approach minima for the runway to be used and that these are available to the crew.
- c. Cat 2 and/or Cat 3 procedures in operation.

Confirm that “*Low visibility procedures are in force*” is reported on ATIS or R/T. Generally, if ATIS and ATC do not report to the contrary, all the necessary facilities are serviceable. If “*Low visibility procedures are in force*” is transmitted, then the appropriate runway and ILS protection procedures are active.

2.3.3 B747 ‘Classic’ FLYING MANUAL ‘Extract’ - Cat 3 & Cat 2 Briefing examples

CATEGORY 3 BRIEFING CARD

- Ensure Autopilot is placarded TRIPLE or DUAL.
- Confirm crew is Cat 3 qualified & Autoland Check complete.
- In Cat 3 conditions request a Cat 3 approach from ATC.
- If any RUNWAY lighting deficiency reported, use Cat 3 DH and RVR 600m.
- Discuss minima and reversionary minima:

TRIPLE Cat 3 DH/RVR 20ft/200m			DUAL Cat 3 DH/RVR 50ft/300m		
T/D	MID	END	T/D	MID	END
200	150*	advisory	300	150*	advisory
Loss of one Autopilot Above Alert Height Revert to DUAL Cat 3			Loss of second Autopilot Revert to ILS Cat 1 (Hand flown)		
Below Alert Height Continue to TRIPLE Cat 3					

- Go-around is mandatory if RVR falls below minima before passing 1,000ft RA.
- If already below DH and visual, the approach may be continued.
- Loss of Electrical Busses (1) or (2) or (3 + 4) requires a Go-around.
- Familiarise yourselves with actions required following autoland warning on the approach.
- Co-pilot must stay on instruments throughout and call “Alert”, “100 Above”, “Decide”.
- For auto-go-around call “Go-around Green”.
- Engineer to monitor N1 gauges + warning lights + keep Checklist open at the ‘Autoland Aide-mémoire’ and provide guidance.
- After nose-wheel is on the ground, check A/P & A/T disengaged.
- Familiarise yourselves with Cat 2 & 3 turnoffs. **Do not** call “Clear of R/W” until past Cat 2 or 3 protected area boundary (on passing the last alternating yellow/green taxiway centreline lights).
- After a Go-around, if no further Cat 3 approaches are to be attempted, RESTORE ELECTRICS TO NORMAL on completion of the After Take-off Checklist.

CATEGORY 2 BRIEFING

Briefing is the same as for Cat 3 ... Except: —

DH /RVR is as published on AOM page		
TDZ as published	MID 150*	END Advisory

- If ANY lighting or RVR measurement deficiency is reported, use Cat 2 DH and RVR 600m.
- Do not split the ELECTRICAL Busses.

**NOTE: Midpoint RVR, when reported, must not be below minimum required
(See Performance Manual for RVR in USA and Canada)**

2.3.4 Sample 'Classic B747' Top-of-Descent Checklist with Cat 3/Cat 2 "Grey Boxed" Items

Prior to an intended autoland, the grey-shaded part of the top of descent checklist must be run before the rest of the checks are completed and descent commenced, followed by the Approach and Landing checklists.

On other intended approaches, the top of descent checklist may be commenced at Pressurisation in the second box (not shaded), then followed again by the Approach and Landing checklists.

B747 - Classic FLYING MANUAL BEFORE DESCENT CHECKLIST Pre AUTOLAND (Action Boxed Items)		
INS (CAT 3 only)	Check Status	ALL
Electrics (Cat 3 only)	Split	E/C
Radio Altimeters	Tested	C/P
ILS Deviation	Tested	C/P
Flag Watcher	Check Flags	C/P
Flight Mode Annunciators	Tested	C/P
Auto Pilot Wailer	Tested	C/P
Pressurisation	Set, All Packs ON	E
Humidifiers	Off	E
Landing Data	Checked, Indexed & bugged	ALL
HSIs & VORs	Radio Mode & Manual	C/P
Transfer Switches & Flight		
Director +Compasses Selection	Status . . .	ALL
Seats & Safety Harness	Locked & Secure	ALL
Safety Height	Checked	ALL
Briefing	Stated ... Say Transition Level	C
Limits	Set & Crosschecked	ALL
Ignition	Flight Start	E
Before Descent Check	Complete	E
APPROACH CHECKLIST		
Annunciators Panels	Checked	E
Cabin signs and Exit Lights	On	E
Boost Pumps	Mains on, lights out	E
Cross-feed Valves	Set for Landing	E
Fuel Heat (-7 engines)	Check and off	E
Auto-Brakes	As required. Light Out	C
Q.N.H.	Set and Cross Checked	ALL
Flaps	Selected x°/ Moving &/ x° Set	P/E
	Green Light ON	P/E
Landing gear	Eight Greens	E
Approach check	Complete	E
LANDING CHECKLIST		
Gear Check	Down, In, Green	ALL
Speedbrake	Armed	C
Hydraulics	Checked	E
Landing Check	Complete	E

Where C = Captain P = Co-Pilot E = Flight Engineer

2.3.5 Initial Approach for Landing

A. Required RVR

The general RVR requirements for landing are			
Landing	TDZ	Mid Point	Stop end
Countries other than USA & Canada	Minimum required for the approach	Min 150m if reported. Min 75m if reported & Min TDZ<150m.	Min 75m if reported & if required by Performance Manual, otherwise 'advisory'

If a 'NO AUTOLAND' message (or its equivalent on the aircraft type operated) is present, then the minimum AOM & approach RVR become Cat 2 ILS, for a manual landing.

Approaching destination, inform ATC that a Cat 2 or Cat 3 approach will be made, thus ensuring priority over non-Cat 2 & 3 aircraft holding. 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 RVR.

B. Commencing the Approach

On first contact with the Approach controller request a Cat 2 or a Cat 3 approach with a 10 nautical miles final, at least.

- a. **INS:** Confirm that the required minimum number of INS units for the particular aircraft type are functioning correctly to cater for any go around tracking needs in case of a missed approach.
- b. **Flight Mode Annunciators:** Confirm that any Flight Mode Annunciators are functioning correctly where fitted.
- c. **Autopilot Wailer:** The 'autopilot disconnected' warning wailer must be serviceable to carry out a Cat 3 approach.
- d. **Electrics:** Remember that electrics must be split for all Cat 3 autolands, even if only being carried out for practice. The captain will always monitor the action of the crewmember splitting the electrics. For example on Classic B747aircraft, the electrics are split by the engineer, monitored by the Captain (it is extremely difficult to see the electrics panel from the right hand seat). After splitting the AC system, all four KW/KVAR meters should still register an output. On the B747 Classic, two amber lights will be illuminated. They are on the top row of the panel and are labelled BUS TIE OPEN.

Before splitting DC power, specifically check the ammeter readings for all **Transformer Rectifying Units (TRUs)**. Until the electrics are split, the voltage on failed TRU is supported by the others to which it is coupled so giving no indication of a failure.

- e. **Radio Altimeters:** Check all Radio Altimeters. Each autopilot requires its own Radio Altimeter for autoland, hence an unserviceable Radio Altimeter leaves fewer serviceable channels and may restrict the aircraft to Cat 2 operation. Additionally, the approach autothrottle is controlled by one of the LRRAs and if this Radio Altimeter is unserviceable, the thrust levers must be closed manually during the flare.
- f. **ILS Deviation:** The fact that these test items may be carried out some significant time before TOD means that the aircraft may still be in a Scheduled Navigation Area. If this is the case, the RADIO/INS-FMS switch must be selected to RADIO where this selector is fitted.

Similarly, the aircraft might be within range of another ILS transmission. Note that a dead ILS frequency does not have to be used for the airborne autoland check.

The indications of the required test vary and may be with respect to the Course selected. If the aircraft is on a "downwind" heading at the time, the indications will appear reversed, and the picture must be looked at "upside down". For details specific to a particular aircraft type and its derivatives see the relevant type specific Section in this volume for guidance.

- i. **Flag Watchers:** Do not forget to include these in the items checked where fitted. They enable the pilots to monitor extra systems on the approach, while still monitoring the engine instruments.

When making an approach in genuine Cat 3 conditions, maximum landing flap should be used for landing; (Flap 30 for a B747). This gives a better cockpit cut-off angle and hence improves the visible visual segment.

- g. **RVR:** If the touchdown or midpoint RVR falls below minimum prior to 1,000 ft aal, it is permissible to continue the approach to 1,000 ft aal, 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.

In the USA these are special requirements: -

- (i) The RVR requirements are such that both touchdown and midpoint RVRs must be at or above AOM.

(ii) If, during a Cat 3 approach "LAND 2" is annunciated on the PFD, then the approach minima must revert to Cat 2.

i. **Confidence checks**

Aircraft autoland systems may carry out confidence checks when fully auto-coupled, in the initial stages of an approach. For details, see the Operations/Flight manual for the aircraft type.

2.3.6 Autoland warnings & required actions aide-mémoire

This Classic-B747 aide-mémoire ready-reference card, illustrates necessary action in various circumstances. It can be adapted to suit the particular aircraft operated. It is kept handy for ready reference during the approach but should be committed to memory on 2-pilot crews. A similar memory-jogger to be used when on auto-approaches to autoland should also be developed for other Company aircraft types.

WIND SPEED	TOTAL	CROSS	TAIL
Limits in knots	25	10 gusting 15	5

B747 Classic WARNINGS after Start of Approach (DH & 1,000ft RA)

ABOVE ALERT HEIGHT

WARNING	TRIPLE	DUAL
FLASHING AMBER	Revert to 50ft/300m	Revert to ILS Cat 1
STEADY RED		Paddle out A/P Revert to ILS Cat 1
FLASHING RED & WAILER	Cancel Warning & Revert to ILS Manual	
ILS DEVIATION LIGHTS	Continue unless Tracking Poor	
ENGINE FAILURE	Disconnect A/Ps → → MANUAL GO AROUND	

If possible, re-engage A/Ps; but not below 1,000 ft RA

BELOW ALERT HEIGHT

WARNING	TRIPLE	DUAL
STEADY AMBER	Continue Approach do NOT alter minima	
FLASHING AMBER		A/P disconnects at 150 ft RA

Amber lights are inhibited below 150 ft RA

STEADY RED & WAILER	Disconnect A/P	MANUAL GO AROUND *
FLASHING RED & WAILER	Cancel Warning	
ENGINE FAILURE	Disconnect A/Ps	
C.I.W.S. RED LIGHT	Disconnect A/Ps	
ILS DEVIATION LIGHTS		AUTO GO AROUND *

* Manual landing is permitted only when the aircraft is correctly aligned AND the visual reference specified in the Operations Manual has been established.

2.3.7 Final Approach

a. **Last 1,500 feet of the approach for an auto-landing**

Again, on first contact with the Tower, advise that the aircraft is making a Cat 2 or Cat 3 approach.

When the visibility is rapidly improving, 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 allow the controller to advise that appropriate protection is no longer available.

Remember to only use taxiing lights as against landing lights particularly at night, so as not to be blinded by light pollution and reflection, thus permitting sight of more centreline landing lights during roll-out.

The remaining autopilots are automatically armed when the APPROACH mode is selected. Operate the aircraft in accordance with normal approach procedures, making flap and gear selections appropriate to the weather conditions.

b. **The 1,000 feet Radio Altimeter point**

This is the point at which the Final Approach begins. If after leaving the final approach fix or 'holding' radio facility, the visibility deteriorates below limits, the intermediate approach may be continued in the hope that it will improve. If this improvement has not occurred by 1,000 ft 'Radio' however, a go-around must be initiated. Below 1,000 feet 'Radio', all RVRs become advisory only. This means that any deterioration below limits can be ignored. It also means that any improvements must be ignored. This point on the approach defines what sort of approach can be flown in terms of the degree of reversion available; Triple to Dual, or whatever. More simply perhaps, it defines how many autopilots can be lost for the approach to be continued from 1,000 ft RA to Alert Height.

1,000 ft Radio is also the point on the approach where certain things are programmed to occur. For example for B747-200 series aircraft, a third autopilot which has dropped from 'command' is locked out and is physically prevented from re-engagement. Re-engagement of a second autopilot is possible on both B747-100 and 200 series aircraft, but for example, in order to achieve commonality in a company operating both series, no autopilots will be engaged or re-engaged below 1,000 ft RA.

The complete engagement of all channel operation is indicated on the B747-100/200 series by **Flare Armed** and **Dual/Triple Green**. Other aircraft have similar indications that are described in the type specific Sections of the manual. For all aircraft, the appropriate indicator(s) should be illuminated by '1,000 feet (Radio)' at which a 'height' call is made. The **"1,000 feet"** call is **standardised at this point on all approaches for all aircraft in a company**.

For details that apply to a particular aircraft type, see the relevant type-specific Section of this operations manual volume.

c. **500 feet RA**

Below 500 ft RA, an immediate manual go around shall be flown for

- Any AP red light
- An AP wailer
- A CIWS red light
- Any ILS deviation light

2.3.8 ILS Deviation Lights

These illuminate steady red if the aircraft is below 500 ft Radio, with a tracking error greater than 1 dot on the glideslope, or 1/4 dot on the Localiser (LOC).

Generally, a failure of the automatic system powering a particular autopilot may leave that autopilot's ON/OFF control switch in the ON position but without any hydraulic "muscle" to control the aircraft. On Classic B747 series aircraft, 'A' and 'B' autopilots, use hydraulic systems 3 and 2 respectively; autopilot 'C' uses system 1. For specific details on how autopilots work on a particular aircraft type, please refer to the type specific Operations Manual Technical volume.

If a transient fault causes an autopilot to **drop-out**, or to be paddled out, that autopilot can be re selected to ON once the fault has been cleared. Do not attempt to re-engage an autopilot below 1,000 feet RA. Below 1,000 feet RA any third autopilot may be mechanically locked out.

2.3.9 Alert Height

This is an intermediate height between 500 feet and DH, depending upon the autopilot capability. It will be ideally chosen to coincide with the **"100 feet above"** (DH) call.

Once the autopilots are controlling the aircraft, it will follow the channel having the median channel signal where three autopilots are fitted, whilst two autopilot aircraft follow the lesser signal of their two channels. As the approach continues, the approach funnel becomes smaller and smaller, so that the difference in signal between channels becomes less and less. Therefore, at some point in the approach, a reduction of autopilots from **three** to **two**, should not cause any deterioration to the aircraft's performance. So if an autopilot drops out below that height, there is no need to revert to higher Aerodrome Operating Limits. This point is indicated by the term Alert Height and is set for each aircraft type. For a B747 'Classic', it is set at 200 feet.

2.3.10 Visual Segment for Landing

All approaches, including Cat 3, are "See to Land". Autoland is not a blind landing system, and if at Decision Height nothing is seen, or if the visual reference is insufficient, A GO-AROUND MUST BE FLOWN. Unless a No Decision Height situation exists. Sufficient visual reference in this case is not a subjective assessment, but is defined for each type of approach. Generally the visual segment varies for each type of aircraft, but requires that

a certain number of lights are visible at various stages during the approach. Generalising, the lights that must be visible are as follows:

Category 2: A minimum of three consecutive centreline approach lights

Dual Cat 3: Runway centreline markings or lights and Touchdown Zone lights, such that there is adequate visual reference to complete a manual landing if the autopilot should disconnect.

Triple Cat 3: Runway centreline lights or centreline markings

2.3.11 Engine Failure

Unless the aircraft is cleared for asymmetric auto-approaches leading to autoland, an immediate go-around will be flown in the event of an engine failure during the approach; taking care to guard the rudders on the side of the live engines for deflection should an autopilot disconnection occur.

2.3.12 Auto Go-Around

Although covered here as an aspect of autoland, auto go-around is available on every auto-coupled approach and should not be thought of merely as part of the autoland operation

An auto go-around can be carried-out on Classic B747 aircraft with the Navigation Mode Switches in ILS or LAND, even with only a single autopilot selected to COMMAND and is usually available at any time during the approach after Glideslope capture. This may not be so on other aircraft types.

On B747 Classic aircraft, the handling pilot initiates the auto go-around by pushing the thrust levers towards Go-Around Power. The increase in power causes the nose of the aircraft to pitch up, and with the thrust levers advanced, 'palm switches' 2 and 3 are in a good position to be activated by **rotating** the palm of the hand **downwards**.

The call from the handling pilot is standard - "Go-Around, Flaps 20". The Engineer then follows-up the handling pilot's forward thrust lever movement and sets the power to the Go-Around EPR indicated on the TTI. Before the non handling pilot selects the flaps he should check and call "Go Around Green". If it is not illuminated the call is "Manual Go Around". On the B747-100/200 **it is specifically the AUTOPILOT Go-Around Green Arrow which is being checked to confirm correct functioning of the automatic go-around profile**. For details of the equivalent check that applies to a particular aircraft type, see the relevant type-specific Operations/Flight manual.

The NHP then selects Flaps to a take-off setting (20° on B747 aircraft) in the normal way for the initial stage of the go-around and waits for the Altimeters to show a *positive climb*, NOT just a *rate of climb on the VSI...*, before making the appropriate 'Positive Climb' call, as a reminder to the handling pilot to ask for the landing gear to be selected up.

If the call from the non-handling pilot is "Manual Go Around", the handling pilot disconnects the autopilots using the thumb switch on the control wheel, and carries out a manual go-around.

On an auto go-around, the non-handling pilot does not switch off the Flight Directors, nor does he/she select the NAV MODE SWITCH to Heading, because that may cause all autopilots to drop out and the auto go-around then becomes a manual one !

If the aircraft has a climb at a pre-programmed rate governed by the position of the trailing-edge flaps, it may be necessary, after go-around power has been set, for the handling pilot to make a substantial power reduction to contain the speed within the limiting speed for the climb at the selected flap setting. **Remember that your aircraft will be relatively light and the engine power can rapidly overwhelm the pitch authority.**

As on any Go-around, the aircraft is accelerated and cleaned up at 1,000 feet Radio. To avoid the complete autopilot disengagement mentioned earlier, autopilots may need to be deselected first, after which the NAV MODE SWITCH can be selected to HDG leaving a single channel still in command.

For details that apply to a particular aircraft type, see the relevant type-specific Section in the appropriate volume of the operations manual.

2.3.13 Autopilot Faults

A fault on any autopilot channel during the approach is usually displayed by the illumination of a warning light in the appropriate autopilot's FMA. Specific reasons for any particular warning light are given in the type specific Operations/Flying Manual but from the practical point of view, the subsequent actions are of more importance. Faults without warning lights are possible for certain aircraft, if an autopilot fails a Confidence Check as discussed earlier.

Generally, in older aircraft, a failure of the hydraulic system powering a particular autopilot will leave the appropriate switch in the ON position, but without any hydraulic "muscle" to control the aircraft. On B747 'Classics', "A" and "B" autopilots use hydraulic systems 3 and 2 respectively; autopilot "C" uses system 1. If a transient fault causes an autopilot to drop out or to be deselected, that autopilot can be re-selected to COMMAND once the fault has been cleared.

2.3.14 After Landing

Disconnect the autopilot and the autothrottle after nose-wheel touchdown, **but only if there is no autopilot rudder channel**, hence no rudder control for roll-out guidance on the runway. As briefed before 'top-of-descent', a particular airfield may have specified low visibility turn-offs with or without appropriately colour coded taxiway lights. Ensure that the aircraft tail is clear of the Category 3 Protected Area before calling "Runway Vacated".

To reduce the possibility of getting lost on the taxiways, if at any time the crew becomes uncertain of the aircraft's position on the airport, STOP and inform ATC with immediate urgency, so that other aircraft are re-routed as necessary. ATC may then offer assistance and instructions, based on ground-monitoring radar.

Once on the stand, with the Leaving Aircraft Checklist complete, fill out the aircraft's Autoland Book, to keep the record for that individual aircraft up to date.

2.3.15 Crew Duties during an approach

So as not to duplicate material under this heading, please refer to Paragraph 5.8 (Crew Duties during the Approach) in the last Section (5) of this PART 3, and as also discussed in 2.3.16, 2.3.17 and 2.3.18 hereunder, on the allocation of crew duties during an approach (autocoupled), for an auto or manual landing. Duties also apply to manual approaches.

2.3.16 Approach Procedures & Summary of Standard Calls

Notes on Autopilot Approach Operational Procedures

- a. Examples given are for B747 that can be adapted to establish a cross-company SOP.
- b. When Cat 2 or Cat 3 Approaches are conducted with a flight crew of only two pilots, it shall be the responsibility of both crew members to constantly watch for the presence of warning flags displays or EICAS messages that relate to All Weather Operations. (Refer to the aircraft systems manual).
- c. In addition, it shall be the responsibility of the Pilot Not Flying (PNF) [or Non-Handling (NHP)] but pilot **MONITORING** (PM), to continuously check and cross-check the flight path on his instruments for agreement between the Pilot Flying (PF) [or Handling Pilot (HP)] and PNF/PM's instruments and warning flags. Steps that are identified with PF are to be performed by the PF and steps identified with PNF or PM are to be performed by the Non-handling pilot; that is the Monitoring pilot. Calls are shown in "UPPER CASE" in the tabulations that follow.
- d. The PF shall select the appropriate Flight Director modes on the Guidance Panel. At 1,200 feet AGL, the Flight Director/ Autopilot will enter the dual (or triple) approach mode. The PNF/PM's command bars will appear at this time. The autopilot will then fly the average of the two (or three signals being received if on a 3 auto-pilot installation) for the remainder of the approach.



Air Force 1 on an autoland practise?

US Gov photo by Joe Crowaz

2.3.17 Sample Procedures & calls when cleared for a Cat 2 auto-approach & manual landing

PHASE OF FLIGHT	PF LEFT SEAT	PNF/PM RIGHT SEAT
Before Top of Descent		Obtain current weather conditions
In Range	Review approach procedures to be used, including missed approach.	
	Complete approach briefing	
	Baro altimeter QNH set/crosschecked	Baro Altimeter QNH set/crosschecked
	Set Decision Height (Baro & RA)	Set Decision Height (Baro & RA)
	Perform Radio Altimeter Test	Perform Radio Altimeter Test
		Maintain communications
	Set seat height	Set seat height
	Verify ILS frequencies	Tune both NAVs to ILS Frequency and identify
		Inform ATC of a "COUPLED APPROACH" to ensure that aircraft and vehicles are held short of the ILS critical area
	Set approach course	Set approach course & cross check
		Tune both ADFs to LOM frequency and identify
	Select ADF 1 and/or 2 bearing pointer(s) for display on RMI & PFD HSI	Select ADF 1 and/or ADF 2 bearing pointer(s) for display on RMI & PFD HSI
Reduce to manoeuvring speed		
Call for flaps 10° (or whatever)	Select flaps 10° & verify Call "MOVING & SET"	
Cleared for Approach	When heading less than 90° to approach course, select APR mode ON (note "HDG" green and LOC" and "GS" white (armed).	
	Engage Auto-pilot and Auto-throttle (if available)	
	Call for flaps 20° (or whatever)	Select flaps 20° & verify Call "MOVING & SET"
	Confirm localiser captured ("LOC") Green)	Call "LOCALISER ALIVE"

PHASE OF FLIGHT	PF LEFT SEAT	PNF/PM RIGHT SEAT
1 dot below glide slope	Call for Gear down Verify 'gear down' indication Call for full flaps Call for landing checklist	Select landing gear down Check indications Select full flaps & verify Call "MOVING & SET" Complete the landing checklist Check latest RVR
Glide slope intercept	Confirm glide slope capture ("GS" green)	Set missed approach altitude in pre-select window
Outer Marker	Start stop watch	Call "OUTER MARKER" Start stop watch Check altitude at OM is correct Call "GLIDE SLOPE ALTITUDE CHECKS"
	Cross check altitude & raw data	Check raw data
1,000' above minimums (BARO)	Call "1,000 ABOVE" Say "CONTINUE" or "GO AROUND"	Call "HEIGHT CHECKS, RVR OK" or "RVR BELOW MINIMA"
500' above minimums (BARO)	Call "500 ABOVE"	Call "HEIGHT CHECKS"
200' above minimums (RADALT)		PNF/PM now assumes a head up posture for acquisition of visual segment. When PNF has the necessary visual cues, he will call "STROBES" "APPROACH LIGHTS" or, "RUNWAY" as appropriate. If PNF/PM does not have visual cues he remains silent.
100' above minimums (RAD ALT)	Call "100 ABOVE"	Call "100 ABOVE"
Minimums (RAD ALT)	Say "LAND" or GO AROUND" PF continues approach, or Executes a missed approach depending on PNF observations prior to reaching DH	Call "DECIDE" Call "50 ABOVE TOUCHDOWN"
Landing	Disconnect Autopilot & Autothrottle	Call 30, 20, 10, (feet on RA)
	Perform a visual manual landing, or an autoland if desired	Monitor localiser & glide slope, airspeed & descent rate all the way to touch down
	Carry out normal PF drills after landing roll-out procedures ended.	Carry out normal PNF drills after landing roll-out procedures ended
END		

2.3.18 Sample Procedures & Calls when on a Cat 2 or Cat 3 approach TO AUTOLAND
 (Example of a Category 2 & 3 auto-coupled drill and calls)

a. Autoland

Whenever it is intended to carry out an autoland for whatever reason, then the procedures and requirements for a Cat 2 & 3a autopilot coupled approach and landing must be complied with. In particular, the commander (left hand seat) must be the operating pilot and full flap (or less depending upon performance considerations) must be used. If the reported weather conditions are Category 1 or better, Low Visibility procedures need not be in force and the full Cat 2 & 3a lighting is not required.

b. Operational Procedures - Autopilot approach with Autoland

- i. When Category 2 & 3 Approaches are conducted, both crew members shall constantly watch for the presence of warning flags displays or EICAS messages that relate to Category 2 & 3 operations.
- ii. In addition, it shall be the responsibility of the PNF to check for correspondence between the PF's and PNF/PM's instruments and warning flags. Steps that are identified with PF are to be performed by the PF and steps identified with PNF are to be performed by the PNF/PM.
- iii. The PF shall select the appropriate Flight Director modes on the Guidance Panel. At 1,200 feet AGL, the Flight Director/ Autopilot will enter the Triple approach mode. The autopilot will then fly the average of the signals being received for the remainder of the approach

Note: The tabulated drill and calls are essentially the same as for a Cat 2 approach for manual landing (2.3.17) but this time for an auto-landing.

PHASE OF FLIGHT	PF LEFT SEAT	PNF/PM RIGHT SEAT
In Range	Review approach procedures to be used, including missed approach.	Obtain current weather conditions
	Complete approach briefing	
	Baro Altimeter QNH set/crosschecked	Baro altimeter QNH set/crosschecked
	Set Decision Height (Baro & RA)	Set Decision Height (Baro & RA)
	Perform Radio Altimeter Test	Perform Radio Altimeter Test Maintain communications
	Set seat height	Set seat height
Final Approach Transition	Verify ILS frequencies	Tune NAVs to ILS frequency and identify
	Set approach course	Set approach course and cross check
		Tune both ADFs to LOM frequency and identify
	Select ADF 1and/or ADF2 bearing pointer(s) for display on RMI & PFD HSI	Select ADF 1and/or ADF 2 bearing pointer(s) for display on RMI & PFD HSI
	Reduce to manoeuvring speed	
	Call for flaps 10° (or whatever)	Select flaps 10° and verify. Call "MOVING & SET"

PHASE OF FLIGHT	PF LEFT SEAT	PNF/PM RIGHT SEAT
Cleared for Approach	When heading less than 90° to approach course select APR mode ON. Note "HDG" Green and LOC" and "GS" white (armed)	
	Engage Auto-pilot and Auto-throttle (if available).	
	Call for flaps 20° (or whatever)	Select flaps 20° & verify. Call "MOVING & SET"
	Confirm localiser captured ("LOC" green)	Call "LOCALISER ALIVE "
1 dot below glide slope	Call for Gear down Verify gear down indication	Select landing gear down Check indications
	Call for full flaps	Select full flaps & verify Call "MOVING & SET"
	Call for landing checklist	Complete landing checklist Check latest RVR
Glide slope intercept	Confirm glide slope capture ("GS" green)	
		Set missed approach altitude in pre-select window
Outer Marker		Call "OUTER MARKER"
	Start stop watch	Start stop watch
		Check Altitude at OM is correct Call "GLIDE SLOPE ALTITUDE CHECKS"
	Cross check altitude & raw data	Check raw data
1000' above minimums (BARO)	Call "1000 ABOVE" Say "CONTINUE" or "GO AROUND"	Call "HEIGHT CHECKS, RVR OK" or "RVR BELOW MINIMA"
500' above minimums (BARO)	Call "500 ABOVE"	Call "HEIGHT CHECKS"
200' above minimums (RAD ALT)	Response : "CONTINUE"	Call "ALERT HEIGHT"
		PNF/MP now assumes a head up posture for acquisition of visual segment. When PNF has visual cues necessary, he will call "STROBES" "APPROACH LIGHTS " or, "RUNWAY" as appropriate If PNF does not have visual cues he remains silent
100' above minimums (RAD ALT)	Call "100 ABOVE"	Call "100 ABOVE"

PHASE OF FLIGHT	PF LEFT SEAT	PNF/PM RIGHT SEAT
Minimums (RAD ALT)	Say "LAND" or "GO AROUND" PF continues approach or executes a missed approach depending on PNF responses prior to reaching DH	Call "DECIDE"
		Call "50 ABOVE TOUCHDOWN"
		Call 30, 20, 10 (...feet on RA)
Landing	Perform Autoland Below Cat 2 AOM, autoland is mandatory	Monitor localizer & glide slope, airspeed & descent rate to touchdown
	Carry out normal PF drills after landing roll-out procedure ended	Carry out normal PNF drills after landing roll-out procedure ended
	Disconnect Autopilot and also the Autothrottle	
END		

Note 1: Below 500 feet RA, in the event of an autopilot and/or other warnings, an immediate manual go around will be flown for

- a. An autopilot RED light.
- b. An autopilot wailer.
- c. A Central Indication Warning System (CIWS) red light.
- d. Any ILS Deviation Light (Steady).
(If tracking error is more than 1 dot on glideslope or ¼ dot on localiser.
- e. An engine failure (unless aircraft is cleared to autoland asymmetrically).

Note 2: Below 200 feet Alert Height, continue to touchdown provided that the autopilots remain engaged. Otherwise carry out an automatic go-around using the autothrottle go-around mode selected by way of palm switches, or fly a very positive (almost 'aggressive') go-around nose-up attitude, to achieve an immediate climb using manually applied maximum permissible power.

END OF SECTION 2

SECTION 3 - POST FLIGHT

3.1 ON COMPLETION OF THE FLIGHT

3.1.1 Technical Log Entry

All faults and deficiencies noted during the sector will be entered in the technical log in the normal manner at the end of each Sector flown, as per Aircrew Orders; with particular emphasis on faults that may affect the autoland capability of the aircraft on the next sector, should AWO conditions still prevail at departure and an autoland be also necessary at the next destination. A sector is defined as from engines started to engines shut down, after taxiing out and flight to destination or return to the stand without taking-off, for whatever the reason. A sample autoland report form is illustrated at 3.1.5 and an example of a personal Autoland record card is offered in 3.1.6 (a) & (b).

3.1.2 Personal record of Autoland and Autoland Reporting

Some Companies issue a formal autoland qualification certificate authorising the holder to operate in Category 2 and/or 3 minima conditions. This authorisation may be in the form of an appropriate certificate incorporating a log to record autolandings, which may be similar to the example given in 3.1.6 in Section 3 of this PART 3. Subject to the test being satisfactory, such a certificate permitting Cat 2 and Cat 3 operations remains current between OPCs and LIFUs,

Apart from an entry in the personal flying log-book 'Remarks' column, holders of such a document will need to enter every Autoland carried-out as part of the operating crew, in their personal Autoland certificate/log record card issued to each crew member after completion of AWOPS training during a conversion course. This record is necessary after each autoland to establish acceptable Company 'Recency' between recurrent OPCs and LIFUS refresher training & revalidation periods.

An *Autoland Report* form (see below) must also be completed by the Captain every time an auto-approach (with or without autoland) is flown and also after any unsuccessful auto-approach leading to a diversion.

3.1.3 Auto-approach & Autoland Report Forms

Auto-approach and autoland record forms (see 3.1.5 below) are best produced in sets of 3 colour-coded sheets (1 original + 2 copies), per "Page", for ease of recognition and distribution. Each copy of the triplicate form should be printed on a differently coloured paper, say White, Pale Green and Pale Yellow; and the sheaf bound in pads of 50 forms (that, is 150 sheets of 50 forms x 3 copies per pad); with each form separately numbered. The first two sheets should have a self-impregnated 'carbon' backing for ease of reproducing in black, the original entries from sheet 1 on to the other two copies. Paper colours are chosen for ease of reading the copies of handwritten entries on sheet 1. Each triplicate report form must carry the same sequential pre-printed 'page' to ensure that the record history continuity can be checked and a chronological record kept.

Alternatively, "pages" will have a blank page-number box to allow the Captain who completes the report as aircraft commander, to number the page sequentially

3.1.4 Distribution of Autoland Reports.

The first report original top-copy (White) must be removed by the Captain and returned to the Fleet Technical manager via the ship's papers box, for his information and the fleet office records. Both the yellow and green copies of the completed autoland report are then left in the autoland record pad in the aircraft library, with the Technical Log (sector unserviceabilities and remedial engineering action) and the Sector Refuelling log, where the fuel record is not incorporated on Technical log pages. On return to Main Base, the Pale Green report copy is removed by "Engineering", for engineering/maintenance records and the pale Yellow report copy is left in the pad for the attention of crews to consult, when they check the aircraft's autoland history before flight.

3.1.6 (a) Autolandings Authorisation & Autoland Record Card - Side 1 (Pages 1 & 4)
 With 'Initial AWOPS Authority on Page 1 & Revalidations Record on Page 2

Although there is no EASA requirement for such a record, some companies require the issue an Autolanding authorisation and record log (as offered in this 3.1.6 & 3.1.6a 4-page example) on completion of an aircraft type-conversion training course incorporating an autolanding element core.

Record of completed autolands							ALL WEATHER OPERATIONS CERTIFICATE
Date	A/C reg.	Airport	R/W	PF PNF	CAT 1, 2, 3a/b	Captain's Signature	ZOOM AIRWAYS AIRBUS A320

Page4

Page1

Side 1



Fold over down the middle for ease of placing in Licence or passport

SECTION 4 - AUTOLAND AND ALL WEATHER OPERATIONS REQUIREMENTS SUMMARY

4.1 APPLICATION SUBMISSION PROCEDURE FOR AWOPS

(See Appendix B 'Submission' for a checklist of required actions)

Operators seeking Regulatory Authority agreement to conduct Cat 2 and/or Cat 3 operations are required to make a General Submission accordingly, to their NAA Directorate of Civil Aviation, on the special application form provided. EASA is the relevant European Community NAA and the UK CAA is the AWOPS gateway for G-registered aircraft and British AOC holders for such a Submission.

In accordance with International agreement, (in this case, the UK CAA as the NAA representing EASA) would issue when satisfied, a certificate of AWOPS competence acceptable to other ICAO member-States.

4.1.1 Applicants new to Category 2 or 3 Operations

Before operators commence using the AWOPS Low visibility take-offs and autoland procedures, the certifying NAA will need to be satisfied that the operator is adequately prepared. This will require an assessment of the following matters:

- a. Aircraft certification and equipment
- b. Maintenance procedures
- c. Demonstration of achievement of required accuracy
- d. Internal reporting system of results of autolands
- e. Crew training and procedures
- f. Qualification, recency and standards of aircraft and crews
- g. *Operations Manual* material
- h. Aerodrome and runway evaluation
- i. Environmental limits
- j. Introduction of additional aircraft to fleet.

- 4.1.1 A proving process is necessary for a new operator that applies to conduct Cat 2 & Cat 3 operations. After 6 months of successful Category 1 (DH 200 ft/RVR 550m) operations on the aircraft type, the company would then have to demonstrate competence to conduct CAT 2 & 3 operations by a proving process, to demonstrate compliance with the requirements, both operational and maintenance, prior to being given a variation to their AOC to include Cat 2 & 3.

The AWOPS working-up programme might then continue as now follows.

After completing a further six months of Cat 2 operations, (DH 200 feet (60m) but not lower than 100 feet and a Runway Visual Range of not less than 300 metres), and Cat 3a (DH lower than 100 feet (30m) and a Runway Visual Range of not less than 200 metres) approaches and landings, the operator may be approved for Cat 3b operations (DH Decision Height lower than 50 feet (15m) or no decision height and a Runway Visual Range of less than 200 metres but not less than 75 metres). For Cat 3b no DH (wheels on ground) operations, the Authority might impose higher RVR minima than the lowest applicable against 'No DH' operations for a period of time, before issuing an unrestricted AWOPS authority for the fleet.

4.1.2 Applicants experienced in Category 2 & 3 Operations

Applicants experienced in Cat 2 and 3 operations who are introducing a new type of aircraft to LVO, may make an initial application to operate that aircraft to Cat 3a minima of 50ft and 250m RVR; subject to the approval of the NAA.

Following a period of six months operating to Cat 3a minima of 50ft and 250m RVR, such an operator would apply to operate to Cat 3a minima of 50ft/200m RVR, though it must be noted that not all aircraft are suitable for operations below 250m RVR. Finally, if applicable, application can be made to operate to Cat 3b minima.

4.1.3 Regulatory Requirements to be satisfied

The following information indicates the nature of the aircraft's State of Registry NAA requirements for Category 2, 3a and 3b operations and for take-off in very low visibilities.

When planning such operations, aircraft owners and air transport operators (AOC holders) intending to operate down to Category 2 or 3 Aerodrome Operating Minima (AOMs), are advised to consult at an early stage the NAA of the State issuing the AOC and also of the State of the operated aircraft(s)' Registry if applicable. The relevant NAA will establish what needs to be satisfied before permission is given to carry out operations in less than Cat 1 Aerodrome Operating Minima conditions within the Company's home base NAA airspace and elsewhere.

Operators seeking formal agreement for Cat 2 and/or Cat 3 operations must file a General Submission accompanied by specific proposed minima for particular runways; in accordance with Requirements that are laid down in Part 2 of this Document

In reiteration, Permission for AWOPS must be granted by the State NAA issuing the AOC and also by the NAA of the aircraft Registry if applicable; for operations with the aircraft type to be used in specified conditions below Cat 1 AOM. It is also necessary for the operator to seek additional permissions for AWOPS from the Regulatory Authority of each State to and from where such operations are intended. However,

Foreign operators no longer require CAA approval to conduct All Weather Operations in the UK, but they must be formally authorised for AWOPS beforehand, by the NAA of AOC issue and by the State of Registry, as applicable.

Requirements for AWOPS and the training scales described in this Part should satisfy State NAAs. Nonetheless, the Regulatory Authority involved with an AWOPS application may be more or less restrictive in certain respects and might, for example, vary the necessary training that is indicated.

When applying to other Regulatory Authorities for clearance to operate to and from their State, operators will seek permission:

- a. to operate generally to Category 2 AOM within the destination Authority's airspace; then
- b. for Category 3a or 3b operations (on a runway by runway basis), at suitably equipped airports within that Authority's airspace; or
- c. for both (a) and (b) above.

4.1.4 Safety Levels

The operational aim is that low minima landings should not increase the overall risk of a fatal accident in public transport operations. The risk referred to is estimated to be 1.3×10^{-6} (that is 1.3x1 million).

4.1.5 NAA Acceptance Criteria

Acceptance of a proposed Category 2 or 3 operations will depend upon whether the following criteria are met:

- a. the aeroplane has suitable flight characteristics and equipment;
- b. the aeroplane will be operated by a qualified crew in conformity with laid down procedures;
- c. the aerodrome is suitably equipped and maintained;
- d. It can be shown that the required safety level can be maintained.

4.1.6 Applicability

The criteria given in the preceding paragraph and detailed elsewhere in this document, apply to the airline's home base aerodrome(s) and to aeroplanes registered by other NAAs that are flying thereto for any purpose. These criteria also apply to operations by foreign registered aeroplanes engaged in International Commercial Air Transport to that NAA's airports, if their State of Registry has no promulgated equivalent requirements. Operators of aeroplanes used for other than Public Transport and who wish to become involved in Category 2 and/or 3 operations, are required to meet the listed criteria in full.

4.1.7 AWO Requirements to be established

The operator will establish from current legislation:

- a. The minimum overall flying experience that will be required for captains and first officers to carry out Cat 2 and Cat 3 landings
- b. The take-off and landings 'recency' requirements for the crews and how to regain lost 'recency'
- c. The competency exercises to be covered in simulator recurrent training
- d. The operational restrictions that are to be placed on low-visibility landings. Generally accepted limitations include:
 - i. The runway must be approved for autoland
 - ii. The availability of high intensity approach lighting
 - iii. Braking action not reported as worse than "medium"
 - iv. Wind components lower than approved for autoland in Cat 1 or better conditions
 - v. The number of zone RVR reports required:
 - vi. For RVRs of less than 200 metres in ANY zone, all three zones (**touchdown, mid and end**) are required;
 - vii. However, for RVRs not less than 200 metres, then only two zones, **touchdown and mid** or **touchdown and end**, are required.

Note: Initial operator approval for low visibility landings will be to Cat 2 limits only for a sufficient time to evaluate the performance of the aircraft and crews, prior to approving lower Cat 3 limits.

4.2 OPERATOR REQUIREMENTS IN PREPARATION FOR AWOPS

Any operator wishing to conduct autoland procedures whether for low visibility operations (LVO) or on Normal Operations, will require approval by way of a Safety Operational Clearance in accordance with the NAA specifications for AWOPS based on ICAO Doc.9365-AN/910 *Manual of All Weather Operations* and on EASA EU-OPS 1 – Sub Part E for European Community operators.

An initial AWOPS submission checklist that covers the necessary matters that need addressing before Low Visibility Operations are authorised by the relevant NAA, may be found in Appendix B.

From a philosophical perspective, the change in emphasis and requirements for AWO has been in step with the autoland being an integral part of modern aircraft design. If the aircraft is approved for autoland, the maintenance programme and crew training are satisfactory, then, once the proving has been complete in accordance with App 1 to OPS 1.440, Cat 2 & 3 operations are just part of normal operations with some additional data collection and analysis so as to monitor continued autoland performance.

4.2.1 LOW VISIBILITY OPERATIONS - GENERAL OPERATING RULES – Appendix 1 to OPS 1.440

- (a) **General.** The following procedures apply to the introduction and approval of low visibility operations.
- (b) **Operational demonstration.** The purpose of the operational demonstration is to determine or validate the use and effectiveness of the applicable aircraft flight guidance systems, including HUDLS if appropriate, training, flight crew procedures, maintenance programme, and manuals applicable to the Category II/III programme being approved.
1. At least 30 approaches and landings must be accomplished in operations using the Category II/III systems installed in each aircraft type if the requested DH is 50 ft or higher. If the DH is less than 50 ft, at least 100 approaches and landings will need to be **accomplished, unless** otherwise approved by the Authority.
 2. If an operator has different variants of the same type of aircraft utilising the same basic flight control and display systems, or different basic flight control and display systems on the same type of aircraft, the operator must show that the various variants have satisfactory performance, but the operator need not conduct a full operational demonstration for each variant. The Authority may also accept a reduction of the number of approach and **landings, based** on credit given for the experience gained by another operator with an AOC issued in accordance with OPS 1 and using the same aeroplane type or variant and procedures.
 3. If the number of unsuccessful approaches exceeds 5% of the **total, (e.g. unsatisfactory landings, system disconnects)** the evaluation programme must be extended in steps of at least 10 approaches and landings until the overall failure rate does not exceed 5%.
- (c) **Data collection for operational demonstrations.** Each applicant must develop a data collection method (e.g. a form to be used by the flight crew) to record approach and landing performance. The resulting data and a summary of the demonstration data shall be made available to the Authority for evaluation.
- (d) **Data analysis.** Unsatisfactory approaches and/or automatic landings shall be documented and analysed.
- (e) **Continuous monitoring**
1. After obtaining the initial authorisation, the operations must be continuously monitored by the operator to detect any undesirable trends before they become hazardous. Flight crew reports may be used to achieve this.
 2. The following information must be retained for a period of 12 months:
 - (i) the total number of approaches, by aeroplane type, where the airborne Category II or III equipment was utilised to make satisfactory, actual or practice, approaches to the applicable Category II or III minima; and
 - (ii) reports of unsatisfactory approaches and/or automatic landings, by aerodrome and aeroplane registration, in the following categories:
 - (A) airborne equipment faults;
 - (B) ground facility difficulties;
 - (C) missed approaches because of ATC instructions; or
 - (D) other reasons.
 3. An operator must establish a procedure to monitor the performance of the automatic landing system or HUDLS to touchdown performance, as appropriate, of each aeroplane.
- (f) **Transitional periods**
(See EU-OPS1 and Section 4 Training, also *Appendix A 'Legislation'* of this document)
1. Operators with no previous Category II or III experience
 2. Operators with previous Category II or III experience.

(g) **Maintenance of Category II, Category III and LVTO equipment.**

(h) **Eligible aerodromes and runways**

1. Each aeroplane type/runway combination must be verified by the successful completion of at least one approach and landing in Category II or better conditions, prior to commencing Category III operations.

Note: For additional details on (a) to (f) above see EASA-OPS1 *Appendix 1 to OPS 1.440 - Low visibility operations - General operating rules.* (See Appendix A of this document)

4.2.2 Aircraft Certification and Equipment

The aircraft must be certified for autoland and the *Flight Manual* should indicate the minimum equipment that satisfies the certification requirement; for example, the number of serviceable autopilots, radio altimeters, autobrake etc. Minimum equipment requirements for the conduct of autolands must also be included in the MEL.

4.2.3 Overall Maintenance Requirements and Maintenance Procedures

The operator must have in place, the requirements and practices that are necessary for supporting Cat 2, Cat 3a and Cat 3b operations, in their NAA-approved *Aircraft Maintenance Planning Document*.

The operator must include in the *Aircraft Maintenance Planning Document* any special maintenance requirements specified by the manufacturer for autoland operations. The company must also ensure maintenance procedures and requirements required for Cat 2, Cat 3a & Cat 3b operations are complied with; as detailed in the applicable NAA approved *Aircraft Maintenance Planning Document*.

4.2.4 Demonstration of Required Touch-down Accuracy Achievement (See 4.1(b) above)

The accuracy with which the aircraft is delivered to the runway during an autoland may depend upon the physical characteristics of the runway, the ILS, wind velocity and **gradient**; or upon the maintenance system in so far as all components of the autoland system and the integrated system itself are operating within tolerance.

With the introduction of an additional aircraft to a fleet, the new aircraft may need to have successfully completed an autoland operated by the company's crew and without passengers, prior to being approved for autoland in revenue operations.

When first introducing autolandings, the operator should conduct a series of trials in VMC conditions to confirm that acceptable results are being obtained. Some landings will be made during training flights without passengers and conducted preferably by a nominated company 'development pilot'. Significant displacement either laterally or longitudinally or 'firm' landings should be investigated and the cause rectified. Trials should continue until an agreed number of consecutive 'acceptable' landings are achieved. The NAA might require a significant number of successful autolands on proving programmes for a completely new aircraft series. For example, more than 400 autolandings for the certification of the B747-400 were required when it was first introduced into Service. This may be shared experience with another operator using the same aircraft type and version, before AWOPS operations were permitted. For example, British Airways and QANTAS combined results to satisfy the joint B747-400 autoland certification programme agreed between the UK CAA and the Australian CAAC.

For pilots undergoing initial introduction to autoland, the conduct of autolands in VMC or better than Cat 1 conditions is essential in order to gain the required confidence in the system, when it is used in association with low-visibility operations.

4.2.5 Internal Reporting System (also see 4.1(c), 4.1(d) & 4.1(e))

The company should initiate a system of 'pilot reporting' where the crew fills out an appropriate form after each autoland. The forms must show the parameters for the autoland to be classified as "successful". This provides assistance in fault rectification for unsuccessful autolands and is a means of providing trend information for the maintenance system.

4.2.6 Crew Training and Procedures

Some companies may wish to restrict approval of 'operating pilot' for autolands to captains, with a further requirement that the support pilot be appropriately qualified in these procedures.

Captains and support pilots can be qualified for autoland during aircraft type conversion training.

Training should be on a simulator of at least Level 3 and an appropriate level of visual system must be available for initial and recurrent training. Training must include the handling of engine failures, ground system failures and aircraft system failures at various speeds below and above V1. The simulator should faithfully reproduce the visual segment appropriate to the low-visibility minima.

Procedures, including standard calls, should initially be those recommended by the manufacturer for the conduct of a Cat 2 or Cat 3 approach. The procedures must envisage the non-flying pilot remaining on instruments until autopilot disconnect.

4.2.7 Operations Manual Material

At least the following AWOPS topics must be addressed in the *Operations Manual*:

- a. Minima to be used for autoland
- b. ILS autoland crew procedures
- c. Aircraft environmental limits for the minima being flown
- d. A list of runways approved for autoland
- e. Nomination of 'monitoring pilot' and 'lookout pilot' (lookout when approaching minima)
- f. Limitations on conduct of autolands including Recency, nominated crew etc
- g. Action in the event of system failures
- h. Reporting and MEL requirements
- i. Approved flap positions
- j. Precautions to be taken when the ILS critical areas are not protected.

4.2.8 Aircraft Flight Manual

Any approvals must not be outside the limits of those indicated in the *Aircraft Flight Manual*.

4.3 AERODROME EVALUATION

4.3.1 Criteria applicable to 'Autoland' runways

The following conditions should normally apply in nominating a runway as suitable for autoland:

- a. Nominal glide slope between 2.5 and 3.0 degrees inclusive
- b. ILS of at least Category 1 transmission quality
- c. Offset Localiser not acceptable
- d. Glide slope Reference Datum Height (RDH) between 48 to 59 feet inclusive, with appropriate reduction in useable Landing Distance Available (LDA) if the RDH is greater than 59 feet
- e. Runway slope not to exceed 0.8% within 900 m of threshold, with additional trials conducted when the slope exceeds 0.6%
- f. The pre-threshold terrain to have no substantial discontinuities for at least 300 m before the threshold
- g. At least three successful autolands in Category 1 or better conditions conducted by the 'development pilot' (*not required where the runway has been declared suitable for Cat 2 or Cat 3 operations by a country where low-visibility operations are frequently encountered*).

4.4 LOW VISIBILITY TAKE-OFF

Take-off with visibility less than 400m visibility is normally associated with approval for Cat 2 and Cat 3 landings

Factors affecting the take-off approval include:

- a. Runway lighting
- b. Measurement of visibility
- c. Aerodrome control
- d. Operational factors.

4.4.1 Runway Lighting

A visibility of less than 300 metres requires Cat 2 or Cat 3 aerodrome movement area lighting (taxiway lights, high intensity runway edge lights and runway centreline lights).

4.4.2 Measurement of Visibility

In the absence of RVR readings and under certain conditions, visibility may be measured by the pilot.

RVR readings for the touchdown zone and the mid-point zone are normally given. If the Mid-point RVR is not available, this may preclude LVO departures and/ or arrivals unless Stop-end RVRs are available.

If any zone's visibility is less than 200 metres, then a measurement is required in all three zones. It is important to ascertain visibility at the furthest end of the runway in case of a rejected take-off.

4.5 CROSSWIND LIMITATIONS

Crosswind limitations must be considered. When visibility is reported as less than 400 metres at any point on the runway, a crosswind limit of 10 knots is acceptable.

4.6 OPERATIONAL REQUIREMENTS - Low visibility operations - Operating procedures

Appendix 1 to OPS 1.455

(a) General. Low visibility operations include:

1. Manual take-off (with or without electronic guidance systems or HUDLS/-Hybrid HUD/HUDLS);
2. Auto-coupled approach to below DH, with manual flare, landing and rollout;
3. Approach flown with the use of a HUDLS/Hybrid HUD/HUDLS and/or EVS);
4. Auto-coupled approach followed by auto-flare, auto landing and manual roll-out; and
5. Auto-coupled approach followed by auto-flare, auto landing and auto-rollout, when the applicable RVR is less than 400 m.

Note 1: A hybrid system may be used with any of these modes of operations.

Note 2: Other forms of guidance systems or displays may be certificated and approved.

(b) Procedures and operating instructions

1. The precise nature and scope of procedures and instructions given depend upon the airborne equipment used and the flight deck procedures followed. An operator must clearly define flight crew member duties during take-off, approach, flare, roll-out and missed approach in the Operations Manual. Particular emphasis must be placed on flight crew responsibilities during transition from non-visual conditions to visual conditions, and on the procedures to be used in deteriorating visibility or when failures occur. Special attention must be paid to the distribution of flight deck duties so as to ensure that the workload of the pilot making the decision to land or execute a missed approach enables him/her to devote himself/herself to supervision and the decision making process.
2. An operator must specify the detailed operating procedures and instructions in the Operations Manual. The instructions must be compatible with the limitations and mandatory procedures contained in the Aeroplane Flight Manual and cover the following items in particular:
 - (i) checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight;
 - (ii) effect on minima caused by changes in the status of the ground installations and airborne equipment;
 - (iii) procedures for the take-off, approach, flare, landing, roll-out and missed approach;
 - (iv) procedures to be followed in the event of failures, warnings to include HUD/HUDLS/EVS and other non-normal situations;
 - (v) the minimum visual reference required;
 - (vi) the importance of correct seating and eye position;
 - (vii) action which may be necessary arising from a deterioration of the visual reference;
 - (viii) allocation of crew duties in the carrying out of the procedures according to subparagraphs (i) to (iv) and (vi) above, to allow the Commander to devote himself/herself mainly to supervision and decision making;
 - (ix) the requirement for all height calls below 200 ft to be based on the radio altimeter and for one pilot to continue to monitor the aeroplane instruments until the landing is completed;
 - (x) the requirement for the Localiser Sensitive Area to be protected;
 - (xi) the use of information relating to wind velocity, wind shear, turbulence, runway contamination and use of multiple RVR assessments;
 - (xii) procedures to be used for:
 - (A) lower than Standard Category I;
 - (B) other than Standard Category II;
 - (C) approaches utilising EVS; and
 - (D) practice approaches and landing on runways at which the full Category II or Category III aerodrome procedures are not in force;
 - (xiii) operating limitations resulting from airworthiness certification; and
 - (xiv) information on the maximum deviation allowed from the ILS glide path and/or localiser.

END OF SECTION 4

SECTION 5 - AWOPS CREW TRAINING & REGENCY

5.1 CREW TRAINING & PROCEDURES

5.1.1 Low-visibility Landing Category 2 and Category 3 landing operations.

Landing in Category 2 and Category 3 meteorological conditions requires various NAAs' approvals, including:

- The NAA of Aircraft registration; if different to
- The Airline's AOC Supervisory Authority; and
- The State NAAs where AWOPS are intended outside the European Community (EC).

An operator wishing to gain approval for AWO must satisfy the NAA of compliance with ICAO Doc. 9365-AN/910 *Manual of All Weather Operations* and with the relevant EASA EU-OPS 1 Subpart E, *Appendix 1 to OPS 1.450* requirements and Subpart N - Flight Crew. (See this document's Appendix A - 'Legislation' for the full EASA Subpart E AWOPS requirements and Subpart N for 'general' recurrent revalidation procedures which include autoland revalidation). For the full text, it is necessary to refer to a current copy of EASA OPS 1.

The training, checking and recency requirements have been rationalised and have become less onerous than before JAR-OPS and EASA regulations were introduced.

The training and checking for Cat 2 & Cat 3 is now focused on the conversion course. When the simulator used for the training is ZFT approved, effectively either a Level C or D and the training is part of a ZFT course, then there is no requirement for autolands using Cat 2 & 3 procedures in better than Cat 1 conditions.

There is only a restriction for new captains to the aircraft type. This restriction may be reduced or removed with the agreement of the authority, as is often the case, when the commander has previous Cat 2 & 3 experience, i.e. after a change of aircraft type.

The restriction of 50 hours or 20 sectors before a pilot may carry out Cat 2 & 3 approaches and landings is often fully covered by the LIFUS element of the conversion course, when during LIFUS the crew may operate to normal Cat 2 & 3 minima since there is a training captain acting as commander.

The philosophy for Cat 2 & 3 has now moved such that it is considered a normal part of an aircraft's operation and needs no more restrictive training/checking/recency requirements than any other element of the aircraft's operation. Recency for Cat 2 & 3 is covered by the recurrent training that is carried out as part of the OPC.

There is no requirement for an operator to issue an AWOPS recency certificate, although many still do. Normally this is dealt with by conducting three approaches during an OPC; this may be reduced though to two approaches (one to a landing in the minimum authorised visibility and one to a Go Around) if both pilots have conducted at least one CAT 2/3 approach in the aircraft since the last OPC. The requirement is satisfied by 2 in the simulator plus 1 in the a/c, or 3 in the simulator.

An ongoing recency restriction is for take-off and landing. This requires that at least three take-offs and three landings are carried out in the previous 90 days. The 90-day period prescribed may be extended up to a maximum of 120 days by line flying under the supervision of a type rating instructor or examiner. For periods beyond 120 days, the recency requirement is satisfied by a training flight or use of a flight simulator of the aeroplane type to be used. A take-off and a landing in the previous 28 days may also be required by the operator.

5.1.2 APPENDIX 1 to OPS 1.450 - Low Visibility Operations — Training & Qualifications

Prior to being approved for Cat 2 and Cat 3 landings, the operator must have in place a comprehensive training program covering ground training, simulator training, aircraft training and also a means of calculating the Cat 2 minima radio altimeter readings for each runway. The RVR will depend on the visual segment display the operator requires to be in sight when at 'minimums'.

(a) General

An operator must ensure that flight crew member training programmes for low visibility operations include structured courses of ground, flight simulator and/or flight training. The operator may abbreviate the course content as prescribed by subparagraphs 2 and 3 below provided the content of the abbreviated course is acceptable to the authority.

1. Flight crew members with no Category II or Category III experience must complete the full training programme prescribed in subparagraphs (b), (c) and (d) below.
2. Flight crew members with Category II or Category III experience with a similar type of operation (auto-coupled/auto-land, HUDLS/Hybrid HUDLS or EVS) or Category II with manual land if appropriate with another Community operator may undertake an:
 - (i) abbreviated ground training course if operating a different type/class from that on which the previous Category II or Category III experience was gained;

- (ii) abbreviated ground, flight simulator and/or flight training course if operating the same type/class and variant of the same type or class on which the previous Category II or Category III experience was gained. The abbreviated course is to include at least the requirements of subparagraphs (d)1, (d)2(i) or (d)2(ii) as appropriate and (d)3(i). With the approval of the Authority, the operator may reduce the number of approaches/landings required by subparagraph (d)2(i) if the type/class or the variant of the type or class has the same or similar:
 - (A) level of technology — flight control/guidance system (FGS); and
 - (B) operational procedures;
 - (C) handling characteristics (See paragraph 4 below); as the previously operated type or class, otherwise the requirement of (d)2(i) has to be met in full;
 - (D) use of HUDLS/hybrid HUDLS;
 - (E) use of EVS.
- 3. Flight crew members with Category II or Category III experience with the operator may undertake an abbreviated ground, Flight simulator and/or flight training course. The abbreviated course when changing:
 - (i) aeroplane type/class is to include at least the requirements of subparagraphs (d)1, (d)2(i) or (d)2(ii) as appropriate and (d)3(i);
 - (ii) to a different variant of aeroplane within the same type or class rating that has the same or similar:
 - (A) level of technology — flight control/guidance system (FGS); and
 - (B) operational procedures — integrity;
 - (C) handling characteristics (See paragraph 4 below);
 - (D) use of HUDLS/Hybrid HUDLS;
 - (E) use of EVSas the previously operated type or class, then a difference course or familiarisation appropriate to the change of variant fulfils the abbreviated course requirements;
 - (iii) to a different variant of aeroplane within the same type or class rating that has a significantly different:
 - (A) level of technology — flight control/guidance system (FGS); and
 - (B) operational procedures — integrity;
 - (C) handling characteristics (See paragraph 4 below);
 - (D) use of HUDLS/Hybrid HUDLS;
 - (E) use of EVSthen the requirements of subparagraphs (d)1, (d)2(i) or (d)2(ii) as appropriate and (d)3(i) shall be fulfilled. With the approval of the Authority the operator may reduce the number of approaches/landings required by subparagraph (d)2(i).
- 4. An operator must ensure when undertaking Category II or Category III operations with different variant(s) of aeroplane within the same type or class rating that the differences and/or similarities of the aeroplanes concerned justify such operations, taking account at least the following:
 - (i) the level of technology, including the:
 - (A) FGS and associated displays and controls;
 - (B) the Flight Management System and its integration or not with the FGS;
 - (C) use of HUD/HUDLS with hybrid systems and/or EVS;
 - (ii) operational procedures, including:
 - (A) fail-passive/fail-operational, alert height;
 - (B) manual landing/automatic landing;
 - (C) no decision height operations;
 - (D) use of HUD/HUDLS with hybrid systems;
 - (iii) handling characteristics, including:
 - (A) manual landing from automatic HUDLS and/or EVS guided approach;
 - (B) manual go-around from automatic approach;
 - (C) automatic/manual roll out.

(b) Ground Training

An operator must ensure that the initial ground training course for Low Visibility Operations covers at least:
Literature for distribution should be provided at the ground training school, covering at least

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 to include HUD symbology and EVS characteristics if appropriate;
5. The effects of precipitation, ice accretion, low level wind shear and turbulence;
6. The effect of specific aeroplane/system malfunctions;
7. The use and limitations of RVR assessment systems;
8. The principles of obstacle clearance requirements;
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 400 m or less and any additional procedures required for take-off in conditions below 150 m (200 m for Category D aeroplanes);
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 systems;
12. The importance and significance of alert height if applicable and the action in the event of any failure above and below the alert height;
13. The qualification requirements for pilots to obtain and retain approval to conduct low visibility take-offs and Category II or III operations; and
14. The importance of correct seating and eye position.
15. General AWOPS concepts and appropriate definitions
16. The nature of weather that may cause low visibility
17. Aerodrome procedures, Radio-Aids, Ground Markings, Cat 2 and Cat 3 lighting systems and the meaning of "Approach bans"
18. Factors affecting the determination of minima
19. Reversionary minima
20. An understanding of aircraft maintenance requirements and serviceability
21. Aircraft performance limitations
22. Normal operating procedures
23. Non-normal procedures for handling pilot incapacitation, engine and system failures below 1000 feet, Alert Height (AH) and Decision Height (DH).

(c) Flight Simulator Training and /or Flight Training

(Training on the simulator, should be conducted in both day and night environments (when the simulator supports this) at high weights and to the maximum crosswind limit for which approval is sought).

1. An operator must ensure that flight simulator and/or flight training for low visibility operations includes:
 - (i) checks of satisfactory functioning of equipment, both on the ground and in flight;
 - (ii) effect on minima caused by changes in the status of ground installations;
 - (iii) monitoring of:
 - (A) automatic flight control systems and auto land status annunciators with emphasis on the action to be taken in the event of failures of such systems; and
 - (B) HUD/HUDLS/EVS guidance status and annunciators as appropriate, to include head down displays;
 - (iv) actions to be taken in the event of failures such as engines, electrical systems, hydraulics or flight control systems;
 - (v) the effect of known unserviceabilities and use of minimum equipment lists;
 - (vi) operating limitations resulting from airworthiness certification;
 - (vii) guidance on the visual cues required at decision height together with information on maximum deviation allowed from glide path or localiser; and
 - (viii) the importance and significance of alert height if applicable and the action in the event of any failure above and below the alert height.
 - (ix) Low visibility taxiing;
 - (x) Minimum visibility take-offs in normal operations, with engine and system failures before and after V1, and loss of visibility at varying speeds;
2. An operator must ensure that each flight crew member is trained to carry out his/her duties and instructed on the coordination required with other crew members. Maximum use should be made of flight simulators.
3. Training must be divided into phases covering normal operation with no aeroplane or equipment failures but including all weather conditions which may be encountered and detailed scenarios of aeroplane and equipment failure which could affect Category II or III operations. If the aeroplane system involves the use of hybrid or other special systems (such as HUD/HUDLS or enhanced vision

equipment) then flight crew members must practise the use of these systems in normal and abnormal modes during the flight simulator phase of training.

4. Incapacitation procedures appropriate to low visibility take-offs and Category II and III operations shall be practised, including pilot incapacitation at different altitudes during the approach.
 5. For aeroplanes with no flight simulator available to represent that specific aeroplane, operators must ensure that the flight training phase specific to the visual scenarios of Category II operations is conducted in a specifically approved flight simulator. Such training must include a minimum of four approaches. The training and procedures that are type specific shall be practised in the aeroplane.
 6. Aircraft training must cover the number of autolands each captain and first officer must perform in Cat 1 or better conditions on that aircraft type, using low visibility procedures. Initial Category II and III training shall include at least the following exercises:
 - (i) approach using the appropriate flight guidance, autopilots and control systems installed in the aeroplane, to the appropriate decision height and to include transition to visual flight and landing;
 - (ii) approach with all engines operating using the appropriate flight guidance systems, autopilots, HUDLS and/or EVS and control systems installed in the aeroplane down to the appropriate decision height followed by missed approach; all without external visual reference;
 - (iii) where appropriate, approaches utilising automatic flight systems to provide automatic flare, landing and roll-out; and
 - (iv) normal operation of the applicable system both with and without acquisition of visual cues at decision height.
 7. Subsequent phases of training must include at least:
 - (i) approaches with engine failure at various stages on the approach;
 - (ii) approaches with critical equipment failures (e.g. electrical systems, auto flight systems, ground and/or airborne ILS/MLS systems and status monitors);
 - (iii) approaches where failures of auto flight equipment and/or HUD/HUDLS/EVS at low level require either:
 - (A) reversion to manual flight to control flare, landing and roll out or missed approach; or
 - (B) reversion to manual flight or a downgraded automatic mode to control missed approaches from, at or below decision height including those which may result in a touchdown on the runway;
 - (iv) failures of the systems which will result in excessive localiser and/or glide slope deviation, both above and below decision height, in the minimum visual conditions authorised for the operation. In addition, a continuation to a manual landing must be practised if a head-up display forms a downgraded mode of the automatic system, or the head-up display forms the only flare mode; and (v) failures and procedures specific to aeroplane type or variant.
 8. The training programme must provide practice in handling faults which require a reversion to higher minima.
 9. The training programme must include the handling of the aeroplane when, during a fail passive Category 3 approach, the fault causes the autopilot to disconnect at or below decision height when the last reported RVR is 300 m or less.
 10. Where take-offs are conducted in RVRs of 400 m and below, training must be established to cover systems failures and engine failure resulting in continued as well as rejected take-offs.
 11. The training programme must include, where appropriate, approaches where failures of the HUDLS and/or EVS equipment at low level require either:
 - (i) reversion to head down displays to control missed approach; or
 - (ii) reversion to flight with no, or downgraded, HUDLS Guidance to control missed approaches from decision height or below, including those which may result in a touchdown on the runway.
 12. An operator shall ensure that when undertaking low visibility take-off, lower than Standard Category I, other than Standard Category II, and Category II and III Operations utilising a HUD/HUDLS or hybrid HUD/HUDLS or an EVS, that the training and checking programme includes, where appropriate, the use of the HUD/HUDLS in normal operations during all phases of flight.
- (d) **Conversion training requirements to conduct low visibility take-off, lower than Standard Category I, other than Standard Category II, approach utilising EVS and Category II and III Operations.**

An operator shall ensure that each flight crew member completes the following low visibility procedures training if converting to a new type/class or variant of aeroplane in which low visibility take-off, lower than Standard Category I, Other than Standard Category II, Approach utilising EVS with an RVR of 800m or less and Category II and III Operations will be conducted. The flight crew member experience requirements to undertake an abbreviated course are prescribed in subparagraphs (a) 2, (a) 3, and (a) 4, above:

1. Ground Training. The appropriate requirements prescribed in subparagraph (b) above, taking into account the flight crew member's Category II and Category III training and experience.
2. Flight simulator training and/or flight training.

- (i) A minimum of six (eight for HUDLS with or without EVS) approaches and/or landings in a flight simulator. The requirements for eight HUDLS approaches may be reduced to six when conducting Hybrid HUDLS operations. See subparagraph 4(i) below.
 - (ii) Where no Flight simulator is available to represent that specific aeroplane, a minimum of three (five for HUDLS and/or EVS) approaches including at least one go-around is required on the aeroplane. For Hybrid HUDLS operations a minimum of three approaches are required, including at least one go-around.
 - (iii) Appropriate additional training if any special equipment is required such as head-up displays or enhanced vision equipment. When approach operations utilising EVS are conducted with an RVR of less than 800m, a minimum of five approaches, including at least one go-around are required on the aeroplane.
3. Flight crew qualification. The flight crew qualification requirements **are specific** to the operator and the type of aeroplane operated.
- (i) The operator must ensure that each flight crew member completes a check before conducting Category II or III operations.
 - (ii) The check prescribed in subparagraph (i) above may be replaced by successful completion of the flight simulator and/or flight training prescribed in subparagraph (d) 2 above.
4. Line flying under supervision. An operator must ensure that each flight crew member undergoes the following line flying under supervision (LIFUS):
- (i) for Category II when a manual landing or a HUDLS approach to touchdown is required, a minimum of:
 - (A) three landings from autopilot disconnect;
 - (B) four landings with HUDLS used to touchdown;except that only one manual landing (two using HUDLS to touchdown) is required when the training required in subparagraph (d)2 above has been carried out in a flight simulator qualified for zero flight time conversion.
 - (ii) For Category III, a minimum of two auto lands except that:
 - (A) only 1 autoland is required when the training required in subparagraph (d)2. above has been carried out in a flight simulator qualified for zero flight time conversion;
 - (B) no autoland is required during LIFUS when the training required in subparagraph (d)2 above has been carried out in a flight simulator qualified for zero flight time (ZFT) conversion and the flight crew member successfully completed the ZFT type rating conversion course;
 - (C) the flight crew member, trained and qualified in accordance with paragraph (B) above, is qualified to operate during the conduct of LIFUS to the lowest approved DA(H) and RVR as stipulated in the Operations Manual.
 - (iii) For Category III approaches using HUDLS to touchdown a minimum of four approaches.

(e) Type and command experience

1. Before commencing Category II operations, the following additional requirements are applicable to commanders, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type/class:
 - (i) 50 hours or 20 sectors on the type, including line flying under supervision; and
 - (ii) 100 m must be added to the applicable Category II RVR minima when the operation requires a Category II manual landing or use of HUDLS to touchdown until:
 - (A) a total of 100 hours or 40 sectors, including LIFUS has been achieved on the type; or
 - (B) a total of 50 hours or 20 sectors, including LIFUS has been achieved on the type where the flight crew member has been previously qualified for Category II manual landing operations with a Community operator;
 - (C) for HUDLS operations the sector requirements in paragraphs (e)1 and (e) 2 (i) shall always be applicable, the hours on type/class does not fulfil the requirement.
2. Before commencing Category III operations, the following additional requirements are applicable to commanders, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type:
 - (i) 50 hours or 20 sectors on the type, including line flying under supervision; and
 - (ii) 100 m must be added to the applicable Category II or Category III RVR minima unless he has previously qualified for Category II or III operations with a Community operator, until a total of 100 hours or 40 sectors, including line flying under supervision, has been achieved on the type.
3. The Authority may authorise a reduction in the above command experience requirements for flight crew members who have Category II or Category III command experience.

(f) Low visibility take-off with RVR less than 150/200 m

1. An operator must ensure that prior to authorisation to conduct take-offs in RVRs below 150 m (below 200 m for Category D aeroplanes) the following training is carried out:
 - (i) normal take-off in minimum authorised RVR conditions;
 - (ii) take-off in minimum authorised RVR conditions with an engine failure between V1 and V2, or as soon as safety considerations permit; and
 - (iii) take-off in minimum authorised RVR conditions with an engine failure before V1 resulting in a rejected take-off.
2. An operator must ensure that the training required by subparagraph 1 above is carried out in a flight simulator. This training must include the use of any special procedures and equipment. Where no flight simulator is available to represent that specific aeroplane, the Authority may approve such training in an aeroplane without the requirement for minimum RVR conditions (See Appendix 1 to OPS 1.965).
3. An operator must ensure that a flight crew member has completed a check before conducting low visibility take-offs in RVRs of less than 150 m (less than 200 m for Category D aeroplanes) if applicable. The check may only be replaced by successful completion of the flight simulator and/or flight training prescribed in subparagraph (f) 1 on conversion to an aeroplane type.

(g) Recurrent training and checking — Low visibility operations

1. An operator must ensure that, in conjunction with the normal recurrent training and operator proficiency checks, a pilot's knowledge and ability to perform the tasks associated with the particular category of operation, for which he/she is authorised is checked. The required number of approaches to be undertaken in the flight simulator within the validity period of the operators proficiency check (as prescribed in OPS 1.965 (b)) is to be a minimum of two, (four when HUDLS and/or EVS is utilised to touchdown) one of which must be a landing at the lowest approved RVR; in addition one (two for HUDLS and/or operations utilising EVS) of these approaches may be substituted by an approach and landing in the aeroplane using approved Category II and III procedures. One missed approach shall be flown during the conduct of the operators proficiency check. If the operator is authorised to conduct take-off with RVR less than 150/200 m at least one LVTO to the lowest applicable minima shall be flown during the conduct of the operators proficiency check.
2. For Category III operations an operator must use a flight simulator.
3. An operator must ensure that, for Category III operations on aeroplanes with a fail passive flight control system, including HUDLS, a missed approach is completed at least once over the period of three consecutive operator proficiency checks as the result of an autopilot failure at or below decision height when the last reported RVR was 300 m or less.
4. The Authority may authorise recurrent training and checking for Category II and LVTO operations in an aeroplane type where no flight simulator to represent that specific aeroplane or an acceptable alternate is available.

Note: Recency for LTVO and Category II/III based upon automatic approaches and/or auto-lands is maintained by the recurrent training and checking as prescribed in this paragraph.

(h) Additional training requirements for operators conducting lower than Standard Category I, approaches utilising EVS and other than Standard Category II Operations.

1. Operators conducting lower than Standard Category I operations shall comply with the requirements of Appendix 1 to OPS 1.450 — low visibility operations — training and qualifications applicable to Category II operations, to include the requirements applicable to HUDLS (if appropriate). The operator may combine these additional requirements where appropriate, provided that the operational procedures are compatible. During conversion training the total number of approaches required shall not be additional to the requirements of OPS Subpart N provided the training is conducted utilising the lowest applicable RVR. **During recurrent training and checking the operator may also combine the separate requirements, provided the above operational procedure requirement is met; also provided that at least one approach using lower than Standard Category I minima is conducted at least once every 18 months.**
2. Operators conducting other than Standard Category II operations shall comply with the requirements of Appendix 1 to OPS 1.450 — low visibility operations — training and qualifications applicable to Category II operations to include the requirements applicable to HUDLS (if appropriate). The operator may combine these additional requirements where appropriate, provided that the operational procedures are compatible. During conversion training the total number of approaches required shall not be less than that required to complete Category II training utilising HUD/ HUDLS. During recurrent training and checking the operator may also combine the separate requirements, provided the above operational procedure requirement is met, provided that at least one approach using other than Standard Category II minima is conducted at least once every 18 months.
3. Operators conducting approach operations utilising EVS with RVR of 800 m or less shall comply with the requirements of Appendix 1 to OPS 1.450 — Low Visibility Operations — Training and Qualifications applicable to Category II operations, to include the requirements applicable to HUD (if appropriate). The operator may combine these additional requirements where appropriate, provided that the operational procedures are compatible. During conversion training the total number of

approaches required shall not be less than that required to complete Category II training utilising a HUD. **During recurrent training and checking the operator may also combine the separate requirements provided the above operational procedure requirement is met, provided that at least one approach utilising EVS is conducted at least once every 12 months.**

5.2 EU-OPS 1 Subpart N - FLIGHT CREW - OPS 1.965 Recurrent Training and Checking

(See Appendices 1 and 2 to OPS 1.965)

(a) General. An operator shall ensure that

1. Each flight crew member undergoes recurrent training and checking and that all such training and checking is relevant to the type or variant of aeroplane on which the flight crew member operates;
2. a recurrent training and checking programme is established in the Operations Manual and approved by the Authority;
3. recurrent training is conducted by the following personnel:
 - (i) ground and refresher training — by suitably qualified personnel;
 - (ii) aeroplane/STD training — by a type rating instructor (TRI), class rating instructor (CRI) or in the case of the STD content, a synthetic flight instructor (SFI), providing that the TRI, CRI or SFI satisfies the operator's experience and knowledge requirements sufficient to instruct on the items specified in paragraphs (a)1.(i)(A) and (B) of Appendix 1 to OPS 1.965;
 - (iii) emergency and safety equipment training — by suitably qualified personnel; and
 - (iv) crew resource management (CRM):
 - (A) integration of CRM elements into all the phases of the recurrent training — by all the personnel conducting recurrent training. The operator shall ensure that all personnel conducting recurrent training are suitably qualified to integrate elements of CRM into this training;
 - (B) modular CRM training — by at least one CRM trainer acceptable to the Authority who may be assisted by experts in order to address specific areas;
4. recurrent checking is conducted by the following personnel:
 - (i) operator proficiency checks — by a type rating examiner (TRE), class rating examiner (CRE) or, if the check is conducted in a STD, a TRE, CRE or a synthetic flight examiner (SFE), trained in CRM concepts and the assessment of CRM skills;
 - (ii) line checks — by suitably qualified commanders nominated by the operator and acceptable to the Authority;
 - (iii) emergency and safety equipment checking — by suitably qualified personnel.

(b) Operator proficiency check (OPC)

1. An operator shall ensure that:
 - (i) each flight crew member undergoes operator proficiency checks to demonstrate his/her competence in carrying out normal, abnormal and emergency procedures; and
 - (ii) the check is conducted without external visual reference when the flight crew member will be required to operate under IFR;
 - (iii) each flight crew member undergoes operator proficiency checks as part of a normal flight crew complement.
2. The period of validity of an operator proficiency check shall be six calendar months in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous operator proficiency check, the period of validity shall extend from the date of issue until six calendar months from the expiry date of that previous operator proficiency check.

(c) Line Check.

An operator shall ensure that each flight crew member undergoes a line check on the aeroplane to demonstrate his/her competence in carrying out normal line operations described in the Operations Manual. The period of validity of a line check shall be 12 calendar months, in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous line check the period of validity shall extend from the date of issue until 12 calendar months from the expiry date of that previous line check.

(d) Emergency and Safety Equipment training and checking.

An operator shall ensure that each flight crew member undergoes training and checking on the location and use of all emergency and safety equipment carried. The period of validity of an emergency and safety equipment check shall be 12 calendar months in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous emergency and safety check, the period of validity shall extend from the date of issue until 12 calendar months from the expiry date of that previous emergency and safety equipment check.

(e) **CRM.**

An operator shall ensure that:

1. elements of CRM are integrated into all appropriate phases of the recurrent training, and;
2. each flight crew member undergoes specific modular CRM training. All major topics of CRM training shall be covered over a period not exceeding three years;

(f) **Ground and refresher training.**

An operator shall ensure that each flight crew member undergoes ground and refresher training at least every 12 calendar months. If the training is conducted within 3 calendar months prior to the expiry of the 12 calendar months period, the next ground and refresher training must be completed within 12 calendar months of the original expiry date of the previous ground and refresher training.

(g) **Aeroplane/STD training.**

An operator shall ensure that each flight crew member undergoes aeroplane/STD training at least every 12 calendar months. If the training is conducted within 3 calendar months prior to the expiry of the 12 calendar months period, the next aeroplane STD training must be completed within 12 calendar months of the original expiry date of the previous aeroplane/STD training.

5.2.1 Recent experience

(a) An operator shall ensure that:

1. a pilot is not assigned to operate an aeroplane as part of the minimum certificated crew, either as pilot flying or pilot non-flying unless he/she has carried out three take-offs and three landings in the previous 90 days as pilot flying in an aeroplane, or in a flight simulator of the same type/class.
2. a pilot who does not hold a valid instrument rating is not assigned to operate an aeroplane at night as commander unless he/she has carried out at least one landing at night in the preceding 90 days as pilot flying in an aeroplane, or in a flight simulator, of the same type/class.

(b) The 90-day period prescribed in subparagraphs (a)1 and 2 above may be extended up to a maximum of 120 days by line flying under the supervision of a type rating instructor or examiner. For periods beyond 120 days, the recency requirement is satisfied by a training flight or use of a flight simulator of the aeroplane type to be used.

5.2.2 Route and aerodrome competence qualification (OPS 1.975)

(a) An operator shall ensure that, prior to being assigned as commander or as pilot to whom the conduct of the flight may be delegated by the commander, the pilot has obtained adequate knowledge of the route to be flown and of the aerodromes (including alternates), facilities and procedures to be used.

(b) The period of validity of the route and aerodrome competence qualification shall be 12 calendar months in addition to the remainder of:

1. the month of qualification; or
2. the month of the latest operation on the route or to the aerodrome.

(c) Route and aerodrome competence qualification shall be revalidated by operating on the route or to the aerodrome within the period of validity prescribed in subparagraph (b) above.

(d) If revalidated within the final three calendar months of the validity of the previous route and aerodrome competence qualification, the period of validity shall extend from the date of revalidation until 12 calendar months from the expiry date of that previous route and aerodrome competence qualification.

5.2.3 Alternative training and qualification programme (ATQP)

(Appendix 1 to OPS 1.978) -

(a) An operator's ATQP may apply to the following requirements that relate to

1. OPS 1.450 and Appendix 1 to OPS 1.450 - Low Visibility Operations - Training and Qualifications;
2. OPS 1.945 Conversion training and checking and Appendix 1 to OPS 1.945;
3. OPS 1.950 Differences training and familiarisation training;
4. OPS 1.955 paragraph (b) — Nomination as commander;
5. OPS 1.965 Recurrent training and checking and Appendices 1 and 2 to OPS 1.965;
6. OPS 1.980 Operation on more than one type or variant and Appendix 1 to OPS 1.980.

(b) Components of the ATQP — an alternative training and qualification programme shall comprise the following:

1. Documentation that details the scope and requirements of the programme;
2. A task analysis to determine the tasks to be analysed in terms of:
 - (i) knowledge;
 - (ii) the required skills;

- (iii) the associated skill based training;
and, where appropriate
 - (iv) the validated behavioural markers.
 3. Curricula — the curriculum structure and content shall be determined by task analysis, and shall include proficiency objectives including when and how those objectives shall be met. The process for curriculum development shall be acceptable to the Authority;
 4. A specific training programme for:
 - (i) each aeroplane type/class within the ATQP;
 - (ii) the instructors (Class rating instructor rating/Synthetic flight instructor authorisation/Type rating instructor rating — CRI/SFI/TRI), and other personnel undertaking flight crew instruction;
 - (iii) the examiners (Class rating examiner/Synthetic flight examiner/Type rating examiner — CRE/SFE/TRE); to include a method for the standardisation of the instructors and examiners;
 5. A feedback loop for the purpose of curriculum validation and refinement, and to ascertain that the programme meets its proficiency objectives;
 6. A method for the assessment of flight crew both during conversion and recurrent training and checking. The assessment process shall include event-based assessment as part of the LOE. The method of assessment shall comply with the provisions of OPS 1.965;
 7. An integrated system of quality control, that ensures compliance with all the requirements processes and procedures of the programme;
 8. A process that describes the method to be used if the monitoring and evaluation programmes do not ensure compliance with the established proficiency and qualification standards for flight crew;
 9. A data monitoring/analysis programme.
- (c) **Implementation** — The operator shall develop an evaluation and implementation strategy acceptable to the Authority; the following requirements shall be fulfilled:
 1. The implementation process shall include the following stages:
 - (i) a safety case that substantiates the validity of:
 - (A) the revised training and qualification standards when compared with the standards achieved under OPS 1 prior to the introduction of ATQP.
 - (B) any new training methods implemented as part of ATQP. If approved by the Authority the operator may establish an equivalent method other than a formal safety case.
 - (ii) Undertake a task analysis as required by paragraph (b)2 above in order to establish the operator's programme of targeted training and the associated training objectives.
 - (iii) A period of operation whilst data is collected and analysed to ensure the efficacy of the safety case or equivalent and validate the task analysis. During this period the operator shall continue to operate to the pre-ATQP OPS 1 requirements. The length of this period shall be agreed with the authority;
 2. The operator may then be approved to conduct training and qualification as specified under the

5.3 AWOPS GROUND COURSE OUTLINE

5.3.1 Module 1 - Low Visibility Operations, Generic

Introduction to AWOPS: Video / film on the subject

Lesson 1: What are Low Visibility Operations?

- Section 1: Definitions
- Section 2: Operating minima
- Section 3: Autopilot
- Section 4: Roles and responsibilities

Lesson 2: The Airport

- Section 1: Visual aids
- Section 2: Non-visual aids
- Section 3: Special areas

Lesson 3: Visual Requirements

- Section 1: Visual segment
- Section 2: Visual illusions

Lesson 4: Operation

- Section 1: Pre-flight
- Section 2: Take-off
- Section 3: Approach
- Section 4: Landing
- Section 5: Equipment failure

5.3.2 Module 2 - Low Visibility Operations, Company/Aircraft-Specific

Lesson 1: Company-Specific Operations

- Section 1: Planning
- Section 2: Presentation of minima
- Section 3: Approach briefing
- Section 4: Approach

Lesson 2: Aircraft-Specific Operations

The type-specific lessons include the following information, dependent on aircraft type.

- Section 1: Take-off minima & Cat 1 minima
- Section 2: Cat 2 & Cat 3 minima
- Section 3: Call-outs

5.4 INITIAL AWOPS TRAINING

5.4.1 Syllabus Content

In all cases the crews starting an AWO course will be shown a specialist video as an introduction to Low Visibility Operations as the introduction to the Ground School then, later occasionally, again during recurrent Company Proficiency Check Periods using a level C or D simulator.

A typical introduction to AWOPS training module acceptable to the regulatory Authority may be as follows:

- a. Category 2 LVO only (no autoland) will also include (in the lowest permitted RVR):
 - i. Hand flown ILS to a DH of 100 feet in 400m RVR; and
 - ii. The exercises listed hereunder for Category 2 or 3 (with autoland); with a DH of 100 ft and the autopilot to not below 50 feet before a 'disconnect', to complete the landing manually.
- b. Category 2 or 3 LVO (with autoland) would also include (in the lowest permitted RVR):
 - i. Two normal low visibility departures, followed by a Cat 2 or a Cat 3 autoland approach to a full stop, to start and end the AWO training period;
 - ii. A manual go-around;
 - iii. One automatic go-around (if equipment fit permits);
 - iv. An engine failure close to V1 rejected take-off, in minimum RVR conditions;
 - v. An engine failure at take off after V1;
 - vi. An asymmetric automatic approach to auto land (or to a manual landing; if the Flight Manual and the equipment fitted permits, on multi engine aircraft such as the Boeing B747-400;
 - vii. As many auto-approaches and landings as may be required, to make-up the agreed number of autolands for initial qualification and the issue of an authorisation clearance certificate, when so set up.

5.4.2 Equipment failures

During training, various equipment failures will be demonstrated whilst separate approaches are in progress; to illustrate those that can be completed to a successful landing (automatic or manual), or to emphasise the need for a go around when it is clearly impossible to continue with the approach because of equipment degradations or the particular failure.

Autothrottle failures will illustrate one situation when the approach may be continued whilst the throttles are operated by hand; whereas an engine failure may require a go around at any time.

5.5 RECURRENT REFRESHER TRAINING AND REGENCY REVALIDATION

5.5.1 Pilots' AWOPS recency would be satisfied normally by three approaches during an OPC; this may be reduced though to two approaches (one to a landing in the minimum authorised visibility and one to a Go Around) if both pilots have conducted at least one Cat 2 or 3 approach in the aircraft since the last

OPC. The EU-OPS requirement is satisfied by 2 approaches in the simulator plus 1 in the aircraft, or when necessary 3 in the simulator

5.5.2 Time permitting, the syllabus may include (in the lowest permitted RVR):

- a. Two normal low visibility departures, followed by autoland approaches to a full stop; one to start and one to end the session;
- b. A manual go-around;
- c. An automatic go-around (if equipment fit permits);
- d. An engine failure close to V1 rejected take-off in minimum RVR conditions;
- e. One engine failure at take-off after V1;
- f. An asymmetric automatic approach to auto land if the Flight Manual and the equipment fitted permits (or to a manual landing).

Note 1: A list of faults that can occur during LVO operations will need to be drawn-up and offered to instructors as optional exercises to be included during LVO refresher training. A selection of these faults will be practised in rotation during subsequent refresher training sessions, so that the complete list is covered over three or four semi-annual recurrent check and refresher periods.

Note 2: All AWO training sessions should start and end with a normal approach to a successful autoland; **one to start and one to end the session**, so that trainees are left with the mindset that Autoland works, regardless of the fact that time was spent demonstrating equipment failures and practising necessary crew actions in the event of such failures, or being shown reasons for the need to discontinue an approach by way of a go-around, between the first and last normal AWO approach and automatic landing.

5.6 AUTOLAND RECENCY

Company training and testing during recurrent Operator's Proficiency Check (OPC) and after carrying-out any auto-approaches and landings when on Line Flying Under Supervision (LIFU) periods, will satisfy current recency AWOPS departures and autoland revalidation requirements, (see 5.5.1) subject to the pilot having carried out 3 take-offs and 3 landings in the previous 90 days.

Some Companies issue a formal autoland qualification certificate authorising the holder to operate in Category 2 and/or 3 minima conditions. This authorisation may be in the form of an appropriate certificate incorporating a log to record autolandings, which may be similar to the example given in 3.1.6 in Section 3 of this PART 3. The certificate permitting Cat 2 and Cat 3 operations remains current between OPCs and LIFUs, subject to the test being satisfactory.

There is no longer is a requirement for individual airframe auto-approach and landing 'recency'

5.7 AUTOCOUPLED APPROACH AND LANDING PRACTICE

Pilots are encouraged to carry out practice automatic approaches to autoland but these must be on all engines, whether the aircraft type is cleared to carry out asymmetric automatic landings or not. The electrics must always be split for a Cat 3 autoland, even if only for practice purposes, as this helps trouble-shooting in the event of an unsuccessful approach.

Should a practice autoland be unsuccessful, care should be taken before downgrading the autoland status of the aircraft as it may have been caused by factors not related to the aircraft equipment, e.g., carrying out an approach without Cat 3 protection, and with another aircraft at the Cat 1 holding point thus infringing the Cat 3 protected area. Failure in such a case would hardly be the fault of the autoland systems on board. In such a situation and with the autopilot incorrectly downgraded, operation of the following sector might be compromised if full Cat 3 capability were required for it to operate to the intended destination.

5.8 CREW DUTIES DURING THE APPROACH

The allocation of crew duties & calls and on **"Who does what"** is also discussed in 2.3.16, 2.3.17 and 2.3.18 of Section 2 in this PART 3). During an autocoupled approach for a manual landing or for an autoland and/or a go-around, whether on a practise automatic approach and landing or in actual Low Visibility conditions, crew duties are as follows:

C Captain

- Must keep his hands on controls and thrust levers
- Must keep his feet on rudder pedals to control yaw and to maintain directional control on the ground or in the event of an engine failure at any time

P Co-pilot

- Must monitor the flight path by remaining on instruments down to and including the flare
- Must call any red or amber light if illuminated

- Must make Standard and autoland callouts **when automated calls (if fitted) fail to be made.**

E Flight Engineer

- Must monitor the N1 gauges (or equivalent) to give immediate indication of a failed engine
- Must call any red or amber warning lights illuminating if P fails to do so
- Must have available the Autoland aide-mémoire page in the normal checklist and be able to refer to it instantly should this become necessary following an autopilot drop-out or the illumination of any warning light of import to the auto approach and autoland procedures

Whilst Autoland is compulsory in conditions lower than ILS Cat 1, landing manually is permitted if the autopilots malfunction after the required visual reference has been established provided that

- The malfunction occurs when the aircraft is over the runway
- 'C' is satisfied that a manual landing can safely be made
- The required visual reference can be maintained to touchdown

Do not remove the drift during the flare but allow the aircraft to pivot straight after the nose wheels have been landed. Once the autopilot has landed the nose wheels onto the runway, disengage the autothrottle and also the autopilots, provided there is no rudder channel fitted to maintain directional control using the localiser beam. Use the rudders to keep the aircraft running straight along the centreline and apply 'reverse' manually normally until the autobrakes bring the aircraft to rest on the runway. Disengage the autopilot(s) to free the rudder and nose-wheel steering for use when taxiing.

5.9 TRAINING RECORD & PERSONAL AUTOLAND RECORDS

5.9.1 AWOPS/LVO Training record

A completion of AWOPS training, a suitable form must be raised, for inclusion in each flight crew member's Personal training file, to show the successful achievement of a Company AWOPS course. On completion of the course, flight deck crew members will be issued with a Personal AWOPS clearance Authority combined with an autolands record Card.

5.9.2 Personal Autolandings record

A Personal AWOPS Authority may be issued by some companies after aircraft type conversion training. It is combined with an Autoland record that is separate from personal Flying Log Books, for ease of carriage and reference whilst on flight operations. An example of such a card is offered in Section 3 of this PART 3 at 3.1.6 (a) & (b).

END OF SECTION 5

END OF PART 3

PART 4 - TYPE-SPECIFIC AWOPS DRILLS & PROCEDURES

Sample type- specific section of an Operator's AWO training module contents

This Section is strictly for illustration purposes only and MUST NOT BE USED for actual flight operations on A320 aircraft. It is an example of an operator's guidance on the subject. Refer to the Manufacturer's instructions for the latest recommended procedures.

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SECTION 13 GLOSSARY – AUTO-FLIGHT RELATED TERMS

PART 4 (Airbus A320 type-specific) is an extract from a Flight Crew Operations Manual (FCOM) prepared by Airbus for one of its customers. It contains a selection of instructions for the operation of Airbus A-320 aircraft in low visibility conditions and is an example of the type-specific Section that would be included in an All Weather Operations Guide such as this one, for pilots to study during AWO training. It can then be consulted later, to refresh memory regarding a particular LVO detail or a Standard Operating Procedure. The examples of SOP calls and crew actions given reflect best call and response procedures to give necessary information clearly, so as to avoid misunderstandings. As such, they are generic by design and may need changing to reflect a Company's SOP preference for methods of operation and calls to be made within the Manufacturer's type-specific operating instructions envelope. References to flap settings for instance, may need to be altered to reflect Manufacturer 'parlance'. For example, Flap 0, 1, 2, 3 or FULL for the A-321 series, may need to be changed to Flaps 10°, 20°, 30° etc., for other type-variants.



A310 Instrumentation - Picture by Airbus

1. PRE FLIGHT

1.1 Flight Planning

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

1.2 Meteorology

When the weather at the take-off airfield is at or below landing minima, a return alternate must be nominated in case of an engine failure.

1.2.1 Take-Off (Return) alternate

For 2-engine aircraft, the nominated departure alternate must be within 60 minutes flying time at the one-engine-inoperative cruising speed in still air. When the weather conditions at the departure airport are below manual asymmetric Cat 1 AOM for the precision approach intended for a return to the departure airport and if the departing aircraft is not authorised to carry-out asymmetric automatic approach and autoland operations, this equates to the need for a suitable alternate within a radius of 400nm (with some NAAs accepting a radius of 420nm) for A-320 aircraft.

1.2.2 Take-off airport as Return Alternate

A-320 aircraft, the departure weather conditions must be better than Cat 3a AOM because a single-engine auto-approach and landing **may not be flown in less than Cat 3a conditions**.

The weather at nominated 'departure alternates' must be forecast to be at or above the Cat 1 ILS or non-precision approach minima if appropriate, for the airport runway expected to be available after diversion. The forecast must be acceptable for a period commencing one hour before to one hour after the estimated time of arrival at that airfield.

1.2.3 Destination alternates

When the destination airport is forecast to be at or above the appropriate landing minima at the estimated time of arrival, one destination alternate is required. However, if the forecast is below minima, two alternates must be selected.

These Alternates must be forecast to be at or above the Cat 1 ILS or non-precision approach minima if appropriate, for the runway expected to be available after diversion.

1.2.4 Airports without alternates (Island Reserve operations)

When operating to an airfield approved for use without an alternate and carrying Island Reserve Fuel, the above condition does not apply.

1.2.5 Other Regulators 'Departure and Return Alternate' rules

In the USA and those other countries where Alternate Minima apply, the forecast weather for the nominated return alternate should be better than its own Alternate Minima at the time of the planned approach. As stated in the opening paragraph above, this return alternate must be within 60 minutes flying time at the one-engine-inoperative cruising speed in still air (for twin-engine aircraft) and may not be further from the point of departure than 120 minutes flying time at the one engine inoperative cruise speed for multi-engine aircraft (3 or 4 engines).

1.3 AIS Briefing

In the normal manner, check NOTAMS for the departure airport and its Terminal Area, the en-route segment and for the destination in particular, to confirm that conditions and general airfield equipment serviceability states do not preclude a Cat 2 or 3 approach. If the departure weather conditions require a PVD take off, check that the ILS serving the runway to be used for take-off, is not downgraded from Cat 3. However, in the UK, a downgraded ILS may still be available for a PVD take-off if it is promulgated as 'Suitable for take-off guidance'.

1.4 Crew Recency & Autoland Practice

Every pilot of the operating crew during Low Visibility / All Weather Operations must be qualified for the expected conditions at Departure, or for the Arrival at Destination.

Every member of the flight deck crew expected to be sitting at the controls during Low Visibility operations, must have completed the required initial LVO conversion course qualification and thereafter remain current in 'recency' terms in order to operate below Cat 1 AOM. Recency rules may be found in the Training Section of this guide.

1.4.1 Maintaining Autoland Recency

When intending to fly an automatic approach and auto-landing for 'recency' purposes whenever the opportunity presents itself at a suitably equipped airport, crews should be aware that whilst conducting autolands when Low

Visibility Procedures are not in force, the ILS may be subject to interference resulting in deviations from the desired approach path which may NOT be accompanied by an amber 'LOC' indication. Because of this, inform ATC of the intention to carry-out an auto-approach and landing for 'recency' purposes in every case.

1.5 Fuel

Potential Cat 2 and Cat 3 landings may be lost if an early diversion is enforced due to insufficient holding fuel. It should also be borne in mind that ATC delays due to a traffic back-log may continue for some time after fog clearance, especially in Europe during the period when Cat 3 traffic flow restrictions have been removed and yet the weather conditions are still Cat 2.

1.6 At the Aircraft

In addition to the Normal Outside and Inside Pre-flight and Before Engines Start checks:

- a. Check the Technical Log to establish that the autopilot is not downgraded. Irrespective of lack of NO LAND 3 or NO AUTOLAND messages, the Autoland status is limited to the Allowable Deficiency Defect (ADD) list declared conditions, until all the 'ADD(s)' that refer are cleared.
- b. Ensure that the aircraft Technical Log contains no other defects which would affect auto-approach capability (as shown in the Deferred Defects Manual (DDM)).
- c. Check familiarity with the Cat 2 and 3 holding points for the take-off and any taxiways, which should or should not be used.
- d. Within Europe, if flow restrictions are in force due to destination weather conditions, inform ATC prior to start-up of the intention of a Cat 2 or 3 landing at destination.

2. DEPARTURE (TAXI OUT TO TOP OF DESCENT)

2.1 Taxi Out

Bear in mind that in poor visibility, e.g. 100m (380ft) 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, other aircraft 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 so taxi as slowly as safety demands.

Use of Ground Movement radar, the compass, aerodrome charts and the low visibility ground movement chart will all help to assess the aircraft's 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. Remember that the Green taxiways centreline lights may be illuminated beyond the Cat 2&3 holding point, if it does not coincide with a taxiway stop-bar or if a preceding aircraft is just lining up.

If carrying out a PVD take-off, enter ILS details on the NAV RAD page (Frequency & QDM) and switch-on both PVDs before reaching the holding point. Identify the ILS as soon as possible and check that the appropriate Memo messages for the PVDs are displayed. The Take-off summary lists the minimum take-off RVR for the intended runway.

2.2 The General RVR requirements for take-off are:

Take-off	TDZ	Mid Point	Stop end
U.K.	Minimum	Minimum <i>If reported</i>	Advisory
USA & Canada	Minimum	Minimum	Minimum
	Any one may be unserviceable		

Prior to entering the runway, consider the runway state and braking action (especially with a 100m RVR). 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 on the edge lights.

If the PVD is being used, as the aircraft lines-up and a valid localiser signal is received, the PVD shutter will clear. Check that it is indicating correctly and adjust its brightness as necessary.

Check the number of visible centreline lights is consistent with the reported RVR. In a 100m RVR, the minimum number should be 4 lights or 2 lights, for a spacing of 15m or 30m respectively.

2.3 Take-off

Use the centreline lights and/or markings as the primary directional guidance. As speed increases, their 'streaming' effect improves guidance (offsetting somewhat the restricted view from the high flight deck). Also, the noise of the nose-wheels running over the centreline lights is a confirmation that the take-off run is straight. If the PVD is being used, as visibility decreases, the visible centreline lights move closer to the glare shield until sight of them is lost. At this point the handling pilot will be looking at the PVD and can then follow its demands.

2.4 Rejected Take-off

With very limited visibility, directional control with reference to the centreline lights is difficult particularly with the inherent swing of an engine failure. Loss of the 'streaming effect' as IAS reduces, demands early corrections to maintain the centreline. If the PVD is being used, it will give immediate demands to correct any swing and to maintain the centreline.

Confirm that AUTOBRAKE RTO operates. If not, apply full braking to ensure the aircraft stops before the end of the runway. When 915m (3,000ft) to the end of the runway, the all-White centreline lights change to Red alternating with White lights for 610m (2,000ft); then in the last 305m (1,000ft) from the end of the runway, all centreline lights change to Red.

Determining the aircraft position after stopping can be very difficult. The emergency services may have trouble locating you and may initially be aided by the use of wing and landing lights.

2.5 En-Route

Monitor the trends in visibility at the destination and alternates.

Consult the Landing Summary for the AOM and Regulated Landing Weight (RLW), particularly if the runway is contaminated, as the RLW is more restrictive than for a manual landing. When conducting the Cat 2/Cat 3 briefing, remember that the use of autobrake will ensure symmetrical braking and will minimise the landing distance required in what may be progressively worsening visibility.

2.6 Top of Descent before commencing Approach

In addition to the normal checks,

2.6.1 The CREW

- a. The crew must be Cat 2 &/or 3 qualified; and
- b. Have completed the Top of Descent and a Cat 2 or 3 briefing and agreed Cat 2 & 3 Runway exits; and
- c. The Captain will control the aircraft from 1,000ft RA (Height above terrain), unless the SOP requires that a 'monitored approach' is flown; with the pilot in the Right Hand seat making the necessary selections down to DH/DA, when he either initiates a go-around if no response is made to his 'DECIDE' call, or the pilot in the Left Hand seat replies 'LAND' when the 'DECIDE' call is made, then takes over and lands the aircraft.

2.6.2 The AIRFIELD

- a. The runway to be used must be approved for Cat 2 &/or 3 operations, as applicable
- b. Cat 2 or 3 'Low visibility procedures' must be in force.
- c. The Approach minima for the runway Precision Approach aid are available.
- d. The Cat 2/Cat 3 ILS system is serviceable and Low Visibility procedures are in force.

Generally, if ATIS and ATC do not report to the contrary, all the necessary facilities for AWO are serviceable. If "Low visibility procedure in force" is transmitted, the appropriate runway and ILS protection procedures are active.

3. TOP OF DESCENT TO APPROACH & LANDING

3.1 General RVR requirements for landing –

Landing	TDZ	Mid Point	Stop end
Countries other than USA & Canada	Minimum	Min 150m if reported. Min 75m if reported and min TDZ<150m.	Min 75m if reported and (& if required in the Performance Manual) otherwise advisory

Press EICAS 'Recall' to check that neither a 'NO LAND 3' nor a 'NO AUTOLAND' message is present.

If a NO LAND 3 message is present, the minimum applicable approach AOM is ILS Cat 3a (Cat 2 AOM in the USA).

If a NO AUTOLAND message is present, the minimum approach category is ILS Cat 1.

Approaching destination, inform ATC that a Cat 2 or Cat 3 approach will be made, thus ensuring priority over non-Cat 2/Cat 3 aircraft in the holding stack. When the RVR is just below minimum, and it is necessary to decide 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, monitor the Tower frequency to get the latest RVR.

3.2 Commencing the Approach

On first contact with the Approach controller request a Cat 2 or a Cat 3 approach with a 10nm final.

When making an approach in genuine Cat 3 conditions, Flap 'Full' should be used for landing as this will give a better cockpit cut-off angle and hence improve the visual segment.

If the touchdown or midpoint RVR falls below minimum before 1,000ft 'aal', it is permissible to continue the approach down to 1,000ft 'aal', but the approach must be discontinued at 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.

In the USA the following special requirements apply:

- a. RVR requirements are such that both touchdown and midpoint RVRs must be at or above the listed minimum figure.
- b. If 'LAND 2' is annunciated on the PFD during a Cat 3 approach, then the approach minima must revert to Cat 2.

3.3 Final approach and landing

Reiterating: On first contact with the Tower, advise the controller that the aircraft is making a Cat 2 or a Cat 3 approach.

When the visibility is rapidly improving, the low visibility safeguarding procedures may be abandoned by ATC in order to increase the traffic flow. If this should occur after the aircraft has left the hold, a call to the Tower will enable the controller to advise that appropriate protection is no longer available if that is the case.

The remaining autopilot arms automatically when APP mode is selected. Operate the aircraft in accordance with normal approach procedures, making flap and gear selections appropriate to the weather conditions, but use Flap 'Full' when on an auto approach, with or without autoland for optimum visual cues acquisition in the final stage of the approach and landing.

3.3.1 1,500 feet RA

At '1,500ft RA', the remaining autopilot channel engages. LAND 3 is annunciated in Green, whereas FLARE and ROLLOUT will appear in White on the PFD; also **Bus isolation commences**.

RVR DETERIORATION

The RVRs to be remembered during the approach are those reported at or just before 1,000ft aal (the promulgated Approach Ban limit). If before passing 1,000ft aal, the AOM deteriorates to below the AOM for the precision approach flown, an immediate go-around must be initiated.

RVR information received after passing 1,000ft aal is for information only. Deterioration in the RVRs after passing 1,000ft aal **does not** mean an immediate go-around. The approach may continue to DA/DH. Descent below DA/DH is solely dependent on obtaining the required visual reference as laid down later in this part.

REVERSION TO HIGHER MINIMA

In the event of equipment failure, an approach may only be continued if the RVR last reported by 1,000ft aal is above the reversionary minima for the existing conditions. If not, then an immediate go-around and 'missed approach' must be carried out.

3.3.2 1,000 feet RA (Approach ban limit)

At 1,000ft RA, the monitoring pilot, (or 'flying pilot' if on a monitored approach calls **"1000 Radio"**.

The Captain (LHS) checks the PFD for 'LAND 3', 'LAND 2' or 'NO AUTOLAND' annunciations. Note that in certain circumstances these annunciations can occur as late as 500ft. At 1,000ft RA the Captain announces: **"Autoland 'x feet' Radio/Baro, I have control"** where 'x' is the DH/DA in use. If operating with no decision

height, the call is simply **“Autoland, I have control”**. If the SOP requires a monitored approach procedure with the RHS pilot flying to DH and if the LHS pilot can see enough to land, he responds with **‘LAND’** to the call **‘DECIDE’** at DH/DA. If nothing is said, the RHS ‘pilot flying’ initiates a go-around. If landing, the RHS pilot continues to monitor the flight path by remaining on instruments down to and including the flare.

If a NO LAND 3 message is displayed and LAND 2 is annunciated when carrying out an approach to ILS Cat 3 no DH, or ILS Cat 3b minima, the DH and RVR revert to the published Cat 3a minima for that approach, except in the USA where the reversionary minima is still the Cat 2 AOM for that approach.

3.3.3 500 feet RA

At 500ft RA, the First Officer calls **“500 Radio”**. The ‘runway-align’ sub-mode engages, applying a slip when the crab angle exceeds 5°. This sub-mode **is not** annunciated.

Permission to land will be given when the runway is clear and full ILS protection available. If landing clearance is not received by 200ft RA in Cat 2 or Cat 3 conditions, an immediate Go-Around must be carried out.

3.3.4 200 feet RA

At 200ft RA, the monitoring pilot calls **“200 Radio”**. Below this height any ‘NO LAND 3’ messages and/or ‘LAND 2’ annunciations are inhibited.

With RVR’s below 600m, the use of landing lights is not recommended due to the visual segment being reduced by the diffusion; their use is optional into a Cat 2 & 3 touchdown zone carpet lighting.

3.3.5 100 feet RA

At 100ft RA, the First Officer calls **“100 Radio”**. If ‘LAND 2’ is annunciated, the autopilot will apply an increment of nose-up trim, after passing 100ft Radio.

3.4 Approaching Decision Height

The pilot flying the approach (the co-pilot when on a monitored approach SOP), calls **“50 Above”** and at DH he calls **“Decide”**. These calls are omitted where DH is Zero feet (‘No DH’ Cat 3b operation).

The Captain (or Pilot Monitoring, then Landing when on a monitored approach SOP), should be seeking visual reference from approximately 50ft above DH and should respond promptly to the **“Decide”** call by announcing **“Land”** or **“Go-Around ... , setting Flaps to 3”** (when flap is set to Full for autoland).

The approach may be continued below decision height provided that:

- a. For ILS Cat 2 and ILS Cat 3a, a minimum of 3 approach centreline lights, then runway centreline lights and after that, the runway itself must be visible and remain continuously in view. The aircraft must also be seen to be tracking satisfactorily.
- b. For ILS Cat 3b, the pilot must be able to at least one runway centreline light and/or ‘Runway Markings’.
- c. For ILS Cat 3b (No DH) operations, there is no requirement for any visual reference for landing so **no “Decide” call** will be made.

If visual reference is lost below DH, a go-around must be carried out, except for an ILS Cat 3b approach, when the autoland may be completed.

3.5 Continued Approach

The aircraft commences the flare at approximately 50ft RA dependent on the rate of descent. At 25ft RA the autothrottle retards the thrust levers to idle. Rollout mode is engaged at 5ft RA. On touchdown the speed brakes deploy, auto-braking commences (if selected) and the autopilot lowers the nose wheel to the runway.

Note: For ILS Cat 3b no DH operations, establish visual reference after nose-wheel contact

Apply reverse thrust as required. When landing on a Localiser Roll-out system (LR) runway, leave the autopilot engaged until the Captain is ready to turn off the runway. The autopilots maintain the localiser centreline through the rudder and nose-wheel steering. If required, the roll-out control and autobrakes may remain engaged down to a full stop.

In Cat 2 or 3 conditions, on a normal autoland ‘nil roll-out’ category runway ILS (shown as (L) in AOM listings), the autopilot must be disengaged after nose-wheel touchdown because rollout guidance is not assured. In Cat 1 or better conditions, the autopilot may remain engaged to evaluate any rollout guidance afforded by the ILS.

Distance to go to the end of the runway information is provided by the runway centreline lights. At 915m (3,000 ft) to go, their colour changes from all White to Red alternating with White; then in the last 305m (1,000 ft) to the end of the paved surface, they are all Red. If required, the autobrake setting may be increased during the landing roll,

Pushing either switch during the approach engages the TO/GA mode for pitch and roll and but bear in mind that the MAX auto setting is still less than the maximum braking that can be applied manually (or via the footbrakes).

3.6 Taxi-in

Only the normal runway turn-off lights (Yellow/Green) with subsequent sensitive area exit taxiway centreline lights (all Green) and taxi-track side-information panels, will be illuminated during Cat 3 Operations. Do not report 'runway vacated' until the aircraft is outside the sensitive area shown on the Cat 3 Operations chart in the appropriate Aerodrome Booklet. The alternate Yellow and Green taxiway centreline lights lead the aircraft off the runway to the sensitive-area limit-point and then become All Green thereafter. It is important that crewmembers are fully aware of the runway exit point they have used, as it will provide a reference point for 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.

3.7 Missed Approach - Go-Around

The TO/GA mode is armed when at least one of the throttle levers is moved to the TO/GA range on the pedestal quadrant. Arming is not annunciated. The mode will remain engaged even if the aircraft touches down during the go-around manoeuvre. Use THR mode for A/T. The THR mode provides a de-rated go-around thrust. A second push of the TO/GA switch selects full go-around thrust and THR REF is annunciated on the PFD.

In de-rated mode the rate of climb is limited to 2000 fpm and once reached, the thrust is controlled to maintain that rate of climb. At the selected altitude, the pitch mode changes to ALT but the A/T remains in THR until SPD is selected. Roll mode remains in TO/GA until another mode is selected. Bus isolation will terminate at TOGA initiation.

3.8 TOGA Mode Termination

3.8.1 BELOW 400ft Radio:

AFDS remains in TO/GA mode unless autopilot is disengaged and both flight directors are turned-off; or

3.8.2 ABOVE 400ft Radio:

A different pitch or roll mode can be selected, at which point all APs (except the first in CMD) will automatically disengage. Also, the Autothrottle (A/T) SPD mode can be selected.

4. ABNORMAL EVENTS ON APPROACH (Auto Approach System Failures)

This Section deals with the significant Non-Normal circumstances that could occur during a multi-channel autopilot approach and autoland, and their impact on aircraft performance and crew procedures.

4.1 NO LAND 3 (Message) or LAND 2 (Annunciation)

At any stage of the approach this message and associated annunciation signifies a single failure in the autopilot systems and the loss of fail-operational capability. It may be accompanied by an autopilot channel disengaging. A subsequent fault may cause a total autopilot disengagement. Stay prepared to take over manually and to fly a go-around.

The lowest weather minima permitted with a NO LAND 3 message or LAND 2 annunciation is the Cat 3a minima for that approach (in the USA reversion to Cat 2 minima must take place). Should the LAND 2 annunciation occur below 1000ft, the decision height indices should not be reset as this would distract from the essential monitoring task.

A single failure in the autoflight system below 200ft Radio will not be annunciated until the ground speed is less than 40kt and the autopilot has been disengaged, at which point a 'NO LAND 3' EICAS message will be displayed. This should be reported in the Technical Log as a 'NO LAND 3 Recall'.

4.2 NO AUTOLAND (Message and/or annunciation)

This message indicates a significant loss of autopilot capability during a Cat 2 or a Cat 3 approach, or a lack of multi-channel engagement. In this situation, an immediate go-around must be flown.

4.3 No (PFD) Annunciation by 500 Ft Radio

If by '500ft Radio' during a Cat 2 or Cat 3 approach, there is no annunciation of 'LAND 3', 'LAND 2' or if there is a NO AUTOLAND message on the PFD, there is a significant lack of autopilot capability. An autoland **must not** be attempted and an immediate go-around must be initiated.

4.4 ILS Deviation

Excess ILS deviation is indicated below 500ft Radio by the localiser or glide-slope scales on the PFD changing colour to Amber and flashing of the pointer.

If this 'alert' occurs above 200ft Radio, the Captain must monitor the tracking to confirm that corrective inputs are being applied. If this is not apparent or the alert is persistent, a go-around must be carried out.

If the alert occurs below 200ft Radio an immediate go around must be carried out.

4.5 Autopilot Disconnect

When the actual touchdown RVR is less than 300m/1000ft, a go-around must be initiated in the event of an autopilot disconnect below DH. The Landing may be continued if the commander considers that the prevailing circumstances are sufficiently exceptional that a manual landing is more prudent than a go-around. The standard conditions for continuing with a landing in such circumstances must also be present, that is, the 'disconnect' occurs at a late stage in the flare with the aircraft over the touchdown zone and the commander is satisfied that he has sufficient visual reference for a manual landing.

4.6 Autothrottle Disconnect

Autothrottle is not essential for autoland but its use is recommended. Should the autothrottle be unserviceable or should it disconnect during final approach, the thrust levers must be controlled manually to maintain approach speed. At approximately 25ft Radio, gradually reduce power to reach idle on touchdown. **On a missed approach, go-around power must be applied manually.**

4.7 Generator Failure

In the event of a single generator failure above 200ft Radio the electrical system will automatically reconfigure itself to maintain bus isolation. A subsequent failure will result in a 'NO LAND 3' message and the disengagement of the associated autopilot. Below 200ft Radio, loss of a generator may result in the loss of an autopilot channel as the system will not reconfigure.

4.8 Engine Failure

The lowest permitted minima for one engine inoperative operations are normally "Cat 3a No DH" with the aircraft operated in accordance with the one engine inoperative procedures detailed in 'NON-NORMAL OPERATION.' If an engine fails above 1,500ft Radio (before multi-channel engagement), the pilot must provide rudder inputs to counteract the asymmetric condition until multi-channel engagement occurs.

With an engine failure below 1,500ft Radio the autopilot will contain any deviation from the localiser to acceptable limits, and maintain the approach path. If the autothrottle fails, the thrust lever on the remaining engine should be smoothly advanced to achieve a power setting to maintain the normal approach speed. Power reduction during the flare should be performed slowly, to permit the autopilot sufficient time to counteract the yaw that will be induced.

The autoland system will perform in the normal manner and complete the flare, touchdown and roll-out. Should a go-around be necessary, the autopilot go-around mode is available, however, some initial yaw will be experienced but the autopilot will quickly compensate and maintain the ground track. When the autopilot reverts to single channel operation, be prepared to exert a rudder pedal force to maintain the rudder position.

4.9 Pilot Incapacitation

When operating to Category 3 procedures, the First Officer should complete the Autoland in the event of the Captain becoming incapacitated provided 'LAND 3' remains annunciated on the PFD.

In addition, please refer to A-320 FCOM 1 - Section 1.22.00 AUTO FLIGHT for information on

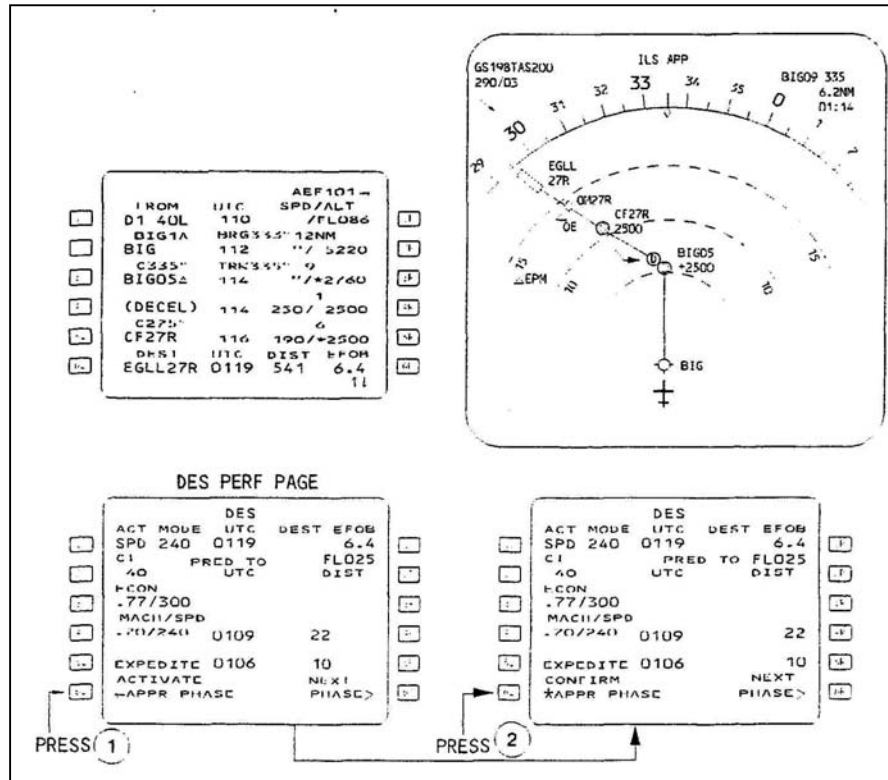
- | | |
|--------------------------------|--------------------------------------------------------------------------------------------------|
| 22.10 General | Description of systems
System Interface diagram
FMGS Modes of Operation
Pilot Interface |
| 22.20 Flight Management | General
Navigation
Flight Planning
Performance
Management of the Displays |

5. APPROACH & LANDING

5.1 INITIAL APPROACH

5.1.1 Upon Reaching the Initial Approach Area

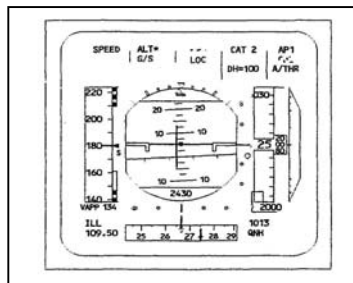
- Approach phase will activate automatically when flying over the DECEL 'pseudo' waypoint with NAV, APPR NAV or LOC* or LOC mode engaged.
- You will activate manually the approach phase on the PERF page if:
 - HDG or TRK mode is engaged or
 - if you are flying a go around or
 - if an early deceleration is required



Airbus graphic

5.1.2 Managed Speed

- Check that managed speed is active
- Monitor the target speed.
 During the approach, the auto-thrust limits the speed of the current configuration (GD, S, F, VAPP).



PFD

Airbus graphic

5.1.3 If ATC requires a specific speed:

Procedure

- Switch to selected speed (turn and pull the speed selector knob on the FCU).
- Adjust the aircraft configuration accordingly

- If ATC orders successive step descents down to the final approach flight path :
 - Use the V/S or FPA mode.
 - Monitor VDEV.

5.1.4 NAV Accuracy

- As required by the SOP.
- Without installed GPS and when no DME is available for the accuracy check, use HIGH/LOW on the PROG page. In this case, consider a "HIGH" to be equivalent to a positive crosscheck.

5.1.5 ATC Clearance

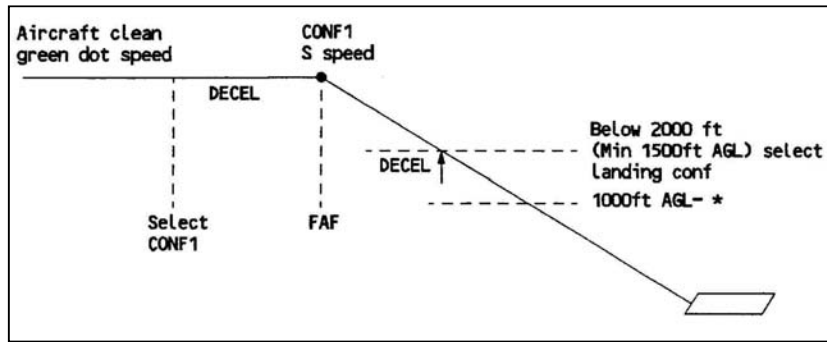
Modify the F-PLN, RAD NAV, and PERF APPR data to agree with the latest clearance and landing information.

5.2 INTERMEDIATE/FINAL APPROACH (ILS approach entered in the F-PLN)

The preferred technique for flying an ILS approach is to fly a decelerated approach using the AP/FDs, the LOC and G/S modes, A/THR in the SPEED mode, managed speed target is recommended.

5.2.1 Decelerated approach

The decelerated approach technique brings the aircraft down to 1,000 feet, at VAPP. In most cases, the interception of the final descent path is achieved with Conf 1 at S speed.



Airbus graphic

- * The approach must be stabilized at approach speed (minimum ground speed) in the landing configuration before reaching 1,000 feet AGL.

5.2.2 Approach Mode Activation (LOC - G/S)

- When cleared by ATC and when appropriate :
 - Press the APPR push-button to arm the APPR mode for the approach as per flight plan

Note 1: If a NON-PRECISION approach is selected in the active flight plan and if the pilot manually tunes an ILS on the RAD NAV page, the MCDU and PFD display 'CHECK APPR GUIDANCE'.

Note 2: Be reminded that, although an ILS is tuned on RAD NAV page, the available approach guidance modes are APP NAV - FINAL when the APPR pushbutton is pressed-in on the FCU.

- The FCU APPR push-button arms or engages LOC and G/S modes if:
 - An ILS approach is entered in the flight plan, or
 - Only a runway or no approach is entered in the flight plan and an ILS is manually tuned on the RAD NAV page or,
 - Both RMPs are set to NAV and an ILS is selected

5.3 AUTOLAND

- Check that the FMA displays the aircraft capability (Cat 2 or Cat 3) for the intended ILS approach.
- Monitor the automatic audio call out.
- **At 350 feet RA**
 - Check "LAND" displayed on the FMA.
 - If LAND is not displayed, do not perform an autoland.
 - Check ILS course.

- **Between 50 and 40 feet RA**
 - Check "FLARE" displayed on the FMA.
- **At 30 feet RA approximately**
 - Check that "IDLE" is displayed on the FMA and that auto-thrust starts to reduce toward IDLE.
- **At 10 feet "RETARD" call out comes up**
 - Move the thrust levers to IDLE and Auto-thrust disconnects.
- **At touchdown**
 - Check that "ROLL OUT" appears on the FMA
- **At the end of the Roll out**
 - Disengage the autopilot.

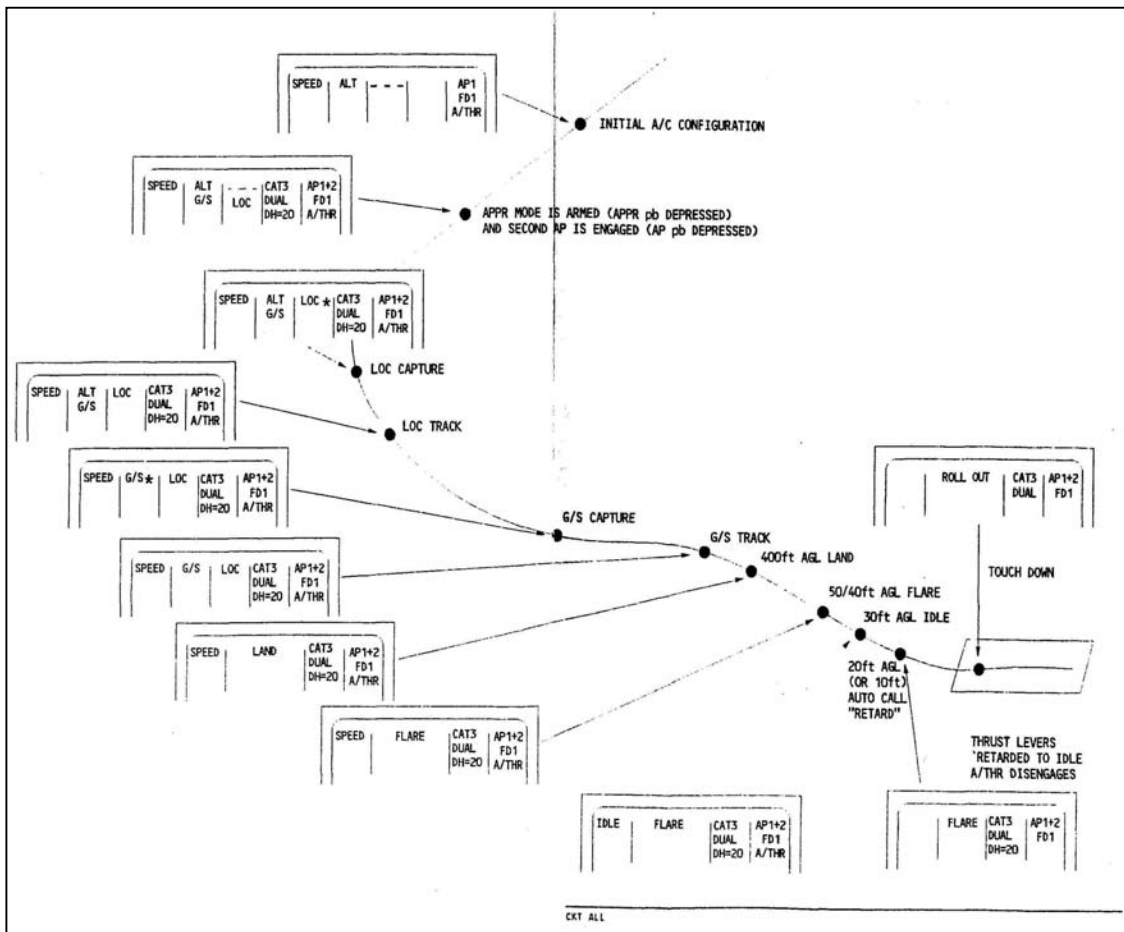
If an AP is not disengaged at the end of the roll-out and the pilot uses the nosewheel steering tiller to taxi the aircraft off the runway, the autopilot will steer the aircraft back to the localizer when the tiller is released.

5.4 MANUAL LANDING

- **At DH**
 - **Disconnect** the A/Ps. (SPEED mode remains engaged).
- **At 20 feet**
 - "RETARD" automatic call out comes up
 - Move the thrust levers to IDLE if they are not there already. (The A/THR disconnects).
- **At touch down**
 - "ROLL OUT" appears on the FMA and the yaw bar comes up on the PFD.

Note: The retard call out is only a reminder when a manual landing is performed.

5.5 AUTO APPROACH AND LANDING PROFILE – DISPLAY ANNUNCIATIONS



Airbus graphic

5.6 EARLY SELECTION OF APPROACH MODE LOC • G/S

Pressing the APPR push-button arms LOC and G/S:

If no RA (radio altitude) signal is available when G/S mode engages (G/S* or G/S on FMA), AP and FD disengage and FD reverts to the HDG/TRK and V/S-FPA modes. Because the RA signal is not valid above 8200 feet AGL (TRT) or 5000 feet/AGL (Collins), do not arm PPR mode above 8000 feet AGL (TRT) or 5000 feet AGL (Collins). If the aircraft is cleared for an ILS approach when it is higher than 8000 feet AGL (TRT) or 5000 feet AGL (Collins), proceed as follows:

- PRESS the LOC pushbutton on the FCU, in order to arm LOC mode.
- When aligned on the localiser and approaching the glide slope:
 - TURN the V/S - FPA knob to set the proper target and PULL to engage.
 - Use the V/S or FPA mode to stay on glide slope. (Do not exceed - 2500 FT/Min).
- At approximately 5000 feet AGL, PRESS the APPR pushbutton on the FCU
 - Check that the LOC and G/S modes are engaged

5.7 GLIDE SLOPE INTERCEPTION FROM ABOVE

If the aircraft is above the glide slope, the system will not capture the G/S automatically. The pilot must bring the aircraft onto the glide slope beam, and select an appropriate V/S to intercept it. Refer to SOP.

CAUTION : *If the pilot selects too great a V/S, it could increase the current speed to VMAX (VFE), which would cause a mode reversion. With an FCU altitude set above aircraft altitude, OPEN CLB would engage.*

5.8 DATA LOCK

When the aircraft reaches 700 feet RA with APPR mode (LOC and G/S) armed or engaged, the ILS frequency and course are frozen in the receiver.

This function (ILS tune inhibit) is available when at least one AP/FD is engaged. Any attempt to change ILS frequency or CRS through the MCDU or RMP does not affect the receiver.

If the speed is managed, the system does not accept any modifications the pilot may enter on the PERF APPR page (surface wind, selected landing configuration, or VAPP) for speed guidance purposes below this altitude.

When the aircraft reaches 400 feet RA, LAND mode engages. The flight crew can disengage this mode only by engaging the GO AROUND mode.

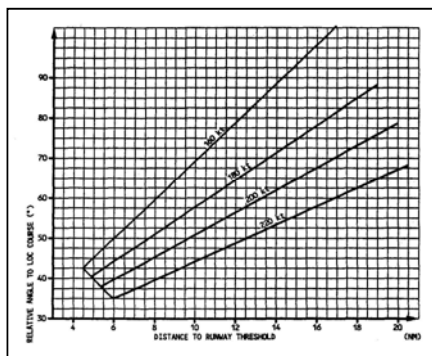
5.8.1 USE of RMPs for ILS/DME

If both FMGCs fail, you will tune the ILS frequency on both RMPs simultaneously. If the ILS has a DME, the PFD will not display the DME distance. In this situation you will fly without DME information. If necessary, increase the DH accordingly.

5.8.2 LOC Beam Capture

The pilot must always monitor the capture of a LOC beam. During this evolution the associated deviation indications on the PFD and ND must indicate movement toward the centre of the scale. The pilot can avoid making a false capture by being careful not to arm the LOC too early.

The following graph shows the angle of interception versus distance which ensures that any overshoot will be less than 1.3 dot.



Airbus graphic

The capture begins when the deviation is two dots or less. It is programmed to line the aircraft up on the beam with a single overshoot, even when the intercept angle is large.

ICAO requires loc beam to ensure a normal capture within 10 NM and +/- 35° of the course centreline. Some current ILS systems just meet the requirement and are subject to false capture outside these limits.

5.9 SWITCHING FROM NON-ILS TO ILS APPROACH

If an ILS approach is possible when a non ILS was previously scheduled, use one of the following procedures:

5.9.1. Use a secondary flight plan to prepare the alternate ILS approach, time permitting,

- Copy the ACTIVE flight plan.
- Revise the ARRIVAL : insert the ILS approach and the applicable STAR/VIA.
- On the RAD NAV page, tune-in the ILS manually.
- Revise the PERF APPR page.

5.9.2. ATC changes the clearance from the non-ILS to the ILS approach.

- a. **If a secondary flight plan has been prepared:**
 - Activate the SEC F-PLN and adjust.
 - Follow subsequent standard procedures.
- b. **If a secondary flight plan has not been prepared:**
 - Revise the ARRIVAL on the primary F-PLN, inserting the ILS approach.
 - Revise the PERF APPR page.
 - Follow subsequent standard procedures.

CAUTION: If the pilot decides to fly the ILS approach without revising the arrival of the primary flight plan (say that a non-ILS approach is in the F-PLN), the LOC and G/S modes will not be available when he presses the APPR pushbutton. Consequently, he should:

- Manually TUNE-in the ILS on the RAD NAV page and check to see that the APPR GUIDANCE message comes up.
- Press the ILS push-button and select ROSE ILS on the EIS CONTROL panel.
- Use HDG, V/S or TRK, FPA modes to fly the ILS.

5.10 MONITORING & STANDARD CALLS DURING ALL APPROACHES & LANDINGS

Limitations regarding Cat 1, Cat 2 and Cat 3 approaches and landings may be found elsewhere in this Guide; including precautions to be taken when performing autoland in good visibility on a Cat 1 ILS beam.

Anytime that a flight parameter is being exceeded during an approach, the PNF/ Pilot Monitoring must speak out and clearly interject as indicated:

- ***During glide beam capture***
 - Pitch attitude becomes lower than -2.5° or greater than +10° (nose up).
 - Vertical speed exceeds +500 feet/minute or -1250 feet/minute.
- ***During final approach***
 - Speed varies from the 'speed target' by -5 knots or +10 knots (say loudly "**SPEED**").
 - Pitch attitude varies from target 'attitude' by -5° (nose down) or +10° (up) (say loudly "**PITCH**").
 - Bank angle becomes greater than 7° (say loudly "**BANK**").
 - Descent rate becomes greater than 1,000 feet/minute (say loudly "**SINK RATE**").
 - There is a 1/2 dot or more LOC or GLIDE deviation (say loudly "**LOCALISER**" or "**GLIDE**").

If the pilot has any doubt about the autopilot guidance, he should use the instinctive disconnect push-button to disconnect the autopilot, or should commence an automatic go around.

6. SOP DUTIES & CALLS

6.1 TASK SHARING FOR CAT 1 APPROACH (or better)
[Same pilot flies and lands aircraft]

PF	PNF / Monitoring
At 350 ft AGL (or RA)	
Check ILS course on PFD	Announce "LAND GREEN" when displayed on FMA
At Decision Altitude (or Decision height) + 100 ft*	
	• Announce "One Hundred above"
At Decision Altitude (or decision Height)*	
	• Announce "Minimums" (Decision Height if QFE is used)
If external visual references are sufficient	
Announce "LANDING"	
If automatic landing not performed	
Disconnect the A/Ps and perform the landing At "RETARD" annunciation, retard thrust levers to IDLE if not yet performed automatically	Monitor CALL OUT or announce as appropriate 300ft 200ft 100ft 50ft 30ft 20ft 10ft
If automatic landing performed refer to Cat 3 without DH	
If external visual references are NOT sufficient	
Announce "GO AROUND" and execute	

Note 1: Cat 1 minimum (DH or DA) is always 'barometer' referenced and should be entered in the MDA/MDH field of the PERF APPR page. Auto callouts "one hundred above" and "minimums" will not be provided.

6.2 TASK SHARING FOR Cat 2 / Cat 3 APPROACH (with DH)
[Same pilot flies & lands aircraft]

PF	PNF /Monitoring
At 350 ft RA	
Check ILS course on PFD Commence outside scanning	Announce "LAND GREEN" when displayed on FMA
At Decision height + 100 ft	
	• Monitor AUTO CALL OUT "One Hundred above"
At decision Height	
	• Monitor AUTO CALL OUT "Minimum"
If external visual references are sufficient	
Announce "LANDING"	
If automatic landing not performed	
Disconnect the A/Ps and perform the landing	Monitor CALL OUT or announce as appropriate 200ft 100ft 50ft 30ft 20ft
At "RETARD" annunciation, retard thrust levers to IDLE if not yet performed	10ft "RETARD" auto call out
If automatic landing performed refer to Cat 3 without DH	
If external visual references are NOT sufficient	
Announce "GO AROUND" and execute	

Note 1: "RETARD" auto-callout comes up at 10 feet if LAND Mode is engaged with one or two APs engaged. Otherwise it is announced at 20 feet.

Note 2: On Cat 3 Approaches
 - AUDIO AUTO Radio Altitude CALL-OUT **is Mandatory**
 - A/THR in SPEED MODE **is Mandatory**

Note 3: On Cat 2 Approaches
 - AUDIO AUTO Radio Altitude CALL-OUT **is NOT Mandatory**

6.3 TASK SHARING FOR Cat 3 APPROACHES / LANDINGS WITH NO DH

PF	PNF/Monitoring
At 350 ft RA	
Check ILS course on PFD	Announce "LAND GREEN" when displayed on FMA
At 100 ft RA	
If no failure is detected announce "LANDING"	- Monitor AUTO CALL OUT "One Hundred"
At 40 feet RA	
	- Check FLARE on FMA and announce
At 30 feet RA	
Monitor thrust reduction and flare by flight instruments	- Monitor AUTO CALL OUT "Thirty"
At 10 feet RA	
AUTO CALL OUT "RETARD"	
Retard both thrust levers to IDLE	- Monitor engine parameters
Monitor lateral guidance by external reference	
AT TOUCH DOWN	
Select and control reverse thrust	- Check ROLL OUT on FMA and announce - Check reverse green and announce - Announce "70 knots"
Disengage the APs at the end of the Roll-out (when leaving the runway at the latest)	

Note 1: On Cat 3 Approaches
 - AUDIO AUTO Radio Altitude CALL-OUT **is Mandatory**
 - A/THR in SPEED MODE **is Mandatory**

6.4 MONITORED APPROACH PROCEDURE

In all the three cases previously listed, the PF flies and lands the aircraft with PNF monitoring the flight path and making calls as necessary. Where **Monitored Approach Procedures** are used, duties vary depending on the Company. For example :

PNF Monitors the approach, then lands the aircraft. PF makes all the auto-flight inputs and cross checks progress along Localiser & Glide-path, or he hand flies the approach if an autoland is not to be attempted. He makes all height calls during the approach. At DH, PF calls DECIDE. If the required visual segment is available, PNF/Monitoring/Landing states : "LANDING". He then takes over and lands the aircraft. If landing, **whoever** was PF remains "on instruments" to touchdown, monitoring rates of descent.

Otherwise the order "Go Around" is given. This is the order for the PF to carry out a Missed Approach Procedure (Auto or Manual), with PNF/ MONITORING/ **LANDING**, **selecting** go-around flap and raising the undercarriage when a positive climb is **established; by** altimeters showing rising numbers (not just a positive rate of climb).

7. LANDING CATEGORIES

Each FMGC computes its own landing category, such as Cat 1, Cat 2, Cat 3 single and Cat 3 dual. It also displays the corresponding landing category on the FMAs. Each category depends upon the availability of aircraft systems and functions. When the landing category downgrades, a triple click aural warning is activated.

7.1 FAIL- OPERATIONAL AUTOMATIC LANDING 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. A Cat 3 DUAL system is a fail-operational automatic landing system.

Note: In the event of a failure, the automatic landing system operates as a fail-passive system.

7.2 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. A Cat 3 single system is a fail-passive automatic landing system.

Note: With a fail-passive automatic landing system the pilot assumes control of the aircraft after a failure.

Below 100 feet (radio altimeter), the FMGS freezes the landing capability until LAND mode is disengaged or both A/Ps are off. Therefore a failure occurring below 100 feet does not change the category of the system.

7.3 ALERT HEIGHT

The alert height is the height above touch down, above which a Cat 3 autoland would be discontinued and a missed approach executed, if a failure occurred in either the aircraft systems or the relevant ground equipments.

Below the alert height, if such a failure occurs, the flare, touchdown and roll out may be accomplished using the remaining automatic system.

8. MALFUNCTION WARNINGS WHEN ON ILS APPROACHES

8.1 AUTOLAND WARNINGS

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

- The APs are lost or
- The aircraft gets too far off the beam or
- The localiser or glide slope transmitter or receiver fails.

When the Autoland RED light comes up, Autoland must be discontinued and a go-around initiated.

8.1.1 Warning of excessive beam deviation

This warning is a flashing of the LOC and G/S scales on the PFD and NO ROSE ILS. It occurs whenever:

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

8.1.2 Warning associated with ILS "landing capability"

Any change in the aircraft's capability for landing sounds a triple-click aural warning.

8.1.3 Failure of both localizer and glide slope receivers

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

8.2 ILS GROUND EQUIPMENT FAILURE

8.2.1 Failure of localizer or glide slope transmitter

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

8.2.2 The FMA retains the LOC and G/S modes.

If the transmitter failure is temporary, the A/Ps are able to regain these modes. If the failure is long term or if it occurs when the aircraft is below 200ft RA, this allows the aircraft to perform a Go-around with one or both A/Ps.

9. Table of equipment required for A-320 Cat 2 and Cat 3 approaches and landings

		CAPABILITY →				
		EQUIPMENT ↓	CAT 2	CAT 3 SINGLE	CAT 3 DUAL	
F M G S		AP /FD	1 AP ENGAGED	1 AP ENGAGED	2 AP ENGAGED	
		AUTOTHRUIST	0	1	1	
		FMA	1	2	2	
		AUTO-THROTTLE CAUTION	0	1	1	
		FAC	1	1	2	
		ELECTRICAL POWER SUPPLY SPLIT	0	0	1	
		ELAC	1	1	1	
	M O N I T O R E D		YAW DAMPER / RUDDER TRIM	1/1	1/1	2/2
			PFD DUs	2	2	2
			FLIGHT WARNING COMPUTER	1	1	2
			BSCU CHANNELS	0	1	1
			RADIO ALTIMETERS	1 DISPLAYED ON BOTH SIDES	2	2
			DH INDICATOR	1	1	1
			ILS RECEIVER	2	2	2
			BEAM EXCESSIVE DEVIATION WARNING	1	2	2
			ATTITUDE INDICATION (PFD1 / PFD2)	N° 1 + N° 2		
			ADR / IR	2/2	2/2	2/2
	C R E W		AP DISCONNECT PB	2	2	2
		“AP OFF“ ECAM WARNING	1	1	1	
		“AUTOLAND “ LIGHT	1	1	1	
		RUDDER TRAVEL LIMIT SYSTEM	1****	1****	1****	
M O N I T O R E D			WINDOW HEAT (L or R windshield)	1**	1**	1**
			WINDSHIELD WIPERS or RAIN REPELLANT (if activated)	1**	1**	1**
			ND DUs	1	2	2
			ANTISKID	0	1	1
			NOSE WHEEL STEERING	0	0	1
			AUTO CALL OUT FUNCTION	0***	1	1
	ATTITUDE INDICATION (Stand- by)	1	1	1		

* One unit required for the PNF

** One unit required for the PF

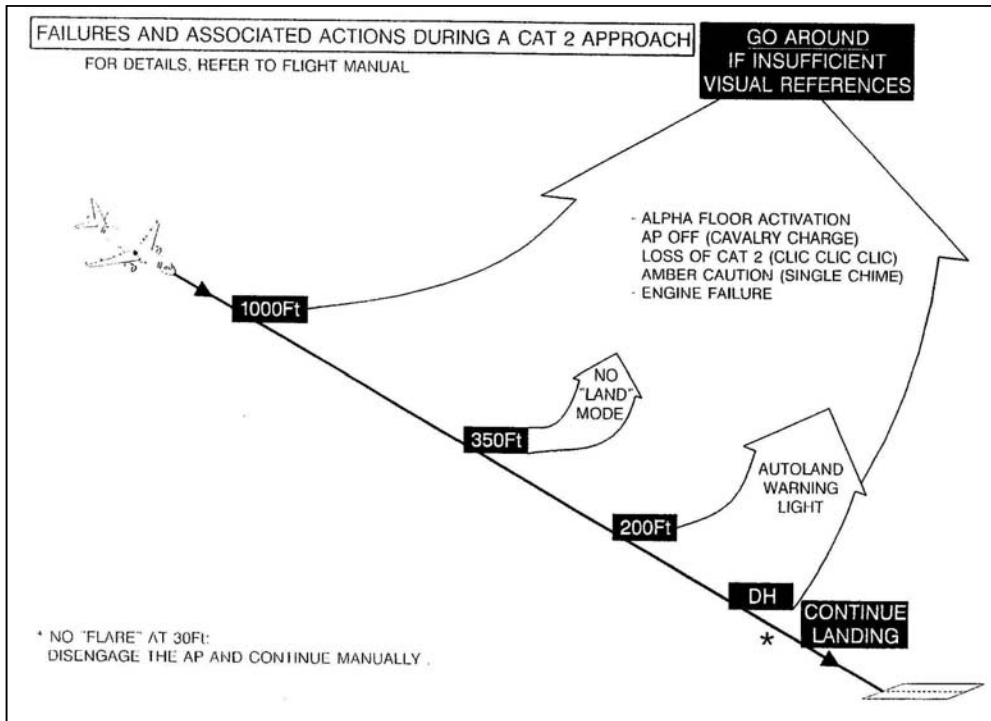
*** Required for Autoland

**** Required for Autoland with crosswind greater than 12 knots. - Electrical power supply split : device ensuring that both FMGC are powered by independent electrical sources

NOTE Auto call-out function. Anti-skid and nose wheel steering are partially monitored by the FMGS

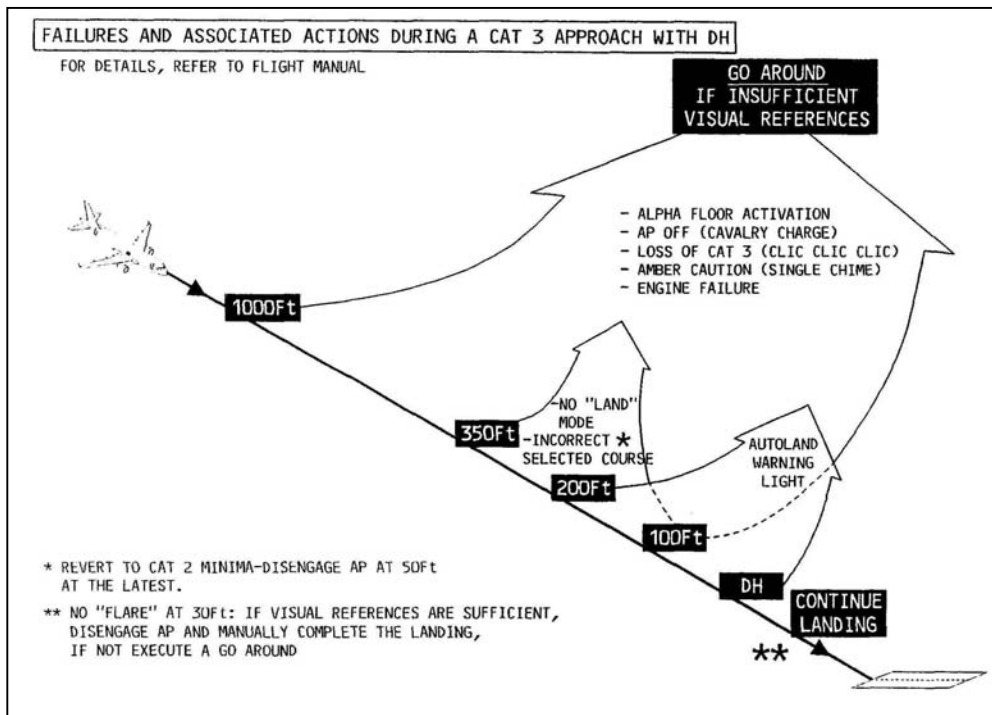
10. FLIGHT PROFILES ILLUSTRATIONS

10.1 FAILURES AND ASSOCIATED ACTIONS ON Cat 2 APPROACHES



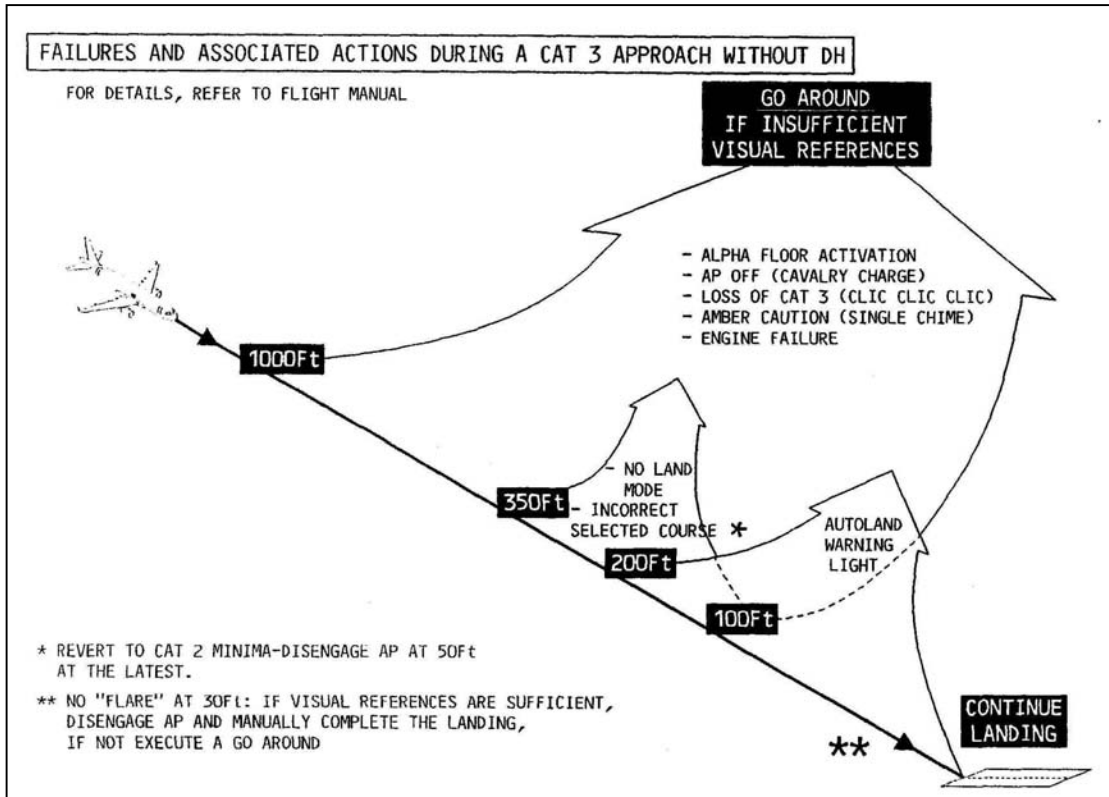
Airbus graphic

10.2 ILLUSTRATING FAILURES & ASSOCIATED ACTIONS ON Cat 3 APPROACHES (with DH)



Airbus graphic

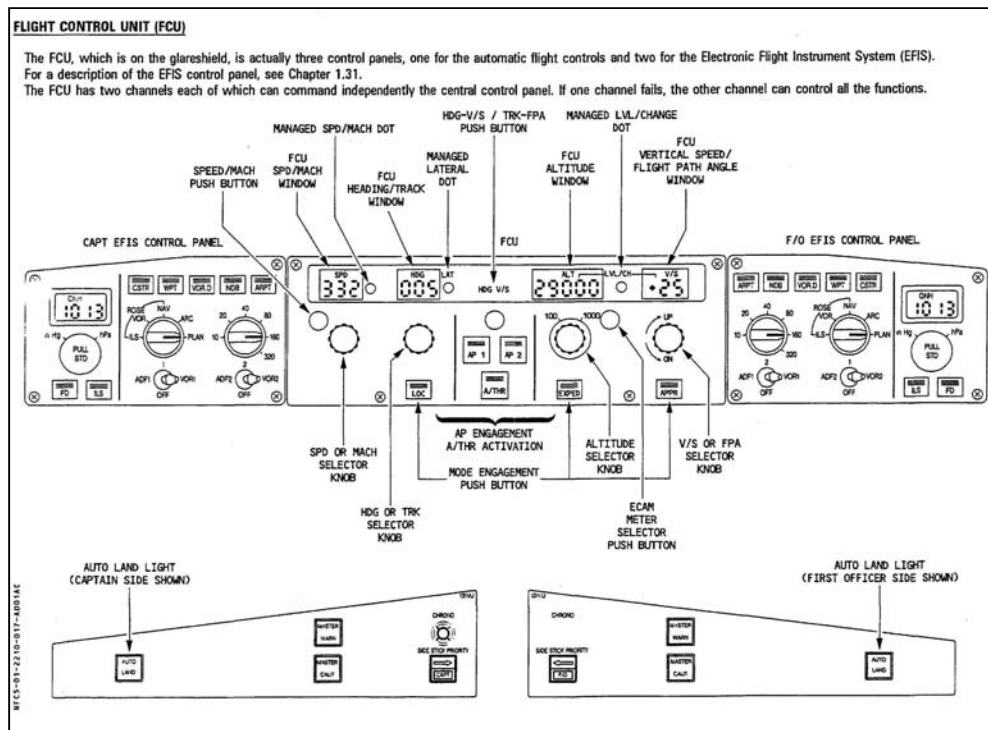
10.3 FAILURES AND ASSOCIATED ACTIONS ON CAT 3 APPROACHES WITHOUT DH



Airbus graphic

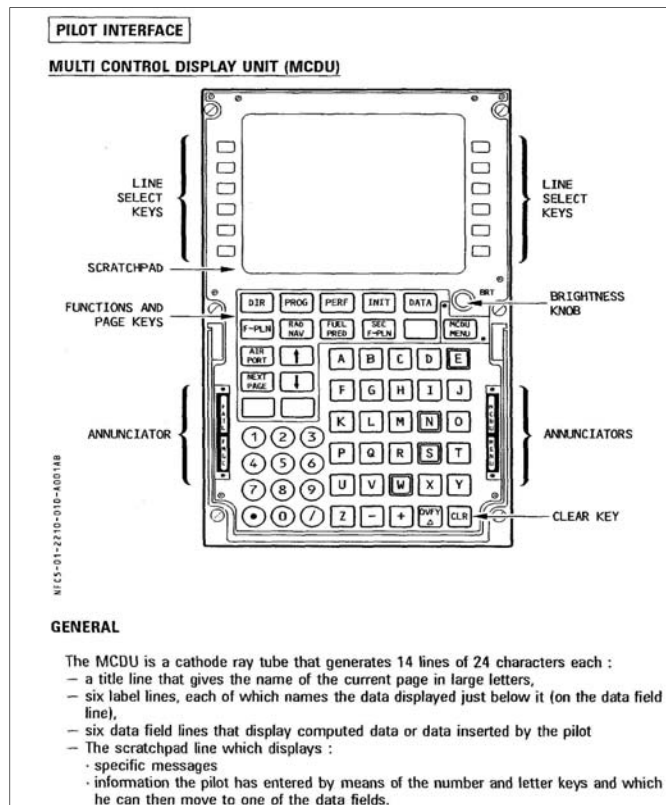
11. AIRBUS A-320 AUTO FLIGHT CONTROLS

11.1 COAMING PANELS

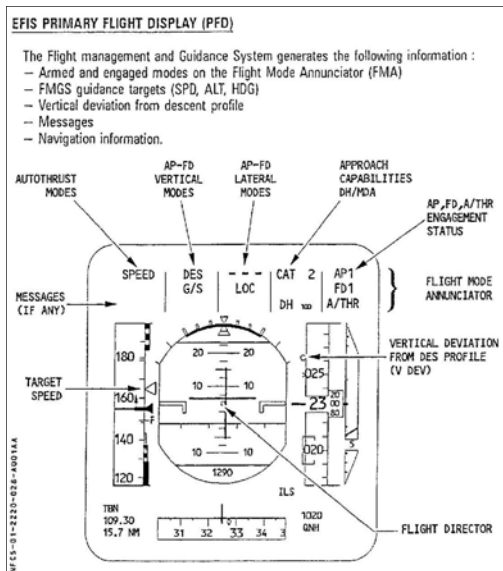


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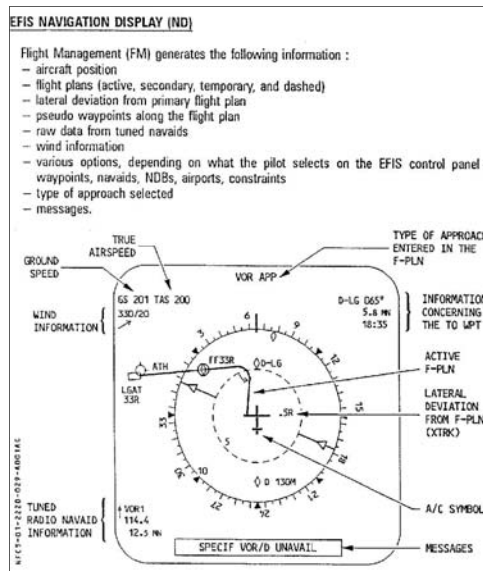
11.2 FLIGHT MANAGEMENT MULTI CONTROL DISPLAY UNIT (MCDU)



11.3 PRIMARY FLIGHT DISPLAY (PFD) & NAVIGATION DISPLAY (ND)

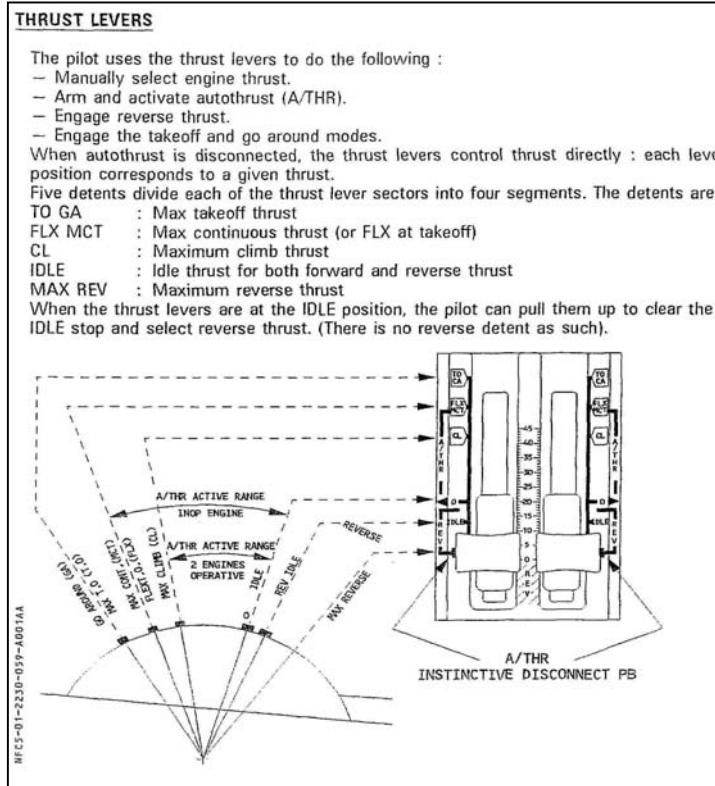


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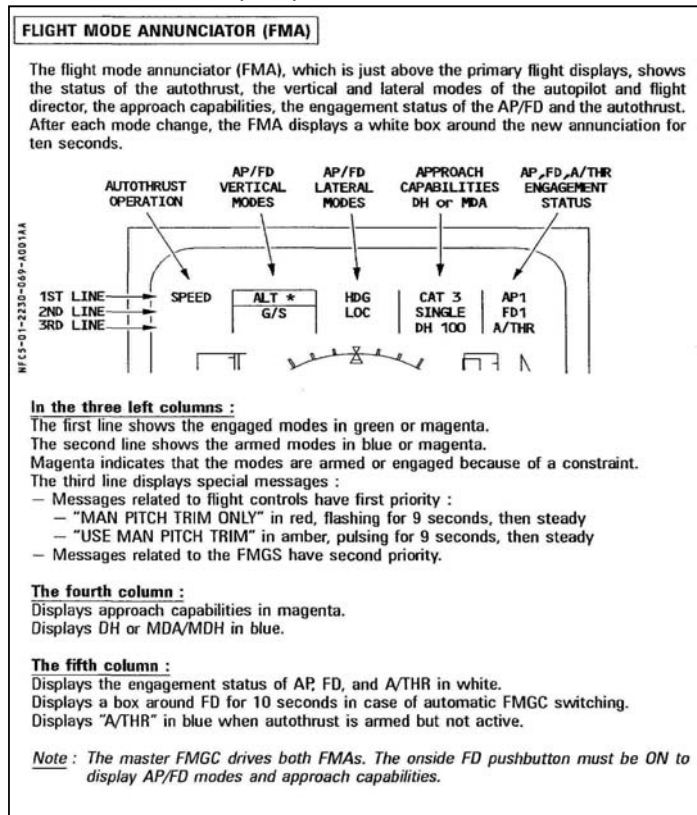
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11.4 THRUST LEVERS INTERFACE



Airbus graphic

11.5 FLIGHT MODE ANNUNCIATOR (FMA)



Airbus graphic

12. POST FLIGHT ACTIONS AT THE END OF THE FLIGHT (SECTOR)

12.1 Technical Log Entry

All faults and deficiencies that are noted during the sector, must be entered on arrival, on the relevant sector page of the technical log, as required by the current Regulatory Authority **Requirements**. Place particular emphasis on faults that may affect the autoland capability of the aircraft on the next sector, should AWO conditions still prevail at departure and/or an autoland is necessary at the next destination. Fuel remaining on arrival must also be recorded in the Technical Log, as per current Regulatory Authority Requirements and Company Aircrew Orders.

The **Technical Faults & noted Deficiencies logbook** holds suitably designed pages in duplicate or triplicate format, bound to form the technical flight-records logbook (The Tech Log). Pages therein have various certification statements relating to the sector flown, or to the next sector. The Tech Log is always left on board as part of the aircraft library.

Pre and post-flight certification statements on 'Sector' pages, include spaces to note faults and deficiencies observed on the sector and a fuel-remaining record with the signature of the arriving commander.

Each page also has provision for the certification of a number of actions that are required before the next sector can be flown, for example, certification that engineering pre-flight checks have been carried-out. A fuel uplift record is also made and the fuel state of the aircraft before the next sector is certified by the refuelling engineer. On hand-over, the Commander of the outgoing flight, signs for the aircraft, to accept it as clear of all technical defects that are not included in any allowable deficiency list (ADL) and to indicate that the engineering pre-flight checks have been carried-out by the person(s) authorised to do them. The signature of the departing captain is also necessary, as an indication that the necessary fuel and the pre-flight fuel-on-board state are as ordered, to satisfy the Navigation flight plan next sector fuel-required calculation and load-sheet fuel trim state.

12.2 Autoland Report

Following the completion of an automatic approach, with or without an autoland and whether for practise or for real, an autoland record form must be completed at the end of that sector. Relevant forms are found, bound in triplicate, in a binder of blank autoland report forms and as an autolands history record for that particular airframe. This autolands record, like the Engineering and pre flight certification Technical Log, is also permanently left in the on-board aircraft library.

See PART 2 of this Guide for an example of a suitable autoland record form and procedure.

13. AIRBUS AUTO-FLIGHT SECTION GLOSSARY

(As Published by Airbus Industries and for use when reading this type-specific section)

See also the Master Glossary published in APPENDIX B of this Guide for more information

A>B	A greater than B
A≥B	A greater than or equal to B
A<B	A smaller than B
A≤B	A smaller than or equal to B
ABN	Abnormal
AC	Alternating Current
A/C	Aircraft
ACARS	ARINC Communication Addressing and Reporting System
ACP	Audio Control Panel
ADF	Automatic Direction Finder
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADM	Air Data Module
ADR	Air Data Reference
ADV	Advisory
AEVC	Avionic Equipment Ventilation Controller
AFS	Auto Flight System
AIDS	Aircraft Integrated Data System
AIL	Aileron
AIU	Audio Interface Unit
AMU	Audio Management Unit
ANT	Antenna
ALT	Altitude
ALTN	Alternate
A/P	Auto Pilot
APP	Approach mode

APPR	Approach mode
APPU	Asymmetry Position Pick off Unit
APU	Auxiliary Power Unit
ARPT	Airport
A/S	Airspeed
ASAP	As Soon As Possible
ASI	Air Speed Indicator
ASP	Audio Selector Panel
A/SKID	Anti-Skid
ATC	Air Traffic Control
ATE	Automatic Test Equipment
A/THR	Auto Thrust Function
ATS	Auto Thrust System
ATT	Attitude
AWY	Airway
BARO	Barometric
BAT	Battery
BCL	Battery Charge Limiter
BCDS	Bite Centralized Data System
BITE	Built-in Test Equipment
BIU	Bite Interface Unit
BFE	Buyer Furnished Equipment
BMC	Bleed Air Monitoring Computer
BNR	Binary
BRG	Bearing
BRK	Brake
BRT	Bright
BSCU	Braking / Steering Control Unit
BTC	Bus Tie Contactor
BTL	Bottle
C	Centigrade
CAPT	Captain, Capture
CAS	Calibrated Airspeed
C/B	Circuit Breaker
CBMS	Circuit Breaker Monitoring System
CDL	Configuration Deviation List
CDU	Control Display Unit
CFDIU	Centralized Fault Data Interface Unit
CFDS	Centralized Fault Display System
COG	Centre of Gravity
CHG	Change
CIDS	Cabin Intercommunication Data System
C/L	Check List
CLB	Climb
CLR	Clear
CMD	Command
CMPTR	Computer
CO	Company
CONT	Continuous
CO RTE	Company Route
CPCU	Cabin Pressure Controller Unit
CRC	Continuous Repetitive Chime
CRG	Cargo
CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CSCU	Cargo Smoke Control Unit
CSD	Constant Speed Drive
CSM/G	Constant Speed Motor/Generator
CSTR	Constraint
CTR	Centre
CTL PNL	Control Panel
CVR	Cockpit Voice Recorder
DA	Drift Angle
DAR	Digital AIDS Recorder
DC	Direct Current
DDRMI	Digital Distance and Radio Magnetic Indicator

DES	Descent
DEST	Destination
DFA	Deployed Flap Approach
DFDR	Digital Flight Data Recorder
DH	Decision Height
DIR	Direction
DIR TO	Direct To
DISC	Disconnect
DIST	Distance
DITS	Digital Information Transfer System
DMC	Display Management Computer
DME	Distance Measuring Equipment
DMU	Data Management Unit
DSDL	Dedicated Serial Data Link
DSPL	Display
DIG	Distance To Go
DU	Display Unit
E	East
ECAM	Electronic Centralized Aircraft Monitoring
ECB	Electronic Control Box (APU)
ECM	Engine Condition Monitoring
ECON	Economic
ECP	ECAM Control Panel
ECS	Environmental Control System
ECU	Engine Control Unit
EDP	Engine Driven Pump
EEC	Electronic Engine Computer
EFCS	Electronic Flight Control System
EFIS	Electronic Flight Instrument System
EFOB	Estimated Fuel On Board
EIU	Engine Interface Unit
EIS	Electronic Instruments System
ELAC	Elevator Aileron Computer
ELV	Elevation
ELEC	Electrics
EMER	Emergency
EMER GEN	Emergency Generator
ENG	Engine
EO	Engine Out
EPR	Engine Pressure Ratio
ESS	Essential
EST	Estimated
ETA	Estimated Time of Arrival
ETE	Estimated Time en Route
ETP	Equal Time Point
EVMU	Engine Vibration Monitoring Unit
E/WD	Engine/Warning Display
EXT PWR	External Power
EXTN	Extension
F	Fahrenheit
FAC	Flight Augmentation Computer
FADEC	Full Authority Digital Engine Control System
FAF	Final Approach Fix
FAR	Federal Aviation Regulations
FAV	Fan Air Valve
F/C	Flight Crew
FCDC	Flight Control Data Concentrator
FCU	Flight Control Unit
FD	Flight Director
FDIU	Flight Data Interface Unit
FDU	Fire Detection Unit
FF	Fuel Flow
FGC	Flight Guidance Computer
FIDS	Fault Isolation and Detection System
FL	Flight Level
FLT	Flight
FLT CTL	Flight Control
FMA	Flight Mode Annunciator

FMGC	Flight Management Guidance Envelope Computer
FMGS	Flight Management Guidance Envelope System
FMS	Flight Management System
F/O	First Officer
FOB	Fuel On Board
F-PLN	Flight Plan
FPA	Flight Path Angle
FPPU	Feed-Back Position Pick-off Unit
FPV	Flight Path Vector
FQI/FQU	Fuel Quantity Indication/Unit
FREQ	Frequency
FRT	Front
FRV	Fuel Return Valve
FT	Foot, Feet
FT/MN	Feet per Minute
FU	Fuel Used
FWD	Forward
FWC	Flight Warning Computer
FWS	Flight Warning System
GA	Go Around
GCU	Generator Control Unit
GEN	Generator
GLC	Generator Line Contactor
GMT	Greenwich Mean Time
GND	Ground
GPCU	Ground Power Control Unit
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GRND	Ground
GRP	Geographic Reference Point
GRVTY	Gravity
GS	Ground Speed
G/S	Glide Slope
GW	Gross Weight
H	Hour, Hot
HCU	Hydraulic Control Unit
HDG	Heading
HDG/S	Heading Selected
HDL	Handle
HI	High
HLD	Hold
HMU	Hydraulic-Mechanical Unit
HP	High Pressure
HPA	Hecto-Pascal
HPV	High Pressure Valve
HSI	Horizontal Situation Indicator
HUD	Head-Up Display
HYD	Hydraulic
HZ	Hertz
IAF	Initial Approach Fix
IAS	Indicated Airspeed
IDENT	Identification
IDG	Integrated Drive Generator
IFR	Instrument Flight Rules
IGN	Ignition
ILS	Instrument Landing System
IMM	Immediate
INB	Inbound
INBO	Inboard
INCREM	Increment
INIT	Initialization
INOP	Inoperative
INR	Inner
INST	Instrument
INTCP	Intercept
I/O	Inputs/Outputs
I/P	Input or Intercept Profile

IP	Intermediate Pressure
IPC	Intermediate Pressure Check valve
IPU	Instrumentation Position Pick-Off Unit
IRS	Inertial Reference System
ISA	International Standard Atmosphere
ISDU	Initial System Display Unit
ISOL	Isolation
KG	Kilogram
KT	Knot
L	Left
LAF	Load Alleviation Function
LAT	Latitude
LAT REV	Lateral Revision
LAV	Lavatory
LCN	Load Classification Number
LDG	Landing
L/G	Landing Gear
LGCIU	Landing Gear Control Interface Unit
LGPIU	Landing gear Position Indicator Unit
LH	Left Hand
LIM	Limitation
LIS	Localizer Inertial Smoothing
LK	Lock
LL	Latitude/Longitude
LLS	Left Line Select key
LOC	Localiser
LONG	Longitude
LP	Low Pressure
LRRA	Low Range Radio Altimeter
LRU	Line Replaceable Unit
LSK	Line Select Key
LT	Light
LVL	Level
LVL/CH	Level Change
LW	Landing Weight
M	Magenta, Mach, Meter
MAC	Mean Aerodynamic Chord
MAG	Magnetic
MAG DEC	Magnetic Declination
MAG VAR	Magnetic Variation
MAINT	Maintenance
MAN	Manual
MAX CLB	Maximum Climb
MAX DES	Maximum Descent
MAX END	Maximum Endurance
MB	Millibar
MCT	Maximum Continuous Thrust
MCDU	Multipurpose Control and Display Unit
MCU	Modular Concept Unit
MDA	Minimum Descent Altitude
MECH	Mechanic
MEL	Minimum Equipment List
MFA	Memorized Fault Annunciator
MIN	Minimum, Minute
MKR	Marker
MLS	Microwave Landing System
MLW	Maximum Landing Weight
MMEL	Master Minimum Equipment List
MMO	Maximum Operating Mach
MN	Mach Number
MRIU	Maintenance and Recording Interface Unit
MSA	Minimum Safe Altitude
MSG	Message
MSL	Mean Sea Level
MSU	Mode Selector Unit
MTBF	Mean Time Between Failure
MTOW	Maximum Take-Off Weight

MZFW	Maximum Zero Fuel Weight
N	Normal, North
NACA	National Advisory Committee for Aeronautics
NAV	Navigation
NAVAID	Navigation Aid (VOR/DME)
ND	Navigation Display
NDB	Non Directional Beacon
NM	Nautical Mile
NW	Nose Wheel
OAT	Outside Air Temperature
OBRM	On Board Replaceable Module
OFF/R	Off Reset
OFST	Offset
O/P	Output
OPP	Opposite
OPT	Optimum
OUTB	Outbound
OUTR	Outer
OVBD	Overboard
OVHD	Overhead
OVHT	Overheat
OVRD	Override
OVSPD	Overspeed
P-ALT	Profile Altitude
Pb	Push-Button
P-CLB	Profile Climb
PCU	Power Control Unit
P-DES	Profile Descent
PDU	Pilot Display Unit
PERF	Performance
PFD	Primary Flight Display
PHC	Probes Heat Computer
P-MACH	Profile Mach
POB	Pressure Off Brake
P-SPEED	Profile Speed
POS	Position
PPOS	Present Position
PPU	Position Pick-off Unit
PR	Pressure
PRED	Prediction
PROC	Procedure
PROC T	Procedure Turn
PROF	Profile
PROG	Progress
PROTEC	Protection
PSU	Passenger Service Unit
PT	Point
PTR	Printer
PTU	Power Transfer Unit (Hydraulic)
PVI	Para-visual Indicator
PWR	Power
QAR	Quick Access Recorder
QFE	Field Elevation Atmosphere Pressure
QFU	Runway Heading
QNE	Sea Level Standard Atmosphere Pressure (1013 hPa)
QNH	Sea Level Atmosphere Pressure
QT	Quart (US)
QTY	Quantity
R	Right, Red
RA	Radio Altitude
RACC	Rotor Active Clearance Control
RAT	Ram Air Turbine
RCDR	Recorder
RCL	Recall
RCVR	Receiver

REL	Release
REV	Reverse
RH	Right Hand
R/I	Radio/Inertial
RISK	Right Line Select Key
RMI	Radio Magnetic Indicator
RMP	Radio Management Panel
RNG	Range
RPM	Revolutions Per Minute
RPTG	Repeating
RQRD	Required
RSV	Reserves
RTE	Route
RTOW	Regulatory Takeoff Weight
RWY	Runway
S	South
sc	Single Chime
S/C	Step Climb
SD	System Display
STAT INV	Static Inverter
S/D	Step Descent
SDAC	System Data Acquisition Concentrator
SDCU	Smoke Detection Control Unit
SEC	Spoiler Elevator Computer
SEL	Selector
SFCC	Slat/Flap Control Computer
SFE	Seller Furnished Equipment
SID	Standard Instrument Departure
SIM	Simulation
SLT	Slat
SPD	Speed
SPD LIM	Speed Limit
SPLR	Spoiler
SRS	Speed Reference System
STAR	Standard Terminal Arrival Route
STEER	Steering
STRG	Steering
STS	Status
SW	Switch
SWTG	Switching
SYNC	Synchronize
SYS	System
T	Tonnes, Temperature
TACT	Tactical
TAS	True Air Speed
TAT	Total Air Temperature
TBD	To Be Determined
T/C	Top of Climb
TCAS	Traffic Collision Alert System or Threat-Analysis/Collision Avoidance System
T/D	Top of Descent
TEMP	Temperature
TGT	Target
THR	Thrust
THS	Trimmable Horizontal Stabilizer
TK	Track angle
TK	Tank
TKE	Track angle Error
TLA	Throttle Lever Angle
TMR	Timer
TNK	Tank
TO	Take-off
TOC	Top of Climb
TOD	Top of Descent
TOGA	Take-Off - Go-Around
TOGW	Take-Off Gross Weight
TOW	Take-Off Weight
T-P	Turn Point
TPIS	Tyre Pressure Indicating System

T-R	Transmitter-Receiver
TRANS	Transition
TROPO	Tropopause
TRK	Track
TRU	Transformer Rectifier Unit
TTG	Time To Go
UFD	Unit Fault Data
ULB	Underwater Locator Beacon
UNLK	Unlock
UTC	Universal Coordinated Time
V	Volt
V1	Critical Engine Failure Speed; (See definition in Master Glossary inPART 1)
V2	Take-off Safety Speed
VBV	Variable By-pass Valve
VC	Calibrated airspeed
VEL	Velocity
VFE	Maxi Velocity Flaps Extended
VFEN	VFE Next
VFTO	Velocity Final Take-Off
VHF	Very High Frequency
VHV	Very High Voltage
VIB	Vibration
VM	Manoeuvring Speed
VMIN	Minimum Operating Speed
VMO	Maximum Operating Speed
VOR	VHF Omni-directional Range
VOR-D	VOR-DME
VR	Rotation Speed
VREF	Landing Reference Speed
Vs	Stalling speed/Slats Retraction Speed
V/S	Vertical Speed
VSI	Vertical Speed Indicator
VSV	Variable Stator Vane
W	White, West, Weight
WBC	Weight and Balance Computer
WGD	Windshield Guidance Display
WHC	Window Heat Computer
WPT	Waypoint
WTB	Wing Tip Brake
WXR	Weather Radar
XCVR	Transceiver
XFR	Transfer
XMTR	Transmitter
XPDR	Transponder
XTK	Cross Track Error
Y	Yellow
ZFCG	Zero Fuel Centre of Gravity
ZFW	Zero Fuel Weight

END OF PART 4

APPENDIX A - REGULATORY REQUIREMENTS AND MEANS OF COMPLIANCE

EU-OPS 1 - SUBPART E ALL WEATHER OPERATIONS & AERODROME OPERATING MINIMA

EU-OPS 1 Legislation and related Means of Compliance guidance quoted or referred to in this AWOPS compendium, has been consolidated into this 'Appendix A' for ease of ready reference.

- Section 1 THE EUROPEAN COMMUNITY & THE EUROPEAN AVIATION SAFETY AGENCY (EASA)
- Section 2 EU-OPS 1 Regulations – Sub-part E (Aerodrome Operating Minima & All Weather Operations)
- Section 3 EU-OPS 1 – Subpart E (Means of Compliance) relating to (2) above
- Section 4 EU-OPS 1 – Subpart N (Flight Crew) – Training extract
- Section 5 EU-OPS 1 – Subpart N (Flight Crew) - (Means of Compliance) extract relating to (4) above

Note that EU-OPS 1 transcripts hereunder are presented as produced by EASA in both numbering and layout.

Appendix A covers Aerodrome Operating Minima and their preparation as well as the procedure to be taken by operators wanting to introduce All Weather Operations (AWO), also known as Low Visibility Operations (LVO), include flight crew training requirements. The necessary environmental infrastructure that is essential so that aircraft can be operated in low cloud, fog and other meteorological conditions that result in low visibilities, is also explained.

Sections 2 and 3 of this Appendix cover the formal Regulatory requirements published in EU-OPS1 regarding AOM & AWOPS. Their *Means of Compliance* are presented in Sections 4 and 5.

For ease of reference, the various steps on the way to an AWO/LVO authorisation and the necessary operational infrastructure are then mentioned in Section 3 under the assorted headings that need to be addressed, below which may be found paraphrased, a collated consolidation of the necessary requirements that need to be met before operations in less than Cat 1 conditions may be carried out.

EU-OPS are an updated transposition of JAR-OPS into EU Law.

Summarising the differences between JAR-OPS and EU-OPS:

- EU-OPS 1 was implemented as an amendment to Annex III to EG regulation 3922/1991.
- EU-OPS 1 has become effective in all EU member states, plus Norway, Iceland and Switzerland.
- JAR-OPS 1 will remain effective in all other JAA countries.
- There are major changes on Cabin Crew training, All Weather Operations (AWO), carriage of Emergency Locator transmitters (ELTs) and Flight Times Limitations (FTL).
- New Sub part Q (Flight Times Limitations) are also known as EU-FTL.

Amended Regulations will be published as EASA-OPS in 2012. There are differences between JAR-OPS and EU-OPS but fewer differences between EU-OPS and what will become EASA-OPS. Meanwhile, JAR-OPS 1 now known as EU-OPS 1 became Law in July 2008 for all EC aircraft operations.

The underlying requirements for the operation of aircraft in the EC as held in EU-OPS are derived from JAR-OPS 1, 2, 3 & 4. The new requirements might not be reflected in exactly the same terms but will have precisely the same intent, having been sourced from JAA Legislation.

IN PARTICULAR: In this Specialist Document, references to sources derived from the Joint Aviation (Airworthiness) Authority (JAA) material will become EASA Law in early 2012; well after this document has been published. It is intended that an updated issue, reflecting EASA requirements where different, will be published in due course.

Until such time as JAR-OPS regulations have been fully transcribed into EU-OPS, all other applicable references to JAR-OPS will be read to mean EU-OPS. The citing of legislation throughout this Document is only indicative; hence readers should consult the 'Source documents' to confirm the current amendment status.

This Appendix contains the underpinning EASA Legislation upon which Aerodrome Operating Minima (AOM) calculations are based. It also introduces the necessary EASA requirements for All Weather Operations (AWO or AWOPS) applicable to all Low visibility Operations (LVO) within the European Community.

The EASA Regulations hereunder refer to AWOPS operations in general. They also apply to the application of AOM and on how pilots are to operate within them. If necessary, pilots may calculate appropriate AOM using the given limiting parameters. Proprietary Flight Guides such as those produced by Jeppesen & Thales/Aerad and other similar providers usually contain a Chapter that deals with said calculations. The subject is covered here nonetheless, for ease of reference. It will be noted that AOM limitations are not only applicable to UK Commercial Air Transport operations, but they are also applicable to all other aircraft, including non-UK registered aircraft operated into and out of UK aerodromes. State Minima that override any self-calculated AOM apply in some Countries such as the USA and France.

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With AERODROME OPERATING MINIMA (AOM) - (In Full for ease of reference)**

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3. OPS 1.440 - Low Visibility Operations — General Operating Rules
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Extracts are from the current EASA OPS 1 - SUB PART E 'ALL WEATHER OPERATIONS'
(Including OPS 1.430 Aerodrome Operating Minima (AOM) and Appendices (Old & New) to OPS 1.1430))

The text in this Appendix is reproduced verbatim from current EASA legislation.

Occasionally, a bracketed (*Editor's Comment:*) is introduced for clarification, as are occasional additional words (*again in brackets and in italics*), to assist with understanding the intent of the sentence. Some very long sentences (*presented in italics*) are exactly as originally drafted because changing the sentence, or adding any bracketed comments to help comprehension, are well nigh impossible to provide without approval from EASA.

SECTION 1 - The European Community (EC), the European Aviation Safety Agency (EASA) & EU-OPS

This Document addresses the requirements of the new EU-OPS-1 Regulatory document that replaces JAA/EU-OPS 1 that is no longer in force. EU-OPS will be followed by EASA-OPS. The document also addresses *Advisory Circulars 'Joint' (ACJ)*, *Acceptable Means of Compliance (AMC)* and *Interpretative & Explanatory Material (IEM)* which refer. Where the European Aviation Safety Agency (EASA) has not yet published the relevant material, reference to EU-OPS will continue until such time as the transition to all-EASA documentation is completed.

From April 2012 a new set of regulations come into force being 'EASA-OPS'. In most areas there will be little or no change from EU OPS but EASA OPS applies to all professional flying including Business Jet Operations and the operations of Professional Aviation Training Organisations. For example FTL schemes are required for this category of operators. The same thing applies to FCL matters.

EU-OPS 1 applies to all flight operations in the European Community (EC) by the Member States that have signed the 'Arrangements Concerning the Development and the Acceptance of Joint Aviation Requirements'. The EC Countries are:

Albania, Armenia, Austria, [Azerbaijan], Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, European Aviation Safety Agency, Finland, the Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, Republic of Moldova, [Republic of Georgia], Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine & the United Kingdom. States shown in brackets thus [xxxx] are in the process of joining the Community. Iceland, Norway and Switzerland though not part of the EC, have voluntarily agreed to adopt the EASA regulatory umbrella, having signed a governmental agreement to enact all EASA legislation in their own countries.



At the time of going to press European Flight Operations are governed by EU-OPS but the European Community has decided that from April 2012 both Flight Operations and Flight Crew Licensing regulation will become the responsibility of the European Aviation Safety Agency (EASA). EASA has already produced draft requirements which are currently under consultation with industry and other stakeholders and expects to promulgate these during 2010. EASA Regulations are based largely on EU-OPS and EU-FCL.

END OF SECTION 1

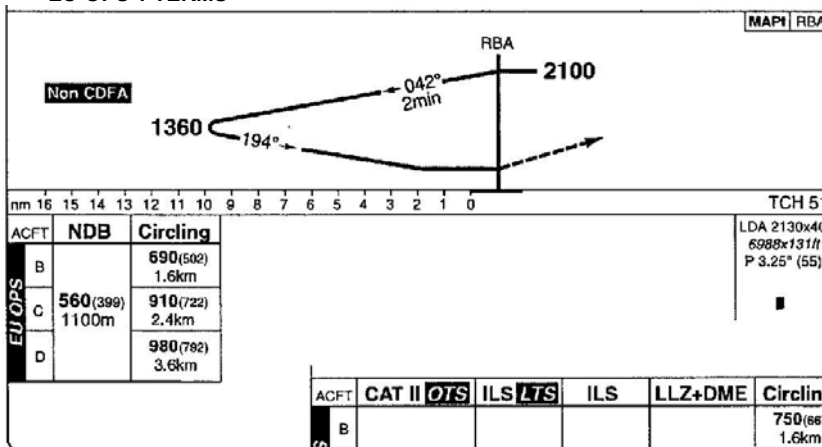
SECTION 2 - EU-OPS 1 REGULATIONS (Subpart E) – ALL WEATHER OPERATIONS (AWO)
With AERODROME OPERATING MINIMA (AOM) - (In Full for ease of reference)

2.1 Preamble - Presentation of EU-OPS1 Subpart E - Aerodrome Operating Minima (AOM)

- Minima according to Appendix 1 (**New**) is introduced in combination with the introduction of *Navtech aérochart*, and is indicated with the symbol EU-OPS. JAR OPS (EU OPS Appendix 1 **Old**) will be presented on a separate page (E.G., page 52-1, 52-2 etc.).
- Minima values based on Stabilised Approach (SAp) and Continuous Descent Final Approach (CDFA) techniques.
- When not applying the CDFA technique, published RVR value has to be increased with 200m for CAT A/B aircraft and 400m for CAT C/D aircraft.
- Procedures marked with **Non CDFA** symbol will have the 200m / 400m add-on in the published value (no further increase necessary).
- ILS CAT I procedure with a published RVR value lower than 750m to runways without RCLL and RTZL requires an approved HUDLS or AP or FD. Otherwise lowest permissible RVR value is 750m. Conditions are given in the chart with a note: [**@**HUDLS, FD or AP required, if not, RVR=750m].
- The minima (ILS **LTS** CAT I Lower Than Standard) requires: - LVP in force
 - Autoland or HUDLS
 - Aerodrome ILS certified to: Class I/T/1 for RVR down to 450m or
 Class II/D/2 + RCLL or RTZL for RVR down to 400m
- The minima (ILS **OTS** CAT II Other Than Standard) requires:
 - LVP in force
 - Autoland or HUDLS
 - Aerodrome ILS certified to: Class I/T/1 for RVR down to 450m, or
 Class II/D/2 + RCLL for RVR down to 350m
- Minima for ILS **LTS** and CAT II **OTS** are only shown when airport facilities (approach lights and ILS classification) are officially prescribed (in AIP or other official source).

Examples

EU-OPS 1 TERMS



ACFT	CAT II OTS	ILS LTS	ILS	LLZ+DME	Circling	DME ABC	3° ALT	LDA 2400
B					750(667) 1.6km	11.2	3500	7874x14 P 3° [5]
C	115 450m	230(200) 450m	230(200) 550m	380(359) 900m	850(767) 2.4km	9	2790	
D					850(767) 3.6km	7	2150	
						5	1510	
						4	1190	
						3	870	
						2	550	
						1.5	380	

2.1.1 OPS 1.430 - AERODROME OPERATING MINIMA - (also see Appendix 1 Old & New to OPS 1.430)

GENERAL

- (a)1. An operator shall establish, for each aerodrome planned to be used, aerodrome operating minima that are not lower than the values given in Appendix 1(Old) or Appendix 1 (New) as applicable. The method of determination of such minima must be acceptable to the Authority. Such minima shall not be lower than any that may be established for such aerodromes by the State in which the aerodrome is located, except when specifically approved by that State. The use of HUD, HUDLS or EVS may allow operations with lower visibilities than normally associated with the aerodrome operating minima. States which promulgate aerodrome operating minima may also promulgate regulations for reduced visibility minima associated with the use of HUD or EVS.

- (a)2 Notwithstanding paragraph (a)1 above, in-flight calculation of minima for use at unplanned alternate aerodromes and/or for approaches utilising EVS shall be carried out in accordance with a method acceptable to the Authority.
- (b) In establishing the aerodrome operating minima which will apply to any particular operation, an operator must take full account of:
1. The type, performance and handling characteristics of the aeroplane;
 2. The composition of the flight crew, their competence and experience;
 3. The dimensions and characteristics of the runways which may be selected for use;
 4. The adequacy and performance of the available visual and non-visual ground aids (See Appendix 1 (New) to OPS 1.430 Table 6a);
 5. The equipment available on the aeroplane for the purpose of navigation and/or control of the flight path, as appropriate, during the take-off, the approach, the flare, the landing, roll-out and the missed approach;
 6. The obstacles in the approach, missed approach and the climb-out areas required for the execution of contingency procedures and necessary clearance;
 7. The obstacle clearance altitude/height for the instrument approach procedures;
 8. The means to determine and report meteorological conditions; and
 9. The flight technique to be used during the final approach.
- (c) The aeroplane categories referred to in this Subpart must be derived in accordance with the method given in Appendix 2 to OPS 1.430 (c).
- (d)1 All approaches shall be flown as stabilised approaches (SAp), unless otherwise approved by the Authority for a particular approach to a particular runway.
- (d)2 All non-precision approaches shall be flown using the continuous descent final approaches (CDFA) technique, unless otherwise approved by the Authority for a particular approach to a particular runway. When calculating the minima in accordance with Appendix 1 (New), the operator shall ensure that the applicable minimum RVR is increased by 200 metres (m) for Cat A/B aeroplanes and by 400 m for Cat C/D aeroplanes for approaches not flown using the CDFA technique, providing that the resulting RVR/CMV value does not exceed 5,000 m.
- (d)3 Notwithstanding the requirements in (d)2 above, an Authority may exempt an operator from the requirement to increase the RVR when not applying the CDFA technique.
- (d)4 Exemptions as described in paragraph (d)3 must be limited to locations where there is a clear public interest to maintain current operations. The exemptions must be based on the operator's experience, training programme and flight crew qualification. The exemptions must be reviewed at regular intervals and must be terminated as soon as facilities are improved to allow application of the CDFA technique.
- (e)1 An operator must ensure that either Appendix 1 (Old) or Appendix 1 (New) to OPS 1.430 is applied. However, an operator must ensure that Appendix 1 (New) to OPS 1.430 is applied not later than three years after publication date.**
- (e)2 Notwithstanding the requirements in (e)1. above, an Authority may exempt an operator from the requirement to increase the RVR above 1 500 m (Cat A/B aeroplanes) or above 2 400 m (Cat C/D aeroplanes), when approving an operation to a particular runway where it is not practicable to fly an approach using the CDFA technique or where the criteria in paragraph (c) of Appendix 1 (New) to OPS 1.430 cannot be met.**
- (e)3 Exemptions as described in paragraph (e)2 must be limited to locations where there is a clear public interest to maintain current operations. The exemptions must be based on the operator's experience, training programme and flight crew qualification. The exemptions must be reviewed at regular intervals and must be terminated as soon as facilities are improved to allow application of the CDFA technique.

2.1.2 OPS 1.435 – TERMINOLOGY

- (a) Terms used in this Subpart have the following meaning:
1. **Circling:** The visual phase of an instrument approach to bring an aircraft into position for landing on a runway which is not suitably located for a straight-in approach.
 2. **Low Visibility Procedures (LVP):** Procedures applied at an aerodrome for the purpose of ensuring safe operations during Lower than Standard Category I, Other than Standard Category II, Category II and III approaches and low visibility take-offs.
 3. **Low Visibility Take-Off (LVTO):** A take-off where the Runway Visual Range (RVR) is less than 400m.

4. **Flight control system:** A system which includes an automatic landing system and/or a hybrid landing system.
5. **Fail-Passive flight control system:** A flight control 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 flight control system the pilot assumes control of the aeroplane after a failure.
6. **Fail-Operational flight control system:** A flight control system is fail-operational if, in the event of a failure below alert height, the approach, flare and landing, can be completed automatically. In the event of a failure, the automatic landing system will operate as a fail-passive system.
7. **Fail-Operational hybrid landing system:** A system which consists of a primary fail-passive automatic landing system and a secondary independent guidance system enabling the pilot to complete a landing manually after failure of the primary system.
Note: A typical secondary independent guidance system consists of a monitored head-up display providing guidance which normally takes the form of command information but it may alternatively be situation (or deviation) information.
8. **Visual Approach:** An approach when either part or all of an instrument approach procedure is not completed and the approach is executed with visual reference to the terrain.
9. **Continuous descent final approach (CDFA):** A specific technique for flying the final-approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the Final Approach Fix altitude / height to a point approximately 15 m (50 feet) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aeroplane flown.
10. **Stabilised approach (SAP):** An approach which is flown in a controlled and appropriate manner in terms of configuration, energy and control of the flight path from a pre-determined point or altitude/height down to a point 50 feet above the threshold or the point where the flare manoeuvre is initiated if higher.
11. **Head-up display (HUD):** A display system which presents flight information into the pilot's forward external field of view and which does not significantly restrict the external view.
12. **Head-up guidance landing system (HUDLS):** The total airborne system which provides head-up guidance to the pilot during the approach and landing and/or go-around. It includes all sensors, computers, power supplies, indications and controls. A HUDLS is typically used for primary **approach guidance to decision heights of 50 ft.**
13. **Hybrid head-up display landing system (hybrid HUDLS):** A system which consists of a primary fail-passive automatic landing system and a secondary independent HUD/HUDLS enabling the pilot to complete a landing manually after failure of the primary system.
Note: Typically, the secondary independent HUD/HUDLS provides guidance which normally takes the form of command information, but it may alternatively be situation (or deviation) information.
14. **Enhanced vision system (EVS):** An electronic means of displaying a real-time image of the external scene, through the use of imaging sensors.
15. **Converted meteorological visibility (CMV):** A value (equivalent to an RVR) which is derived from the reported meteorological visibility, as converted in accordance with the requirements in this subpart.
16. **Lower than Standard Category I Operation:** A Category I Instrument Approach and Landing Operation using Category I DH, with an RVR lower than would normally be associated with the applicable DH.
17. **Other than Standard Category II Operation:** A Category II Instrument Approach and Landing Operation to a runway where some or all of the elements of the ICAO Annex 14 Precision Approach Category II lighting system are not available.
18. **GNSS landing system (GLS):** An approach operation using augmented GNSS information to provide guidance to the aircraft based on its lateral and vertical GNSS position. (It uses geometric altitude reference for its final approach slope).

2.1.3 OPS 1.440 - LOW VISIBILITY OPERATIONS - GENERAL OPERATING RULES (also see Appendix 1 to 1.440)

- (a) An operator shall not conduct Category II or III operations unless:
 1. Each aeroplane concerned is certificated for operations with decision heights below 200 ft, or no decision height, and equipped in accordance with CS-AWO on all weather operations or an equivalent accepted by the Authority;
 2. A suitable system for recording approach and/or automatic landing success and failure is established and maintained to monitor the overall safety of the operation;
 3. The operations are approved by the Authority;
 4. The flight crew consists of at least 2 pilots; and

5. Decision Height is determined by means of a radio altimeter.
- (b) **An operator shall not conduct low visibility take-offs in less than 150 m RVR (Category A, B and C aeroplanes) or 200 m RVR (Category D aeroplanes) unless approved by the Authority.**
- (c) An operator shall not conduct lower than Standard Category I operations unless approved by the Authority.

2.1.4 OPS 1.445 - LOW VISIBILITY OPERATIONS - Aerodrome Considerations

- (a) An operator shall not use an aerodrome for Category II or III operations unless the aerodrome is approved for such operations by the State in which the aerodrome is located.
- (b) An operator shall verify that Low Visibility Procedures (LVP) have been established, and will be enforced, at those aerodromes where low visibility operations are to be conducted.

2.1.5. OPS 1.450 - LOW VISIBILITY OPERATIONS - Training and Qualifications (also see Appendix 1 to OPS 1.450)

An operator shall ensure that, prior to conducting low visibility take-off lower than Standard Category I, other than Standard Category II, Category II and III operations or approaches utilising EVS:

- (a) 1. Each flight crew member:
- (i) Completes the training and checking requirements prescribed in Appendix 1, including Flight simulator training in operating to the limiting values of RVR/CMV and Decision Height appropriate to the operator's approval; and
 - (ii) Is qualified in accordance with Appendix 1;
2. The training and checking is conducted in accordance with a detailed syllabus approved by the Authority and included in the Operations Manual. This training is in addition to that prescribed in Subpart N; and
3. The flight crew qualification is specific to the operation and the aeroplane type.

2.1.6 OPS 1.455 - LOW VISIBILITY OPERATIONS - Operating Procedures (also see Appendix 1 to OPS 1.455)

- (a) An operator must establish procedures and instructions to be used for low visibility take-off, approaches utilising EVS, Lower than Standard Category I, other than Standard Category II, Category II and III operations. These procedures must be included in the Operations Manual and contain the duties of flight crew members during taxiing, take-off, approach, flare, landing, roll-out and missed approach as appropriate.
- (b) The commander shall satisfy himself/herself that:
- 1. The status of the visual and non-visual facilities is sufficient prior to commencing a low visibility take-off, an approach utilising EVS, a lower than Standard Category I, an other than Standard Category II, or a Category II or III approach;
 - 2. Appropriate LVPs are in force according to information received from Air Traffic Services, before commencing a low visibility take-off, a lower than Standard Category I, an other than Standard Category II, or a Category II or III approach; and
 - 3. The flight crew members are properly qualified prior to commencing a low visibility take-off in an RVR of less than 150 m (Category A, B and C aeroplanes) or 200 m (Cat D aeroplanes), an approach utilising EVS, a lower than Standard Category I, an other than Standard Category II or a Category II or III approach.

2.1.7 OPS 1.460 - LOW VISIBILITY OPERATIONS — Minimum Equipment

- (a) An operator must include in the Operations Manual the minimum equipment that has to be serviceable at the commencement of a low visibility take-off, or a lower than Standard Category I approach, or an other than Standard Category II approach, or an approach utilising EVS, or a Category II or III approach, in accordance with the AFM or other approved document.
- (b) The commander shall satisfy himself/herself that the status of the aeroplane and of the relevant airborne systems is appropriate for the specific operation to be conducted.

2.1.8 OPS 1.465 - VFR OPERATING MINIMA (also see Appendix 1 to OPS 1.465)

- (a) An operator shall ensure that:
- 1. VFR flights are conducted in accordance with the Visual Flight Rules and in accordance with the Table in Appendix 1 to OPS 1.465.
 - 2. Special VFR flights are not commenced when the visibility is less than 3 km and not otherwise conducted when the visibility is less than 1.5 km.

2.2 APPENDIX 1 (Old) to OPS 1.430 - AERODROME OPERATING MINIMA

(a) Take-off Minima

1. General

- (i) Take-off minima established by the operator must be expressed as visibility or RVR limits, taking into account all relevant factors for each aerodrome planned to be used and the aeroplane characteristics. Where there is a specific need to see and avoid obstacles on departure and/or for a forced landing, additional conditions (e.g. ceiling) must be specified.
- (ii) The commander shall not commence take-off unless the weather conditions at the aerodrome of departure are equal to or better than applicable minima for landing at that aerodrome, unless a suitable take-off alternate aerodrome is available.

Editor's note: Return Alternate mentioned elsewhere in this document means the same as the term Take-off alternate used in EU-OPS.

- (iii) When the reported meteorological visibility is below that required for take-off and RVR is not reported, a take-off may only be commenced if the commander can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.
- (iv) When no reported meteorological visibility or RVR is available, a take-off may only be commenced if the commander can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.

- 2. **Visual reference.** The take-off minima must be selected to ensure sufficient guidance to control the aeroplane in the event of both a discontinued take-off in adverse circumstances and a continued take-off after failure of the critical power unit.

3. Required RVR/Visibility

Table 1 – Take-off RVR / Visibility	
Facilities	RVR/Visibility (See Note 3)
Nil (Day only)	500 m
Runway edge lighting and/or centreline marking	250/300 m (Notes 1 and 2)
Runway edge & centreline lights	200/250 m (Note 1)
Runway edge and centreline lighting + multiple RVR readings	150/200 m (Notes 1 and 4)
<p><i>Note 1:</i> The higher values apply to Category D aeroplanes.</p> <p><i>Note 2:</i> For night operations at least runway edge and runway end lights are required.</p> <p><i>Note 3:</i> The reported RVR/Visibility value representative of the initial part of the take-off run can be replaced by pilot assessment.</p> <p><i>Note 4:</i> The required RVR value must be achieved for all of the relevant RVR reporting points with the exception given in Note 3 above.</p>	

Comparable Values of RVR & Ground Visibility		
RVR Feet	Visibility Statute Miles	Equivalent RVR Meters
1600	1/4	500
2000	3/8	600
2400	1/2	700
3200	5/8	950
4000	3/4	1,200
4500	7/8	1,350
5000	1	1,500
6000	1¼	2,000

- (i) For multi-engine aeroplanes, whose performance is such that, in the event of a critical power unit failure at any point during take-off, the aeroplane can either stop or continue the take-off to a height of 1,500 ft above the aerodrome while clearing obstacles by the required margins, the take-off minima established by an operator must be expressed as RVR/Visibility values not lower than those given in Table 1 below, except as provided in paragraph (4) below:
- (ii) For multi-engine aeroplanes whose performance is such that they cannot comply with the performance conditions in subparagraph (a)(3)(i) above in the event of a critical power unit failure, there may be a need to re-land immediately and to see and avoid obstacles in the take-off area. Such aeroplanes may be operated to the following take-off minima, provided they are able to comply with the applicable obstacle clearance criteria, assuming engine failure at the height specified. The take-off minima established by an operator must be based upon the height from which the one engine inoperative net take-off flight path can be constructed. The RVR minima used may not be lower than either of the values given in Table 1 above or Table 2 below.

Table 2 - Assumed engine failure height above the runway versus RVR/Visibility

Take-off RVR/Visibility — Flight path	
Assumed engine failure height above the take-off runway	RVR/Visibility (Note 2)
< 50 ft	200 m
51-100 ft	300 m
101-150 ft	400 m
151-200 ft	500 m
201-300 ft	1,000 m
> 300 ft	1,500 m (Note 1)
Note 1: 1,500 m is also applicable if no positive take-off flight path can be constructed. Note 2: The reported RVR/Visibility value representative of the initial part of the take-off run can be replaced by pilot assessment.	

(iii) When reported RVR, or meteorological visibility is not available, the commander shall not commence take-off unless he/she can determine that the actual conditions satisfy the applicable take-off minima.

4. **Exceptions to paragraph (a)(3)(i) above:**

(i) Subject to the approval of the Authority and provided the requirements in sub-headings (A) to (E) below have been satisfied, an operator may reduce the take-off minima to 125 m RVR (Category A, B and C aeroplanes) or 150 m RVR (Category D aeroplanes) when:

- (A) Low Visibility Procedures are in force;
- (B) High intensity runway centreline lights spaced 15 m or less and high intensity edge lights spaced 60 m or less are in operation;
- (C) Flight crew members have satisfactorily completed training in a Flight Simulator;
- (D) A 90 m visual segment is available from the cockpit at the start of the take-off run; and
- (E) The required RVR value has been achieved for all of the relevant RVR reporting points.

(ii) Subject to the approval of the Authority, an operator of an aeroplane using an approved lateral guidance system for take-off may reduce the take-off minima to an RVR less than 125 m (Category A, B and C aeroplanes) or 150 m (Category D aeroplanes) but not lower than 75 m, provided runway protection and facilities equivalent to Category III landing operations are available.

(b) **Non-Precision Approach**

1. **System minima**

(i) An operator must ensure that system minima for non-precision approach procedures, which are based upon the use of ILS without glide path (LLZ only), VOR, NDB, SRA and VDF are not lower than the MDH values given in Table 3 below.

Table 3 - System minima for non-precision approach aids

System minima		System minima	
Facility	Lowest MDH	Facility	Lowest MDH
ILS (no glide path — LLZ)	250 ft	VOR	300 ft
SRA (terminating at 1/2 NM)	250 ft	VOR/DME	250 ft
SRA (terminating at 1 NM)	300 ft	NDB	300 ft
SRA (terminating at 2 NM)	350 ft	VDF (QDM & QGH)	300 ft

2. **Minimum Descent Height.**

An operator must ensure that the minimum descent height for a non-precision approach is not lower than either:

- (i) The OCH/OCL for the category of aeroplane; or
- (ii) The system minimum.

3. **Visual Reference.**

A pilot may not continue an approach below MDA/MDH unless at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

- (i) Elements of the approach light system;
- (ii) The threshold;
- (iii) The threshold markings;
- (iv) The threshold lights;
- (v) The threshold identification lights;
- (vi) The visual glide slope indicator;
- (vii) The touchdown zone or touchdown zone markings;
- (viii) The touchdown zone lights;
- (ix) Runway edge lights; or
- (x) Other visual references accepted by the Authority.

4. **Required RVR.** The lowest minima to be used by an operator for non-precision approaches are:

Table 4a - RVR for non-precision approach — full facilities

Non-precision approach minima Full facilities (Notes (1), (5), (6) and (7))				
MDH	RVR/Aeroplane Category			
	A	B	C	D
250-299 ft	800 m	800 m	800 m	1 200 m
300-449 ft	900 m	1,000 m	1,000 m	1,400 m
450-649 ft	1,000 m	1,200 m	1,200 m	1,600 m
650 ft and above	1,200 m	1,400 m	1,400 m	1,800 m

Table 4 b- RVR for non-precision approach — intermediate facilities

Non-precision approach minima Intermediate facilities (Notes (2), (5), (6) and (7))				
MDH	RVR/Aeroplane Category			
	A	B	C	D
250-299 ft	1,000 m	1,100 m	1,200 m	1,400 m
300-449 ft	1,200 m	1,300 m	1,400 m	1,600 m
450-649 ft	1,400 m	1,500 m	1,600 m	1,800 m
650 ft and above	1,500 m	1,500 m	1,800 m	2,000 m

Table 4c - RVR for non-precision approach — basic facilities

Non-precision approach minima Basic facilities (Notes (3), (5), (6) and (7))				
MDH	RVR/Aeroplane Category			
	A	B	C	D
250-299 ft	1,200 m	1,300 m	1,400 m	1,600 m
300-449 ft	1,300 m	1,400 m	1,600 m	1,800 m
450-649 ft	1,500 m	1 500 m	1 800 m	2,000 m
650 ft and above	1,500 m	1,500 m	2,000 m	2,000 m

Table 4d - RVR for non-precision approach — Nil approach light facilities

Non-precision approach minima Nil approach light facilities (Notes (4), (5), (6) and (7))				
MDH	RVR/Aeroplane Category			
	A	B	C	D
250-299 ft	1,500 m	1,500 m	1,600 m	1,800 m
300-449 ft	1,500 m	1,500 m	1,800 m	2,000 m
450-649 ft	1,500 m	1,500 m	2,000 m	2,000 m
650 ft and above	1,500 m	1,500 m	2,000 m	2,000 m

- Note 1:* Full facilities comprise runway markings, 720 m or more of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.
- Note 2:* Intermediate facilities comprise runway markings, 420-719 m of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.
- Note 3:* Basic facilities comprise runway markings, <420 m of HI/MI approach lights, any length of LI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.
- Note 4:* Nil approach light facilities comprise runway markings, runway edge lights, threshold lights, runway end lights, or no lights at all.
- Note 5:* The tables are only applicable to conventional approaches with a nominal descent slope of not greater than 4°. Greater descent slopes will usually require that visual glide slope guidance (e.g. PAPI) is also visible at the Minimum Descent Height.
- Note 6:* The above figures are either reported RVR or meteorological visibility converted to RVR, as in subparagraph (h) below.
- Note 7:* The MDH mentioned in Table 4a, 4b, 4c and 4d refers to the initial calculation of MDH. When selecting the associated RVR, there is no need to take account of a rounding up to the nearest ten feet, which may be done for operational purposes, e.g. conversion to MDA.

5. **Night operations.** For night operations at least runway edge, threshold & runway end lights must be on.

(c) **Precision Approach — Category I Operations**

1. **General.** A Category I operation is a precision instrument approach and landing using ILS, MLS or PAR with a decision height not lower than 200 ft & with a runway visual range not less than 550 m.
2. **Decision Height:** An operator must ensure that the decision height to be used for a Category I precision approach is not lower than:
 - (i) The minimum decision height specified in the Aeroplane Flight Manual (AFM) if stated;
 - (ii) The minimum height to which the precision approach aid can be used without the required visual reference;
 - (iii) The OCH/OCL for the category of aeroplane; or
 - (iv) 200 ft.
3. **Visual Reference.** A pilot may not continue an approach below the Category I decision height, determined in accordance with subparagraph (c)(2) above, unless at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:
 - (i) Elements of the approach light system;
 - (ii) The threshold;
 - (iii) The threshold markings;
 - (iv) The threshold lights;
 - (v) The threshold identification lights;
 - (vi) The visual glide slope indicator;
 - (vii) The touchdown zone or touchdown zone markings;
 - (viii) The touchdown zone lights; or
 - (ix) Runway edge lights.
4. **Required RVR.** The lowest minima to be used by an operator for Category I operations are:

Table 5 - RVR for Cat I approach v/s facilities and DH

Category I minima				
DECISION HEIGHT (Note 7)	Facilities / RVR (Note 5)			
	FULL (Notes 1 and 6)	INTERIM (Notes 2 and 6)	BASIC (Notes 3 and 6)	NIL (Notes 4 and 6)
200 ft	550 m	700 m	800 m	1,000 m
201-250 ft	600 m	700 m	800 m	1,000 m
251-300 ft	650 m	800 m	900 m	1,200 m
301 ft and above	800 m	900 m	1,000 m	1,200 m

Note 1: Full facilities comprise runway markings, 720 m or more of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Note 2: Intermediate facilities comprise runway markings, 420-719 m of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Note 3: Basic facilities comprise runway markings, <420 m of HI/MI approach lights, any length of LI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Note 4: Nil approach light facilities comprise runway markings, runway edge lights, threshold lights, runway end lights, or no lights at all.

Note 5: The above figures are either the reported RVR or meteorological visibility converted to RVR in accordance with paragraph (h).

Note 6: The Table is applicable to conventional approaches with a glide slope angle up to and including 4° (degree).

Note 7: The DH mentioned in the Table 5 refers to the initial calculation of DH. When selecting the associated RVR, there is no need to take account of a rounding up to the nearest ten feet, which may be done for operational purposes, (e.g. conversion to DA).

5. **Single pilot operations.** For single pilot operations, an operator must calculate the minimum RVR for all approaches in accordance with OPS 1.430 and this Appendix. An RVR of less than 800 m is not permitted except when using a suitable autopilot coupled to an ILS or MLS, in which case normal minima apply. The Decision Height applied must not be less than 1.25 x the minimum use height for the autopilot.
6. **Night operations.** For night operations at least runway edge, threshold and runway end lights must be on.

(d) **Precision Approach — Category II Operations**

1. **General.** A Category II operation is a precision instrument approach and landing using ILS or MLS with:
 - (i) A decision height below 200 ft but not lower than 100 ft; and
 - (ii) A runway visual range of not less than 300 m.
2. **Decision Height.** An operator must ensure that the decision height for a Category II operation is not lower than:
 - (i) The minimum decision height specified in the AFM, if stated;
 - (ii) The minimum height to which the precision approach aid can be used without the required visual reference;
 - (iii) The OCH/OCL for the category of aeroplane;
 - (iv) The decision height to which the flight crew is authorised to operate; or
 - (v) 100 ft.
3. **Visual reference.** A pilot may not continue an approach below the Category II decision height determined in accordance with subparagraph (d)(2) above unless visual reference containing a segment of at least 3 consecutive lights being the centre line of the approach lights, or touchdown zone lights, or runway centre line 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 barrette of the touchdown approach lighting; such as an approach lighting crossbar, or the landing threshold, or a barrette of the touchdown zone lighting.
4. **Required RVR.** The lowest minima to be used by an operator for Category II operations are:

Table 6 - RVR for Cat II approach v/s DH

Category II minima

DECISION HEIGHT	Auto-coupled to below DH (see Note 1)	
	RVR/Aeroplane Category A, B & C	RVR/Aeroplane Category D
100 ft-120 ft	300 m	300 m (Note 2) / 350 m
121 ft-140 ft	400 m	400 m
141 ft and above	450 m	450 m

Note 1: The reference to 'auto-coupled to below DH' in this table means continued use of the automatic flight control system down to a height which is not greater than 80% of the applicable DH. Thus airworthiness requirements may, through minimum engagement height for the automatic flight control system, affect the DH to be applied.

Note 2: 300 m may be used for a Category D aeroplane conducting an auto land.

(e) Precision Approach — Category III Operations

1. **General.** Category III operations are subdivided as follows:

- (i) Category IIIA operations. A precision instrument approach and landing using ILS or MLS with:
 - (A) A decision height lower than 100 ft; and
 - (B) A runway visual range not less than 200 m.
- (ii) Category IIIB operations. A precision instrument approach and landing using ILS or MLS with:
 - (A) A decision height lower than 50 ft, or no decision height; and
 - (B) A runway visual range lower than 200 m but not less than 75 m.

Note: Where the decision height (DH) and runway visual range (RVR) do not fall within the same category, the RVR will determine in which category the operation is to be considered.

2. **Decision Height.** For operations in which a decision height is used, an operator must ensure that the decision height is not lower than:

- (i) The minimum decision height specified in the AFM, if stated;
- (ii) The minimum height to which the precision approach aid can be used without the required visual reference; or
- (iii) The decision height to which the flight crew is authorised to operate.

3. **No Decision Height Operations.** Operations with no decision height may only be conducted if:

- (i) The operation with no decision height is authorised in the AFM;
- (ii) The approach aid and the aerodrome facilities can support operations with no decision height; and
- (iii) The operator has an approval for CAT III operations with no decision height.

Note: In the case of a CAT III runway it may be assumed that operations with no decision height can be supported, unless specifically restricted as published in the AIP or NOTAM.

4. **Visual reference**

- (i) For Category IIIA operations, and for category IIIB operations with fail-passive flight control systems, a pilot may not continue an approach below the decision height determined in accordance with subparagraph (e)(2) above unless a visual reference containing a segment of at least 3 consecutive lights being the centreline of the approach lights, or touchdown zone lights, or runway centre line lights, or runway edge lights, or a combination of these is attained and can be maintained.
- (ii) For Category IIIB operations with fail-operational flight control systems using a decision height, a pilot may not continue an approach below the Decision Height, determined in accordance with subparagraph (e)(2) above, unless a visual reference containing at least one centreline light is attained and can be maintained.
- (iii) For Category III operations with no decision height there is no requirement for visual contact with the runway prior to touchdown.

5. **Required RVR.** The lowest minima to be used by an operator for Category III operations are:

Table 7 - RVR for Cat III approach v/s DH and roll-out control/guidance system

Category III minima			
APPROACH CATEGORY	DECISION HEIGHT (ft) (Note 3)	ROLL-OUT CONTROL GUIDANCE SYSTEM	RVR (m)
III A	Less than 100 ft	Not required	200 m (Note 1)
III B	Less than 100 ft	Fail-passive	150 m (Notes 1 and 2)
III B	Less than 50 ft	Fail-passive	125 m
III B	Less than 50 ft, or No Decision Height	Fail-operational	75 m

Note 1: Crew actions in case of autopilot failure at or below decision height in fail-passive Category III operations

Note 2: For aeroplanes certificated in accordance with CS-AWO on all weather operations 321(b)(3), see 321(b)(3) – (Installed Equipment) therein.

Note 3: Flight control system redundancy is determined under CS-AWO on all weather operations by the minimum certificated decision height.

(f) **Circling**

1. **The lowest minima to be used** by an operator for circling are:

Table 8 - Visibility and MDH for circling v/s aeroplane category

Aeroplane Category				
	A	B	C	D
MDH	400 ft	500 ft	600 ft	700 ft
Minimum meteorological visibility	1,500 m	1,600 m	2,400 m	3,600 m

2. **Circling with prescribed tracks** is an accepted procedure within the meaning of this paragraph

(g) **Visual Approach**

An operator shall not use an RVR of less than 800 m for a visual approach.

(h) **Conversion of Reported Meteorological Visibility to RVR**

- (1) An operator must ensure that a meteorological visibility to RVR conversion is not used for calculating take-off minima, Category II or III minima, or when a reported RVR is available.

Note: If the RVR is reported as being above the maximum value assessed by the aerodrome operator, e.g. 'RVR more than 1,500 metres', it is not considered to be a reported RVR in this context and the Conversion Table may be used.

- (2) When converting meteorological visibility to RVR in all other circumstances than those in subparagraph (h)(1) above, an operator must ensure that the following Table is used:

Table 9 - Conversion of visibility to RVR

Lighting elements in operation	RVR = Reported Met. Visibility x	
	Day	Night
HI approach and runway lighting	1.5	2.0
Any type of lighting installation other than above	1.0	1.5
No lighting	1.0	Not applicable

END of APPENDIX 1 (Old) to OPS 1.430 - Aerodrome Operating Minima in Section 2

2.3 APPENDIX 1 (New) to OPS 1.430 - AERODROME OPERATING MINIMA

(a) Take-off Minima

1. General

- (i) Take-off minima established by the operator must be expressed as visibility or RVR limits, taking into account all relevant factors for each aerodrome planned to be used and the aeroplane characteristics. Where there is a specific need to see and avoid obstacles on departure and/or for a forced landing, additional conditions (e.g. ceiling) must be specified.
- (ii) The commander shall not commence take-off unless the weather conditions at the aerodrome of departure are equal to or better than applicable minima for landing at that aerodrome, unless a suitable take-off alternate aerodrome is available.
- (iii) When the reported meteorological visibility is below that required for take-off and RVR is not reported, a take-off may only be commenced if the commander can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.
- (iv) When no reported meteorological visibility or RVR is available, a take-off may only be commenced if the commander can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.

2. Visual reference. The take-off minima must be selected to ensure sufficient guidance to control the aeroplane in the event of both a discontinued take-off in adverse circumstances and a continued take-off after failure of the critical power unit.

3. Required RVR/Visibility

- (i) For multi-engine aeroplanes, whose performance is such that, in the event of a critical power unit failure at any point during take-off, the aeroplane can either stop or continue the take-off to a height of 1,500 ft above the aerodrome while clearing obstacles by the required margins, the take-off minima established by an operator must be expressed as RVR/Visibility values not lower than those given in Table 1 below except as provided in paragraph (4) below:

Table 1 – RVR / Visibility for take-off

Take-off RVR / Visibility		Comparable Values of RVR & Ground Visibility		
Facilities	RVR/Visibility (See Note 3)	RVR Feet	Visibility Statute Miles	Equivalent RVR Meters
Nil (Day only)	500 m	1600	1/4	500
Runway edge lighting and/or centreline marking	250/300 m <i>(Notes 1 and 2)</i>	2000	3/8	600
Runway edge & centreline lights	200/250 m <i>(Note 1)</i>	2400	1/2	700
Runway edge and centreline lighting + multiple RVR readings	150/200 m <i>(Notes 1 and 4)</i>	3200	5/8	950
<i>Note 1: The higher values apply to Category D aeroplanes.</i>				
<i>Note 2: For night operations at least runway edge and runway end lights are required.</i>				
<i>Note 3: The reported RVR/Visibility value representative of the initial part of the take-off run can be replaced by pilot assessment.</i>				
<i>Note 4: The required RVR value must be achieved for all of the relevant RVR reporting points with the exception given in Note 3 above.</i>				
		4000	3/4	1,200
		4500	7/8	1,350
		5000	1	1,500
		6000	1¼	2,000

- (ii) For multi-engine aeroplanes whose performance is such that they cannot comply with the performance conditions in subparagraph (a)(3)(i) above in the event of a critical power unit failure, there may be a need to re-land immediately and to see and avoid obstacles in the take-off area. Such aeroplanes may be operated to the following take-off minima, provided they are able to comply with the applicable obstacle clearance criteria, assuming engine failure at the height specified. The take-off minima established by an operator must be based upon the height from which the one engine inoperative net take-off flight path can be constructed. The RVR minima used may not be lower than either of the values given in Table 1 above or Table 2 below.

Table 2 - Assumed engine failure height above the runway versus RVR/Visibility

Take-off RVR/Visibility — Flight path	
Assumed engine failure height above the take-off runway	RVR/Visibility (Note 2)
< 50 ft	200 m
51-100 ft	300 m
101-150 ft	400 m
151-200 ft	500 m
201-300 ft	1,000 m
> 300 ft	1,500 m (Note 1)
<p><i>Note 1:</i> 1,500 m is also applicable if no positive take-off flight path can be constructed.</p> <p><i>Note 2:</i> The reported RVR/Visibility value representative of the initial part of the take-off run can be replaced by pilot assessment.</p>	

(iii) When reported RVR, or meteorological visibility is not available, the commander shall not commence take-off unless he/she can determine that the actual conditions satisfy the applicable take-off minima.

4. **Exceptions to paragraph (a)(3)(i) above:**

(i) Subject to the approval of the Authority, and provided the requirements in sub-headings (A) to (E) below have been satisfied, an operator may reduce the take-off minima to 125 m RVR (Category A, B and C aeroplanes) or 150 m RVR (Category D aeroplanes) when:

- (A) Low Visibility Procedures are in force;
- (B) High intensity runway centreline lights spaced 15 m or less and high intensity edge lights spaced 60 m or less are in operation;
- (C) Flight crew members have satisfactorily completed training in a Flight Simulator;
- (D) A 90 m visual segment is available from the cockpit at the start of the take-off run; and
- (E) The required RVR value has been achieved for all of the relevant RVR reporting points.

(ii) Subject to the approval of the Authority, an operator of an aeroplane using either:

- (A) an approved lateral guidance system; or,
- (B) an approved HUD/HUDLS for take-off may reduce the take-off minima to an RVR less than 125 m (Category A, B and C aeroplanes) or 150 m (Category D Aeroplanes) but not lower than 75 m provided runway protection and facilities equivalent to Category III landing operations are available.

(b) **Category I - APV and non-precision approach operations**

1. **A Category I approach operation** is a precision instrument approach and landing using ILS, MLS, GLS (GNSS/GBAS) or PAR with a decision height not lower than 200 ft and with an RVR not less than 550 m, unless accepted by the Authority.
2. **A non-precision approach (NPA) operation** is an instrument approach using any of the facilities described in Table 3 (System minima), with a MDH or DH not lower than 250 ft and an RVR/CMV of not less than 750 m, unless accepted by the Authority.
3. **An APV operation** is an instrument approach which utilises lateral and vertical guidance, but does not meet the requirements established for precision approach and landing operations, with a DH not lower than 250 ft and a runway visual range of not less than 600m unless approved by the Authority.
4. **Decision height (DH).** An operator must ensure that the decision height to be used for an approach is not lower than:
 - (i) the minimum height to which the approach aid can be used without the required visual reference; or
 - (ii) the OCH for the category of aeroplane; or
 - (iii) the published approach procedure decision height where applicable; or
 - (iv) 200 ft for Category I approach operations; or
 - (v) the system minimum in Table 3; or

- (vi) the lowest decision height specified in the Aeroplane Flight Manual (AFM) or equivalent document, if stated; whichever is higher.
5. **Minimum descent height (MDH).** An operator must ensure that the minimum descent height for an approach is not lower than:
- (i) the OCH for the category of aeroplane; or
 - (ii) the system minimum in Table 3; or
 - (iii) the minimum descent height specified in the Aeroplane Flight Manual (AFM) if stated; whichever is higher.
6. **Visual reference.** A pilot may not continue an approach below DA/MDH unless at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:
- (i) elements of the approach light system;
 - (ii) the threshold;
 - (iii) the threshold markings;
 - (iv) the threshold lights;
 - (v) the threshold identification lights;
 - (vi) the visual glide slope indicator;
 - (vii) the touchdown zone or touchdown zone markings;
 - (viii) the touchdown zone lights;
 - (ix) runway edge lights; or
 - (x) other visual references accepted by the Authority.

Table 3 - System minima v/s facilities

System minima	
Facility	Lowest DH/ MDH
Localiser with or without DME	250 ft
SRA (terminating at 1/2 NM)	250 ft
SRA (terminating at 1 NM)	300 ft
SRA (terminating at 2 NM)	350 ft
RNAV/LNAV	300 ft
VOR	300 ft
VOR/DME	250 ft
NDB	350 ft
NDB/DME	300 ft
VDF	350 ft

(c) **Criteria for establishing RVR/Converted Met Visibility (Ref Table 6)**

1. **To qualify for the lowest allowable values of RVR/CMV detailed in Table 6** (applicable to each approach grouping) the instrument approach shall meet at least the following facility requirements and associated conditions:
- (i) Instrument approaches with designated vertical profile up to and including 4.5° for Category A and B aeroplanes, or 3.77° for Category C and D aeroplanes, unless other approach angles are approved by the Authority, where the facilities are:
 - (A) ILS/MLS/GLS/PAR; or
 - (B) APV; and

where the final approach track is offset by not more than 15° for Category A and B aeroplanes or by not more than 5° for Category C and D aeroplanes.
 - (ii) Instrument approaches flown using the CDFA technique with a nominal vertical profile, up to and including 4.5° for Category A and B aeroplanes, or 3.77° for Category C and D aeroplanes, unless other approach angles are approved by the Authority where the facilities are NDB, NDB/DME, VOR, VOR/DME, LLZ, LLZ/DME, VDF, SRA or NAV/LNAV, with a final-approach segment of at least 3NM, which also fulfil the following criteria:
 - (A) The final approach track is offset by not more than 15° for Category A and B aeroplanes or by not more than 5° for Category C and D aeroplanes; and
 - (B) The FAF or another appropriate fix where descent is initiated is available, or distance to THR is available by FMS/RNAV or DME; and
 - (C) If the MAPt is determined by timing, the distance from FAF to THR is ≤ 8 NM.

- (iii) Instrument approaches where the facilities are NDB, NDB/DME, VOR, VOR/DME, LLZ, LLZ/DME, VDF, SRA or RNAV/LNAV, not fulfilling the criteria in paragraph (c)1.(ii) above, or with an MDH \geq 1,200 ft.
 - 2. **The missed approach**, after an approach has been flown using the CDFA technique, shall be executed when reaching the decision altitude (height) or the MAPt, whichever occurs first. The lateral part of the missed approach procedure must be flown via the MAPt, unless otherwise stated on the approach chart.
- (d) **Determination of RVR/CMV/Visibility minima for Cat I, APV & non-precision approach operations**
1. **The minimum RVR/CMV/Visibility** shall be the highest of the values derived from Table 5 or Table 6 but not greater than the maximum values shown in Table 6, where applicable.
 2. **Values in Table 5** are derived from the formula below.
 Required RVR/visibility (m) = [(DH/MDH (ft) \times 0.3048)/tan α] – length of approach lights (m)
Note 1: α is the calculation angle, being a default value of 3.00 degrees increasing in steps
 3. **The formula may be used** with the approval of the Authority, with the actual approach slope and/or the actual length of the approach lights for a particular runway.
 4. **If the approach is flown with a level flight segment at or above MDA/H**, 200 metres shall be added for Cat A and B aeroplane and 400 metres for Cat C and D aeroplane to the minimum RVR/CMV value resulting from the application of Tables 5 and 6.
Note: The added value corresponds to the time/distance required to establish the aeroplane on the final descent.
 5. **An RVR of less than 750 m as indicated in Table 5 may be used:**
 - (i) for Category I approach operations to runways with FALS (see below), Runway Touchdown Zone Lights (RTZL) and Runway Centreline Lights (RCLL), provided that the DH is not more than 200 ft; or
 - (ii) for Category I approach operations to runways without RTZL and RCLL, when using an approved HUDLS, or equivalent approved system, or when conducting a coupled approach or flight-director-flown approach to a DH equal to or greater than 200 ft., the ILS must not be promulgated as a restricted facility; or
 - (iii) for APV approach operations to runways with FALS, RTZL and RCLL when using an approved HUD.
 6. **The Authority may approve RVR values lower than those given in Table 5**, for HUDLS and auto-land operations in accordance with paragraph (e) of this Appendix.
 7. **The visual aids** comprise standard runway day markings and approach and runway lighting (runway edge lights, threshold lights, runway end lights and in some cases also touch-down zone and/or runway centre line lights). The approach light configurations acceptable are classified and listed in Table 4 below.
 8. **Notwithstanding the requirements in paragraph (d)(7) above**, the authority may approve that RVR values relevant to a Basic Approach Lighting System (BALS) are used on runways where the approach lights are restricted in length below 210m due to terrain or water, but where at least one cross-bar is available.
 9. **For night operations** or for any operation where credit for runway and approach lights is required, the lights must be on and serviceable except as provided for in Table 6a.

Table 4 – Approach Light systems

OPS Class of Facility	Length, configuration and intensity of approach lights
FALS (full approach light system)	ICAO: Precision approach CAT I Lighting System (HIALS 720 m \geq) distance coded centreline, Barrette centreline
IALS (intermediate approach light system)	ICAO: Simple approach lighting system (HIALS 420-719 m) single source, Barrette
BALS (basic approach light system)	Any other approach lighting system (HIALS, MIALS or ALS 210-419 m)
NALS (no approach light system)	Any other approach lighting system (HIALS, MIALS or ALS < 210 m) or no approach lights

Table 5 - RVR/CMV (See Table 11) v. DH/MDH

DH or MDH			Class of Lighting Facility			
			FALS	IALS	BALS	NALS
			See paragraphs (d)5, (d)6 and (d)10 about RVR < 750 m			
Feet			Metres			
481	—	500	1 500	1 800	2 100	2 300
501	—	520	1 600	1 900	2 100	2 400
521	—	540	1 700	2 000	2 200	2 400
541	—	560	1 800	2 100	2 300	2 500
561	—	580	1 900	2 200	2 400	2 600
581	—	600	2 000	2 300	2 500	2 700
601	—	620	2 100	2 400	2 600	2 800
621	—	640	2 200	2 500	2 700	2 900
641	—	660	2 300	2 600	2 800	3 000
661	—	680	2 400	2 700	2 900	3 100
681	—	700	2 500	2 800	3 000	3 200
701	—	720	2 600	2 900	3 100	3 300
721	—	740	2 700	3 000	3 200	3 400
741	—	760	2 700	3 000	3 300	3 500
761	—	800	2 900	3 200	3 400	3 600
801	—	850	3 100	3 400	3 600	3 800
851	—	900	3 300	3 600	3 800	4 000
901	—	950	3 600	3 900	4 100	4 300
951	—	1 000	3 800	4 100	4 300	4 500
1 001	—	1 100	4 100	4 400	4 600	4 900
1 101	—	1 200	4 600	4 900	5 000	5 000
1 201 and above			5 000	5 000	5 000	5 000

Table 6 - Minimum and maximum applicable RVR/converted met visibility (see Table 11) for all instrument approaches down to CAT I minima (lower and upper cut-off limits):

Facility/conditions	RVR/CMV (m)	Aeroplane category			
		A	B	C	D
ILS, MLS, GLS, PAR and APV	Min	According to Table 5			
	Max	1 500	1 500	2 400	2 400
NDB, NDB/DME, VOR, VOR/DME, LLZ, LLZ/DME, VDF, SRA, RNAV/LNAV with a procedure which fulfils the criteria in paragraph (c)1.(ii):	Min	750	750	750	750
	Max	1 500	1 500	2 400	2 400
For NDB, NDB/DME, VOR, VOR/DME, LLZ, LLZ/DME, VDF, SRA, RNAV/LNAV: - not fulfilling the criteria in paragraph (c)1.(ii) above, or - with a DH or MDH ≥ 1 200 ft	Min	1 000	1 000	1 200	1 200
	Max	According to Table 5 if flown using the CDFA technique, otherwise an add-on of 200/400m applies to the values in Table 5 but not to result in a value exceeding 5 000m.			

Table 6a - Failed or downgraded equipment — effect on landing minima:

Failed or downgraded equipment (Note 1)	Effect on landing minima				
	CAT IIIB (Note 2)	CAT IIIA	CAT II	CAT I	Non precision
ILS stand-by 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
Touchdown zone RVR assessment system	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 stop-end RVR	No effect				
Anemometer for runway in use	No effect if other ground source available				
Celiometer	No effect				
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				
Whole runway light system	Not allowed		Day — minima as for nil facilities Night — Not allowed		
Edge lights	Day only - Night not allowed				

Note 1: Conditions applicable to Table 6a:

- (a) multiple failures of runway lights other than indicated in Table 6a are not acceptable.
- (b) deficiencies of approach and runway lights are treated separately.
- (c) Category II or III operations. A combination of deficiencies in runway lights and RVR assessment equipment is not allowed.
- (d) failures other than ILS affect RVR only and not DH.

Note 2: For CAT IIIB operations with no DH, an operator shall ensure that, for aeroplanes authorised to conduct no DH operations with the lowest RVR limitations, the following applies in addition to the content of Table 6a:

- (a) RVR. At least one RVR value must be available at the aerodrome;
- (b) runway lights
 - (i) no runway edge lights, or no centre lights — Day — RVR 200 m; night — not allowed;
 - (ii) no TDZ lights — no restrictions;
 - (iii) no standby power to runway lights — Day — RVR 200 m; night — not allowed.

o **Single pilot operations**

For single pilot operations, an operator must calculate the minimum RVR/visibility for all approaches in accordance with OPS 1.430 and this Appendix.

- (i) An RVR of less than 800 metres as indicated in Table 5 may be used for Category I approaches provided any of the following is used at least down to the applicable DH:
 - (A) a suitable autopilot, coupled to an ILS or MLS which is not promulgated as restricted; or
 - (B) an approved HUDLS (including, where appropriate, EVS), or equivalent approved system.
- (ii) Where RTZL and/or RCLL are not available, the minimum RVR/CMV shall not be less than 600 m.
- (iii) An RVR of less than 800 metres as indicated in Table 5, may be used for APV operations to runways with FALS, RTZL and RCLL when using an approved HUDLS, or equivalent approved system, or when conducting a coupled approach to a DH equal to or greater than 250 ft.

(e) **Lower than Standard Category I Operations**

1. **Decision height.**

A lower than Standard Category I Operation decision height must not be lower than:

- (i) the minimum decision height specified in the AFM, if stated; or
- (ii) the minimum height to which the precision approach aid can be used without the required visual reference; or
- (iii) the OCH for the category of aeroplane; or
- (iv) the decision height to which the flight crew is authorised to operate; or
- (v) 200 ft.

whichever is higher.

2. **Type of facility.**

An ILS/MLS which supports a lower than Standard Category I operation must be an unrestricted facility with a straight-in course ($\leq 3^\circ$ offset) and the ILS must be certificated to:

- (i) Class I/T/1 for operations to a minimum of 450m RVR; or
- (ii) Class II/D/2 for operations to less than 450m RVR.

Single ILS facilities are only acceptable if Level 2 performance is provided.

3. **Required RVR/CMV.**

The lowest minima to be used by an operator for lower than Standard Category I operations are stipulated in Table 6b below:

Table 6b - Lower than Standard Category I Minimum RVR/CMV v. approach light system

Lower than Standard Category I minima						
DH(ft)			Class of lighting facility			
			FALS	IALS	BALS	NALS
			RVR/CMV (metres)			
200	—	210	400	500	600	750
211	—	220	450	550	650	800
221	—	230	500	600	700	900
231	—	240	500	650	750	1 000
241	—	249	550	700	800	1 000

Note 1: The visual aids comprise standard runway day markings, approach lighting, runway edge lights, threshold lights, runway end lights and, for operations below 450m, shall include touch-down zone and/or runway centreline lights.

4. **Visual reference.**

A pilot shall not continue an approach below decision height unless visual reference containing a segment of at least three consecutive lights being the centre line of the approach lights, or touchdown zone lights, or runway centre line 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 barrette of the touchdown zone lighting unless the operation is conducted utilising an approved HUDLS usable to at least 150 ft.

5. **Approval.**

To conduct lower than Standard Category I operations:

- (i) the approach shall be flown auto-coupled to an auto-land; or an approved HUDLS shall be used to at least 150 ft above the threshold.
- (ii) the aeroplane shall be certificated in accordance with CS-AWO to conduct Category II operations;
- (iii) the auto-land system shall be approved for Category IIIA operations;
- (iv) in service proving requirements shall be completed in accordance with Appendix 1 to OPS 1.440 paragraph (h);
- (v) training specified in Appendix 1 to OPS 1.450 paragraph (h) shall be completed. This shall include training and checking in a Flight Simulator using the appropriate ground and visual aids at the lowest applicable RVR;

- (vi) the Operator must ensure that Low Visibility procedures are established and in operation at the intended aerodrome of landing; and
- (vii) the Operator shall be approved by the Authority.

(f) **Precision approach — Category II and other than Standard Category II operations**

1. **General.**

- (i) A Category II operation is a precision instrument approach and landing using ILS or MLS with:
 - (A) A decision height below 200 ft but not lower than 100 ft; and
 - (B) A runway visual range of not less than 300 m.
- (ii) An other than Standard Category II operation is a precision instrument approach and landing using ILS or MLS which meets facility requirements as established in paragraph (iii) below with:
 - (A) A decision height below 200 ft but not lower than 100 ft; (See Table 7b below) and
 - (B) A runway visual range of not less than 350/400 m. (See Table 7b below)
- (iii) The ILS/MLS that supports other than a Standard Category II operation shall be an unrestricted facility with a straight in course ($\leq 3\sigma$ offset) and the ILS shall be certificated to:
 - (A) Class I/T/1 for operations down to 450m RVR and to a DH of 200 ft or more; or,
 - (B) Class II/D/2 for operations in RVRs of less than 450m or to a DH of less than 200 ft.

Single ILS facilities are only acceptable if Level 2 performance is provided.

2. **Decision Height.** An operator must ensure that the decision height for:

- (i) Other than Standard Category II and Category II operations is not lower than:
 - (A) The minimum decision height specified in the AFM, if stated; or
 - (B) The minimum height to which the precision approach aid can be used without the required visual reference; or
 - (C) The OCH for the category of aeroplane; or
 - (D) The decision height to which the flight crew is authorised to operate; or
 - (E) 100 ft.
 whichever is higher.

3. **Visual reference.**

A pilot may not continue an approach below either the Category II or the other than Standard Category II decision height determined in accordance with subparagraph (d)2., above unless visual reference containing a segment of at least 3 consecutive lights being the centre line of the approach lights, or touchdown zone lights, or runway centre line 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 barrette of the touchdown zone lighting, unless the operation is conducted utilising an approved HUDLS to touchdown.

4. (i) **Required RVR.** The lowest minima to be used by an operator for Category II operations are:

Table 7a - RVR for Cat II operations v. DH

DH(ft)	Category II minima	
	Auto-coupled/Approved HUDLS to below DH (Note 1a)	
	RVR Aeroplane Category A, B and C	RVR Aeroplane Category D
100-120	300 m	300/350m (Note 2a)
121-140	400 m	400 m
141 and above	450 m	450m

Note 1a: The reference to 'auto-coupled to below DH/Approved HUDLS' in this table means continued use of the automatic flight control system or the HUDLS down to a height of 80% of the DH. Thus airworthiness requirements may, through minimum engagement height for the automatic flight control system, affect the DH to be applied.

Note 2a: 300m may be used for a Category D aeroplane conducting an auto-land.

- (ii) **Required RVR.** The lowest minima to be used by an operator for other than Standard Category II operations are:

Table 7b - Other than Standard Category II Minimum RVR v. approach light system

Other than Standard Category II minima					
Auto-land or approved HUDLS utilised to touchdown					
Class of lighting facility					
FALS		IALS		BALS	NALS
See paragraph (d)5, (d)6 and (d)10. about RVR < 750m					
CAT A-C	CAT D	CAT A-D	CAT A-D	CAT A-D	
DH (ft)	RVR metres				
100-120	350	400	450	600	700
121-140	400	450	500	600	700
141-160	450	500	500	600	750
161-199	450	500	550	650	750

Note: The visual aids required to conduct other than Standard Category II Operations comprise standard runway day markings and approach and runway lighting (runway edge lights, threshold lights, runway end lights). For operations in RVR of 400 m or less, centre line lights must be available. The approach light configurations are classified and listed in Table 4 above.

- (iii) To conduct other than Standard Category II operations the operator must ensure that appropriate low visibility procedures are established and in operation at the intended aerodrome of landing.

(g) Precision approach — Category III operations

1. General.

Category III operations are subdivided as follows:

- (i) Category III A operations. A precision instrument approach and landing using ILS or MLS with:
 - (A) a decision height lower than 100 ft; and
 - (B) a runway visual range not less than 200 m.
- (ii) Category III B operations. A precision instrument approach and landing using ILS or MLS with:
 - (A) a decision height lower than 100 ft, or no decision height; and
 - (B) a runway visual range lower than 200 m but not less than 75 m.

Note: Where the decision height (DH) and runway visual range (RVR) do not fall within the same Category, the RVR will determine in which Category the operation is to be considered.

2. Decision height.

For operations in which a decision height is used, an operator must ensure that the decision height is not lower than:

- (i) the minimum decision height specified in the AFM, if stated; or
- (ii) the minimum height to which the precision approach aid can be used without the required visual reference; or
- (iii) the decision height to which the flight crew is authorised to operate.

3. No decision height operations.

Operations with no decision height may only be conducted if:

- (i) the operation with no decision height is authorised in the AFM; and
- (ii) the approach aid and the aerodrome facilities can support operations with no decision height; and
- (iii) the operator has an approval for CAT III operations with no decision height.

Note: In the case of a CAT III runway it may be assumed that operations with no decision height can be supported unless specifically restricted as published in the AIP or NOTAM.

4. Visual reference

- (i) For Category IIIA operations, and for Category IIIB operations conducted either with fail-passive flight control systems, or with the use of an approved HUDLS, a pilot may not

continue an approach below the decision height determined in accordance with subparagraph (g)2 above unless a visual reference containing a segment of at least three consecutive lights being the 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.

- (ii) For Category IIIB operations conducted either with fail-operational flight control systems or with a fail-operational hybrid landing system (comprising e.g. a HUDLS) using a decision height, a pilot may not continue an approach below the decision height, determined in accordance with subparagraph (e)2. above, unless a visual reference containing at least one centreline light is attained and can be maintained.

5. **Required RVR.** The lowest minima to be used by an operator for Category III operations are:

Table 8 - RVR for Cat III Operations v. DH and roll-out control/guidance system

Category III minima			
Category	Decision height (ft) (Note 2)	Roll-out control/Guidance system	RVR (m)
IIIA	Less than 100 ft	Not required	200 m
IIIB	Less than 100 ft	Fail-passive	150 m (Note 1)
IIIB	Less than 50 ft	Fail-passive	125 m
IIIB	Less than 50 ft or No decision height	Fail-operational (Note 3)	75 m

Note 1: For aeroplanes certificated in accordance with CS-AWO 321(b)3. or equivalent.

Note 2: Flight control system redundancy is determined under CS-AWO by the minimum certificated decision height.

Note 3: The fail-operational system referred to may consist of a fail-operational hybrid system.

(h) **Enhanced vision systems**

1. A pilot using an enhanced vision system certificated for the purpose of this paragraph and used in accordance with the procedures and limitations of the approved flight manual, may:
 - (i) continue an approach below DH or MDH to 100 feet above the threshold elevation of the runway, provided that at least one of the following visual references is displayed and identifiable on the enhanced vision system:
 - (A) elements of the approach lighting; or
 - (B) the runway threshold, identified by at least one of the following: the beginning of the runway landing surface, the threshold lights, the threshold identification lights; and the touchdown zone, identified by at least one of the following: the runway touchdown zone landing surface, the touchdown zone lights, the touchdown zone markings or the runway lights;
 - (ii) reduce the calculated RVR/CMV for the approach from the value in column 1 of Table 9 below to the value in column 2:

Table 9 - Approach utilising EVS RVR/CMV reduction v. normal RVR/CMV

RVR/CMV normally required	RVR/CMV for approach utilising EVS
550	350
600	400
650	450
700	450
750	500
800	550
900	600
1 000	650
1 100	750

RVR/CMV normally required	RVR/CMV for approach utilising EVS
1 200	800
1 300	900
1 400	900
1 500	1 000
1 600	1 100
1 700	1 100
1 800	1 200
1 900	1 300
2 000	1 300
2 100	1 400
2 200	1 500
2 300	1 500
2 400	1 600
2 500	1 700
2 600	1 700
2 700	1 800
2 800	1 900
2 900	1 900
3 000	2 000
3 100	2 000
3 200	2 100
3 300	2 200
3 400	2 200
3 500	2 300
3 600	2 400
3 700	2 400
3 800	2 500
3 900	2 600
4 000	2 600
4 100	2 700
4 200	2 800
4 300	2 800
4 400	2 900
4 500	3 000
4 600	3 000
4 700	3 100
4 800	3 200
4 900	3 200
5 000	3 300

2. Paragraph (h)1 above may only be used for ILS, MLS, PAR, GLS and APV Operations with a DH no lower than 200 feet ,or an approach flown using approved vertical flight path guidance to a MDH or DH no lower than 250 feet.
3. A pilot may not continue an approach below 100 feet above runway threshold elevation for the intended runway, unless at least one of the visual references specified below is distinctly visible and identifiable to the pilot without reliance on the enhanced vision system:

- (A) The lights or markings of the threshold; or
 - (B) The lights or markings of the touchdown zone.
- (i) **Intentionally left blank**
- (j) **Circling**
1. **Minimum descent height (MDH).** The MDH for circling shall be the higher of:
 - (i) the published circling OCH for the aeroplane category; or
 - (ii) the minimum circling height derived from Table 10 below; or
 - (iii) the DH/MDH of the preceding instrument approach procedure.
 2. **Minimum descent altitude (MDA).** The MDA for circling shall be calculated by adding the published aerodrome elevation to the MDH, as determined by 1 above.
 3. **Visibility.** The minimum visibility for circling shall be the higher of:
 - (i) the circling visibility for the aeroplane category, if published; or
 - (ii) the minimum visibility derived from Table 10 below; or
 - (iii) the RVR/CMV derived from Tables 5 and 6 for the preceding instrument approach procedure.
 4. Notwithstanding the requirements in subparagraph 3 above, an Authority may exempt an operator from the requirement to increase the visibility above that derived from Table 10.
 5. Exemptions as described in subparagraph 4 must be limited to locations where there is a clear public interest to maintain current operations. The exemptions must be based on the operator's experience, training programme and flight crew qualification. The exemptions must be reviewed at regular intervals.

Table 10 - Minimum visibility and MDH for circling v. aeroplane category

	Aeroplane Category			
	A	B	C	D
MDH (ft)	400	400	600	700
Minimum meteorological visibility (m)	1 500	1 600	2 400	3 600

Note: Circling with prescribed tracks is an accepted procedure within the meaning of this paragraph.

- (k) **Visual approach.** An operator shall not use an RVR of less than 800 m for a visual approach.
- (l) **Conversion of reported meteorological visibility to RVR/CMV.**
1. An operator must ensure that a meteorological visibility to RVR/CMV conversion is not used for takeoff, for calculating any other required RVR minimum less than 800 m, or when reported RVR is available.

Note: If the RVR is reported as being above the maximum value assessed by the aerodrome operator, e.g. 'RVR more than 4-1,500 metres', it is not considered to be a reported value for the purpose of this paragraph.
 2. When converting meteorological visibility to RVR in all other circumstances than those in subparagraph (l)(1) above, an operator must ensure that the following Table is used:

Table 11- Conversion of met visibility to RVR/CMV

Lighting elements in operation	RVR / CMV = Reported met Visibility x	
	Day	Night
HI approach and runway lighting	1.5	2.0
Any type of lighting installation other than above	1.0	Not Applicable
No lighting	1.0	

END of 2.3 - APPENDIX 1 (New) to OPS 1.430 - Aerodrome Operating Minima in Section 2

2.4 APPENDIX 2 TO OPS 1.430 (c) - Aeroplane Categories — All Weather Operations

(a) Classification of aeroplanes

The criteria taken into consideration for the classification of aeroplanes by categories is the indicated airspeed at threshold (VAT) which is equal to the stalling speed (VSO) multiplied by 1.3, or VS1G multiplied by 1.23 in the landing configuration at the maximum certificated landing mass. If both VSO and VS1G are available, the higher resulting VAT shall be used. The aeroplane categories corresponding to VAT values are in the Table below:

Aeroplane Category	VAT, Vth or Vref
A	Less than 91 kt
B	From 91 to 120 kt
C	From 121 to 140 kt
D	From 141 to 165 kt
E	From 166 to 210 kt

The landing configuration which is to be taken into consideration shall be defined by the operator or by the aeroplane manufacturer.

(b) Permanent change of category (maximum landing mass)

1. An operator may impose a permanent, lower, landing mass, and use this mass for determining the VAT if approved by the Authority.
2. The category defined for a given aeroplane shall be a permanent value and thus independent of the changing conditions of day-to-day operations.

2.5 APPENDIX 1 TO OPS 1.440 - Low Visibility Operations — General Operating Rules

(a) General. The following procedures apply to the introduction and approval of low visibility operations.

(b) Operational demonstration. The purpose of the operational demonstration is to determine or validate the use and effectiveness of the applicable aircraft flight guidance systems, including HUDLS if appropriate, training, flight crew procedures, maintenance programme and manuals applicable to the Category II/III programme being approved.

1. At least 30 approaches and landings must be accomplished in operations using the Category II/III systems installed in each aircraft type if the requested DH is 50 ft or higher. If the DH is less than 50 ft, at least 100 approaches and landings will need to be accomplished unless otherwise approved by the Authority.
2. If an operator has different variants of the same type of aircraft utilising the same basic flight control and display systems, or different basic flight control and display systems on the same type of aircraft, the operator must show that the various variants have satisfactory performance, but the operator need not conduct a full operational demonstration for each variant. The Authority may also accept a reduction of the number of approach and landings based on credit given for the experience gained by another operator with an AOC issued in accordance with OPS 1 using the same aeroplane type or variant and procedures.
3. If the number of unsuccessful approaches exceeds 5% of the total (e.g. unsatisfactory landings, system disconnects) the evaluation programme must be extended in steps of at least 10 approaches and landings until the overall failure rate does not exceed 5%.

(c) Data collection for operational demonstrations.

Each applicant must develop a data collection method (e.g. a form to be used by the flight crew) to record approach and landing performance. The resulting data and a summary of the demonstration data shall be made available to the Authority for evaluation.

(d) Data analysis. Unsatisfactory approaches and/or automatic landings shall be documented and analysed.

(e) Continuous monitoring

1. After obtaining the initial authorisation, the operations must be continuously monitored by the operator to detect any undesirable trends before they become hazardous. Flight crew reports may be used to achieve this.
2. The following information must be retained for a period of 12 months:

- (i) the total number of approaches, by aeroplane type, where the airborne Category II or III equipment was utilised to make satisfactory, actual or practice approaches to the applicable Category II or III minima; and
 - (ii) reports of unsatisfactory approaches and/or automatic landings, by aerodrome and aeroplane registration, in the following categories:
 - (A) airborne equipment faults;
 - (B) ground facility difficulties;
 - (C) missed approaches because of ATC instructions; or
 - (D) other reasons.
3. An operator must establish a procedure to monitor the performance of the automatic landing system or HUDLS to touchdown performance, as appropriate, of each aeroplane.
- (f) **Transitional periods**
1. **Operators with no previous Category II or III experience**
 - (i) An operator without previous Category II or III operational experience may be approved for Category II or IIIA operations, having gained a minimum experience of six months of Category I operations on the aeroplane type.
 - (ii) On completing six months of Category II or IIIA operations on the aeroplane type the operator may be approved for Category IIIB operations. When granting such an approval, the Authority may impose higher minima than the lowest applicable for an additional period. The increase in minima will normally only refer to RVR and/or a restriction against operations with no decision height and must be selected such that they will not require any change of the operational procedures.
 2. **Operators with previous Category II or III experience.**
 - (i) An operator with previous Category II or III experience may obtain authorisation for a reduced transition period by application to the Authority.
 - (ii) An operator authorised for Category II or III operations using auto-coupled approach procedures, with or without auto-land, and subsequently introducing manually flown Category II or III operations using a HUDLS shall be considered to be a 'New Category II/III operator' for the purposes of the demonstration period provisions.
- (g) **Maintenance of Category II, Category III and LVTO equipment.** Maintenance instructions for the on-board guidance systems must be established by the operator, in liaison with the manufacturer, and included in the operator's aeroplane maintenance programme prescribed in Part M, paragraph M.A.302 which must be approved by the Authority.
- (h) **Eligible aerodromes and runways**
1. Each aeroplane type/runway combination must be verified by the successful completion of at least one approach and landing in Category II or better conditions, prior to commencing Category III operations.
 2. For runways with irregular pre-threshold terrain, or other foreseeable or known deficiencies, each aeroplane type/runway combination must be verified by operations in standard Category I or better conditions, prior to commencing Lower than Standard Category I, Category II, or other than Standard Category II or Category III operations.
 3. If an operator has different variants of the same type of aeroplane, *(being used)* in accordance with flight control and display systems on the same type of aeroplane in accordance with subparagraph 4 below, the operator must show that the variants have satisfactory operational performance. However, the operator need not conduct a full operational demonstration for each variant/runway combination.
 4. For the purpose of paragraph (h), an aeroplane type or variant of an aeroplane type is deemed to be the same type/variant of aeroplane if that type/variant has the same or similar:
 - (i) level of technology, including the:
 - (A) FGS and associated displays and controls;
 - (B) the FMS and level of integration with the FGS;
 - (C) use of HUDLS.
 - (ii) Operational procedures, including:
 - (A) alert height;
 - (B) manual landing/automatic landing;
 - (C) no decision height operations;

- (D) use of HUD/HUDLS in hybrid operations.
- (iii) Handling characteristics, including:
 - (A) manual landing from automatic or HUDLS guided approach;
 - (B) manual go-around from automatic approach;
 - (C) automatic/manual roll out.
- 5. Operators using the same aeroplane type/class or variant of a type in accordance with subparagraph 4 above may take credit from each others' experience and records in complying with this paragraph.
- 6. Operators conducting Other than Standard Category II operations shall comply with Appendix 1 to OPS 1.440 — Low Visibility Operations — General Operating Rules applicable to Category II operations.

2.6 A APPENDIX 1 to OPS 1.450 - Low Visibility Operations — Training & Qualifications

- (a) **LVO Programme.** An operator must ensure that flight crew member training programmes for low visibility operations include structured courses of ground, flight simulator and/or flight training. The operator may abbreviate the course content as prescribed by subparagraphs 2 and 3 below provided the content of the abbreviated course is acceptable to the authority.
 - 1. Flight crew members with no Category II or Category III experience must complete the full training programme prescribed in subparagraphs (b), (c) and (d) below.
 - 2. Flight crew members with Category II or Category III experience with a similar type of operation (auto-coupled/auto-land, HUDLS/Hybrid HUDLS or EVS) or Category II with manual land if appropriate with another Community operator may undertake an:
 - (i) abbreviated ground training course if operating a different type/class from that on which the previous Category II or Category III experience was gained;
 - (ii) abbreviated ground, flight simulator and/or flight training course if operating the same type/class and variant of the same type or class on which the previous Category II or Category III experience was gained. The abbreviated course is to include at least the requirements of subparagraphs (d)1, (d)2(i) or (d)2(ii) as appropriate and (d)3(i). With the approval of the Authority, the operator may reduce the number of approaches/landings required by subparagraph (d)2(i) if the type/class or the variant of the type or class has the same or similar:
 - (A) level of technology — flight control/guidance system (FGS); and
 - (B) operational procedures;
 - (C) handling characteristics (See paragraph 4 below); as the previously operated type or class, otherwise the requirement of (d)2(i) has to be met in full;
 - (D) use of HUDLS/hybrid HUDLS;
 - (E) use of EVS
 - 3. Flight crew members with Category II or Category III experience with the operator may undertake an abbreviated ground, Flight simulator and/or flight training course. The abbreviated course when changing:
 - (i) aeroplane type/class is to include at least the requirements of subparagraphs (d)1, (d)2(i) or (d)2(ii) as appropriate and (d)3(i);
 - (ii) to a different variant of aeroplane within the same type or class rating that has the same or similar:
 - (A) level of technology — flight control/guidance system (FGS); and
 - (B) operational procedures — integrity;
 - (C) handling characteristics (See paragraph 4 below);
 - (D) use of HUDLS/Hybrid HUDLS;
 - (E) use of EVS;as the previously operated type or class, then a difference course or familiarisation appropriate to the change of variant fulfils the abbreviated course requirements;
 - (iii) to a different variant of aeroplane within the same type or class rating that has a significantly different:
 - (A) level of technology — flight control/guidance system (FGS); and
 - (B) operational procedures — integrity;
 - (C) handling characteristics (See paragraph 4 below);
 - (D) use of HUDLS/Hybrid HUDLS;
 - (E) use of EVS;

then the requirements of subparagraphs (d)1, (d)2(i) or (d)2(ii) as appropriate and (d)3(i) shall be fulfilled. With the approval of the Authority the operator may reduce the number of approaches/landings required by subparagraph (d)2(i).

4. An operator must **ensure, when** undertaking Category II or Category III operations with different variant(s) of aeroplane within the same type or class rating that the differences and/or similarities of the aeroplanes concerned justify such operations, taking account at least the following:
 - (i) the level of technology, including the:
 - (A) FGS and associated displays and controls;
 - (B) the Flight Management System and its integration or not with the FGS;
 - (C) use of HUD/HUDLS with hybrid systems and/or EVS;
 - (ii) operational procedures, including:
 - (A) fail-passive/fail-operational, alert height;
 - (B) manual landing/automatic landing;
 - (C) no decision height operations;
 - (D) use of HUD/HUDLS with hybrid systems;
 - (iii) handling characteristics, including:
 - (A) manual landing from automatic HUDLS and/or EVS guided approach;
 - (B) manual go-around from automatic approach;
 - (C) automatic/manual roll out.
- (b) **Ground Training.** An operator must ensure that the initial ground training course for Low Visibility Operations covers at least:
 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 to include HUD symbology and EVS characteristics if appropriate;
 5. The effects of precipitation, ice accretion, low level wind shear and turbulence;
 6. The effect of specific aeroplane/system malfunctions;
 7. The use and limitations of RVR assessment systems;
 8. The principles of obstacle clearance requirements;
 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 400 m or less and any additional procedures required for take-off in conditions below 150 m (200 m for Category D aeroplanes);
 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 systems;
 12. The importance and significance of alert height if applicable and the action in the event of any failure above and below the alert height;
 13. The qualification requirements for pilots to obtain and retain approval to conduct low visibility take-offs and Category II or III operations; and
 14. The importance of correct seating and eye position.
- (c) **Flight Simulator Training and /or Flight Training**

(Training on the simulator, should be conducted in both day and night environments (when the simulator supports this) at high weights and to the maximum crosswind limit for which approval is sought)

 1. An operator must ensure that flight simulator and/or flight training for low visibility operations includes:
 - (i) checks of satisfactory functioning of equipment, both on the ground and in flight;

- (ii) effect on minima caused by changes in the status of ground installations;
 - (iii) monitoring of:
 - (A) automatic flight control systems and auto land status annunciators with emphasis on the action to be taken in the event of failures of such systems; and
 - (B) HUD/HUDLS/EVS guidance status and annunciators as appropriate, to include head down displays;
 - (iv) actions to be taken in the event of failures such as engines, electrical systems, hydraulics or flight control systems;
 - (v) the effect of known unserviceabilities and use of minimum equipment lists;
 - (vi) operating limitations resulting from airworthiness certification;
 - (vii) guidance on the visual cues required at decision height together with information on maximum deviation allowed from glide path or localiser; and
 - (viii) the importance and significance of alert height if applicable and the action in the event of any failure above and below the alert height.
 - (ix) Low visibility taxiing;
 - (x) Minimum visibility take-offs in normal operations, with engine and system failures before and after V1, and loss of visibility at varying speeds;
2. An operator must ensure that each flight crew member is trained to carry out his/her duties and instructed on the coordination required with other crew members. Maximum use should be made of flight simulators.
3. Training must be divided into phases covering normal operation with no aeroplane or equipment failures but including all weather conditions which may be encountered and detailed scenarios of aeroplane and equipment failure which could affect Category II or III operations. If the aeroplane system involves the use of hybrid or other special systems (such as HUD/HUDLS or enhanced vision equipment) then flight crew members must practise the use of these systems in normal and abnormal modes during the flight simulator phase of training
4. Incapacitation procedures appropriate to low visibility take-offs and Category II and III operations shall be practised, including pilot incapacitation at different altitudes during the approach.
5. For aeroplanes with no flight simulator available to represent that specific aeroplane, operators must ensure that the flight training phase specific to the visual scenarios of Category II operations is conducted in a specifically approved flight simulator. Such training must include a minimum of four approaches. The training and procedures that are type specific shall be practised in the aeroplane.
6. Aircraft training must cover the number of autolands each captain and first officer must perform in Cat 1 or better conditions on that aircraft type, using low visibility procedures. Initial Category II and III training shall include at least the following exercises:
- (i) (an) approach using the appropriate flight guidance, autopilots and control systems installed in the aeroplane, to the appropriate decision height and to include transition to visual flight and landing;
 - (ii) (an) approach with all engines operating using the appropriate flight guidance systems, autopilots, HUDLS and/or EVS and control systems installed in the aeroplane down to the appropriate decision height followed by missed approach; all without external visual reference;
 - (iii) where appropriate, approaches utilising automatic flight systems to provide automatic flare, landing and roll-out; and
 - (iv) normal operation of the applicable system both with and without acquisition of visual cues at decision height.
7. Subsequent phases of training must include at least:
- (i) approaches with engine failure at various stages on the approach;
 - (ii) approaches with critical equipment failures (e.g. electrical systems, auto flight systems, ground and/or airborne ILS/MLS systems and status monitors);
 - (iii) approaches where failures of auto flight equipment and/or HUD/HUDLS/EVS at low level require either:
 - (A) reversion to manual flight to control flare, landing and roll out or missed approach; or
 - (B) reversion to manual flight or a downgraded automatic mode to control missed approaches from, at or below decision height including those which may result in a touchdown on the runway;
 - (iv) failures of the systems which will result in excessive localiser and/or glide slope deviation, both above and below decision height, in the minimum visual conditions authorised for the operation. In addition, a continuation to a manual landing must be practised if a head-up

display forms a downgraded mode of the automatic system or the head-up display forms the only flare mode; and (v) failures and procedures specific to aeroplane type or variant.

8. The training programme must provide practice in handling faults which require a reversion to higher minima.
 9. The training programme must include the handling of the aeroplane when, during a fail passive Category 3 approach, the fault causes the autopilot to disconnect at or below decision height when the last reported RVR is 300 m or less.
 10. Where take-offs are conducted in RVRs of 400 m and below, training must be established to cover systems failures and engine failure resulting in continued as well as rejected take-offs.
 11. The training programme must include, where appropriate, approaches where failures of the HUDLS and/or EVS equipment at low level require either:
 - (i) reversion to head down displays to control missed approach; or
 - (ii) reversion to flight with no, or downgraded, HUDLS Guidance to control missed approaches from decision height or below, including those which may result in a touchdown on the runway.
 12. An operator shall ensure that when undertaking low visibility take-off, lower than Standard Category I, other than Standard Category II, and Category II and III Operations utilising a HUD/ HUDLS or hybrid HUD/ HUDLS or an EVS, that the training and checking programme includes, where appropriate, the use of the HUD/ HUDLS in normal operations during all phases of flight.
- (d) **Conversion training requirements to conduct low visibility take-off, lower than Standard Category I, other than Standard Category II, approach utilising EVS and Category II and III Operations.**

An operator shall ensure that each flight crew member completes the following low visibility procedures training if converting to a new type/class or variant of aeroplane in which low visibility take-off, lower than Standard Category I, Other than Standard Category II, Approach utilising EVS with an RVR of 800m or less and Category II and III Operations will be conducted. The flight crew member experience requirements to undertake an abbreviated course are prescribed in subparagraphs (a) 2, (a) 3, and (a) 4, above:

1. Ground Training. The appropriate requirements prescribed in subparagraph (b) above, taking into account the flight crew member's Category II and Category III training and experience.
2. Flight simulator training and/or flight training.
 - (i) A minimum of six (eight for HUDLS with or without EVS) approaches and/or landings in a flight simulator. The requirements for eight HUDLS approaches may be reduced to six when conducting Hybrid HUDLS operations. See subparagraph 4(i) below.
 - (ii) Where no Flight simulator is available to represent that specific aeroplane, a minimum of three (five for HUDLS and/or EVS) approaches including at least one go-around is required on the aeroplane. For Hybrid HUDLS operations a minimum of three approaches are required, including at least one go-around.
 - (iii) Appropriate additional training if any special equipment is required such as head-up displays or enhanced vision equipment. When approach operations utilising EVS are conducted with an RVR of less than 800m, a minimum of five approaches, including at least one go-around are required on the aeroplane.
3. Flight crew qualification. The flight crew qualification requirements are specific to the operator and the type of aeroplane operated.
 - (i) The operator must ensure that each flight crew member completes a check before conducting Category II or III operations.
 - (ii) The check prescribed in subparagraph (i) above may be replaced by successful completion of the flight simulator and/or flight training prescribed in subparagraph (d) 2 above.
4. Line flying under supervision. An operator must ensure that each flight crew member undergoes the following line flying under supervision (LIFUS):
 - (i) for Category II when a manual landing or a HUDLS approach to touchdown is required, a minimum of:
 - (A) three landings from autopilot disconnect;
 - (B) four landings with HUDLS used to touchdown;except that only one manual landing (two using HUDLS to touchdown) is required when the training required in subparagraph (d)2 above has been carried out in a flight simulator qualified for zero flight time conversion.
 - (ii) For Category III, a minimum of two auto lands except that:

- (A) only 1 autoland is required when the training required in subparagraph (d)2 above has been carried out in a flight simulator qualified for zero flight time conversion;
 - (B) no autoland is required during LIFUS when the training required in subparagraph (d)2 above has been carried out in a flight simulator qualified for zero flight time (ZFT) conversion and the flight crew member successfully completed the ZFT type rating conversion course;
 - (C) the flight crew member, trained and qualified in accordance with paragraph (B) above, is qualified to operate during the conduct of LIFUS to the lowest approved DA(H) and RVR as stipulated in the Operations Manual. *(Editor's note: All conditions listed above are applicable and must be complied with. See also (f) below)*
- (iii) For Category III approaches using HUDLS to touchdown a minimum of four approaches

(e) Type and command experience

1. Before commencing Category II operations, the following additional requirements are applicable to commanders, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type/class:
 - (i) 50 hours or 20 sectors on the type, including line flying under supervision; and
 - (ii) 100 m must be added to the applicable Category II RVR minima when the operation requires a Category II manual landing or use of HUDLS to touchdown until:
 - (A) a total of 100 hours or 40 sectors, including LIFUS has been achieved on the type; or
 - (B) a total of 50 hours or 20 sectors, including LIFUS has been achieved on the type where the flight crew member has been previously qualified for Category II manual landing operations with a Community operator;
 - (C) for HUDLS operations the sector requirements in paragraphs (e)1 and (e) 2 (i) shall always be applicable, the hours on type/class does not fulfil the requirement.
2. Before commencing Category III operations, the following additional requirements are applicable to commanders, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type:
 - (i) 50 hours or 20 sectors on the type, including line flying under supervision; and
 - (ii) 100 m must be added to the applicable Category II or Category III RVR minima unless he has previously qualified for Category II or III operations with a Community operator, until a total of 100 hours or 40 sectors, including line flying under supervision, has been achieved on the type.
3. The Authority may authorise a reduction in the above command experience requirements for flight crew members who have Category II or Category III command experience.

(f) Low visibility take-off with RVR less than 150/200 m

1. An operator must ensure that prior to authorisation to conduct take-offs in RVRs below 150 m (below 200 m for Category D aeroplanes) the following training is carried out:
 - (i) normal take-off in minimum authorised RVR conditions;
 - (ii) take-off in minimum authorised RVR conditions with an engine failure between V1 and V2, or as soon as safety considerations permit; and
 - (iii) take-off in minimum authorised RVR conditions with an engine failure before V1 resulting in a rejected take-off.
2. An operator must ensure that the training required by subparagraph 1 above is carried out in a flight simulator. This training must include the use of any special procedures and equipment. Where no flight simulator is available to represent that specific aeroplane, the Authority may approve such training in an aeroplane without the requirement for minimum RVR conditions (See Appendix 1 to OPS 1.965).
3. An operator must ensure that a flight crew member has completed a check before conducting low visibility take-offs in RVRs of less than 150 m (less than 200 m for Category D aeroplanes) if applicable. The check may only be replaced by successful completion of the flight simulator and/or flight training prescribed in subparagraph (f)1 on conversion to an aeroplane type.

(g) Recurrent training and checking — Low visibility operations

1. An operator must ensure that, in conjunction with the normal recurrent training and operator proficiency checks, a pilot's knowledge and ability to perform the tasks associated with the particular category of operation, for which he/she is authorised is checked. The required number of approaches to be undertaken in the flight simulator (*when*) within the validity period of the operators proficiency check (as prescribed in OPS 1.965 (b)) is to be a minimum of two, (four when HUDLS and/or EVS is utilised to touchdown) one of which must be a landing at the lowest approved RVR.

In addition, one (two for HUDLS and/or operations utilising EVS) of these approaches may be substituted by an approach and landing in the aeroplane using approved Category II and III procedures. One missed approach shall be flown during the conduct of the operators proficiency check. If the operator is authorised to conduct take-off with RVR less than 150/200 m at least one LVTO to the lowest applicable minima shall be flown during the conduct of the operators proficiency check.

2. For Category III operations an operator must use a flight simulator.
3. *An operator must ensure that, for Category III operations on aeroplanes with a fail passive flight control system, including HUDLS, a missed approach is completed at least once over the period of three consecutive operator proficiency checks as the result of an autopilot failure at or below decision height when the last reported RVR was 300 m or less.*
4. The Authority may authorise recurrent training and checking for Category II and LVTO operations in an aeroplane type where no flight simulator to represent that specific aeroplane or an acceptable alternate is available.

Note: 'Recency' for LTVO and Category II/III based upon automatic approaches and/or auto-lands is maintained by the recurrent training and checking as prescribed in this paragraph.

(h) **Additional training requirements for operators conducting lower than Standard Category I, approaches utilising EVS and other than Standard Category II Operations.**

1. Operators conducting lower than Standard Category I operations shall comply with the requirements of Appendix 1 to OPS 1.450 — low visibility operations — training and qualifications applicable to Category II operations to include the requirements applicable to HUDLS (if appropriate). The operator may combine these additional requirements where appropriate provided that the operational procedures are compatible. During conversion training the total number of approaches required shall not be additional to the requirements of OPS Subpart N provided the training is conducted utilising the lowest applicable RVR. **During recurrent training and checking the operator may also combine the separate requirements, provided the above operational procedure requirement is met, provided that at least one approach using lower than Standard Category I minima is conducted at least once every 18 months.**
2. Operators conducting other than Standard Category II operations shall comply with the requirements of Appendix 1 to OPS 1.450 — low visibility operations — training and qualifications applicable to Category II operations to include the requirements applicable to HUDLS (if appropriate). The operator may combine these additional requirements where appropriate provided that the operational procedures are compatible. During conversion training the total number of approaches required shall not be less than that required to complete Category II training utilising HUD/HUDLS. During recurrent training and checking the operator may also combine the separate requirements provided the above operational procedure requirement is met, provided that at least one approach using other than Standard Category II minima is conducted at least once every 18 months.
3. Operators conducting approach operations utilising EVS with RVR of 800 m or less shall comply with the requirements of Appendix 1 to OPS 1.450 — Low Visibility Operations — Training and Qualifications applicable to Category II operations to include the requirements applicable to HUD (if appropriate). The operator may combine these additional requirements where appropriate provided that the operational procedures are compatible. During conversion training the total number of approaches required shall not be less than that required to complete Category II training utilising a HUD. **During recurrent training and checking the operator may also combine the separate requirements provided the above operational procedure requirement is met, provided that at least one approach utilising EVS is conducted at least once every 12 months.**

2.6B OPS 1.978 - Low Visibility Operations — Training & Qualifications (ATQP)
Alternative training and qualification programme (See also Appendix 1 to OPS 1.978)

- (a) An operator, following a minimum of two years continuous operations, may substitute the training and checking requirements for flight crew specified in Appendix 1 to OPS 1.978(a) by an alternative training and Qualification programme (ATQP) approved by the Authority. The two years continuous operations may be reduced at the discretion of the Authority.
- (b) The ATQP must contain training and checking which establishes and maintains a level of proficiency demonstrated to be at least not less than the level of proficiency achieved by following the provisions of OPS 1.945, 1.965 and 1.970. The standard of flight crew training and qualification shall be established prior to the introduction of ATQP; the required ATQP training and qualification standards shall also be specified.
- (c) An operator applying for approval to implement an ATQP shall provide the Authority with an implementation plan in accordance with paragraph (c) of Appendix 1 to OPS 1.978.

- (d) In addition to the checks required by OPS 1.965 and 1.970 an operator shall ensure that each flight crew member undergoes a Line Orientated Evaluation (LOE).
1. The line orientated evaluation (LOE) shall be conducted in a simulator. The LOE may be undertaken with other approved ATQP training.
 2. The period of validity of a LOE shall be 12 calendar months, in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous LOE the period of validity shall extend from the date of issue until 12 calendar months from the expiry date of that previous LOE.
- (e) After two years of operating within an approved ATQP an operator may, with the approval of the Authority, extend the periods of validity of OPS 1.965 and 1.970 as follows:
1. operator proficiency check — 12 calendar months in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous operator proficiency check, the period of validity shall extend from the date of issue until 12 calendar months from the expiry date of that previous operator proficiency check;
 2. line check — 24 calendar months in addition to the remainder of the month of issue. If issued within the final six calendar months of validity of a previous line check, the period of validity shall extend from the date of issue until 24 calendar months from the expiry date of that previous line check. The line check may be combined with a line oriented quality evaluation (LOQE) with the approval of the authority;
 3. emergency and safety equipment checking — 24 calendar months in addition to the remainder of the month of issue. If issued within the final 6 calendar months of validity of a previous check, the period of validity shall extend from the date of issue until 24 calendar months from the expiry date of that previous check.
- (f) The ATQP shall be the responsibility of a nominated post holder.

2.7 APPENDIX 1 TO OPS 1.455 - Low Visibility Operations — Operating Procedures

- (a) **General. Low visibility operations include:**
1. Manual take-off (with or without electronic guidance systems or HUDLS/-Hybrid HUD/HUDLS);
 2. Auto-coupled approach to below DH, with manual flare, landing and rollout;
 3. Approach flown with the use of a HUDLS/Hybrid HUD/HUDLS and/or EVS);
 4. Auto-coupled approach followed by auto-flare, auto landing and manual roll-out; and
 5. Auto-coupled approach followed by auto-flare, auto landing and auto-rollout, when the applicable RVR is less than 400 m.
- Note 1:* A hybrid system may be used with any of these modes of operations.
Note 2: Other forms of guidance systems or displays may be certificated and approved.
- (b) **Procedures and operating instructions**
1. The precise nature and scope of procedures and instructions given depend upon the airborne equipment used and the flight deck procedures followed. An operator must clearly define flight crew member duties during take-off, approach, flare, roll-out and missed approach in the Operations Manual. Particular emphasis must be placed on flight crew responsibilities during transition from non-visual conditions to visual conditions, and on the procedures to be used in deteriorating visibility or when failures occur. Special attention must be paid to the distribution of flight deck **duties**, so as to ensure that the workload of the pilot making the decision to land or execute a missed approach enables him/her to devote himself/herself to supervision and the decision making process.
 2. An operator must specify the detailed operating procedures and instructions in the Operations Manual. The instructions must be compatible with the limitations and mandatory procedures contained in the Aeroplane Flight Manual and cover the following items in particular:
 - (i) checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight;
 - (ii) effect on minima caused by changes in the status of the ground installations and airborne equipment;
 - (iii) procedures for the take-off, approach, flare, landing, roll-out and missed approach;

- (iv) procedures to be followed in the event of failures, warnings to include HUD/HUDLS/EVS and other non-normal situations;
- (v) the minimum visual reference required;
- (vi) the importance of correct seating and eye position;
- (vii) action which may be necessary arising from a deterioration of the visual reference;
- (viii) allocation of crew duties in the carrying out of the procedures according to subparagraphs (i) to (iv) and (vi) above, to allow the Commander to devote himself/herself mainly to supervision and decision making;
- (ix) the requirement for all height calls below 200 ft to be based on the radio altimeter and for one pilot to continue to monitor the aeroplane instruments until the landing is completed;
- (x) the requirement for the Localiser Sensitive Area to be protected;
- (xi) the use of information relating to wind velocity, wind shear, turbulence, runway contamination and use of multiple RVR assessments;
- (xii) procedures to be used for:
 - (A) lower than Standard Category I;
 - (B) other than Standard Category II;
 - (C) approaches utilising EVS; and
 - (D) practice approaches and landing on runways at which the full Category II or Category III aerodrome procedures are not in force;
- (xiii) operating limitations resulting from airworthiness certification; and
- (xiv) information on the maximum deviation allowed from the ILS glide path and/or localiser.

2.8 APPENDIX 1 to OPS 1.465 - Minimum Visibilities for VFR Operations

Airspace class	A B C D E (Note 1)		F G	
			Above 900 m (3,000 ft) AMSL or above 300 m (1,000 ft) above terrain, whichever is the higher	At and below 900 m (3,000 ft) AMSL or 300 m (1,000 ft) above terrain, whichever is the higher
Distance from cloud	1,500 m horizontally 300 m (1,000 ft) vertically		Clear of cloud and in sight of the surface	
Flight visibility	8 km at and above 3,050 m (10,000 ft) AMSL (Note 2) 5 km below 3,050 m (10,000 ft) AMSL		5 km (Note 3)	

Note 1: VMC minima for Class A airspace are included for guidance but do not imply acceptance of VFR Flights in Class A Airspace

Note 2: When the height of the transition altitude is lower than 3,050 m (10,000 ft) AMSL, FL 100 should be used in lieu of 10,000 ft.

Note 3: Cat A and B aeroplanes may be operated in flight visibilities down to 3,000 m, provided the appropriate ATS authority permits use of a flight visibility less than 5 km, and the circumstances are such, that the probability of encounters with other traffic is low, and the IAS is 140 kt or less.

2.9 INSTRUMENT APPROACHES - Aerodrome Operating Minima (AOM) 'Landing Method' summary

Approach Category	Decision Height Minimum (Feet)	Minimum RVR (Metres)	Type of Approach Landing method
Cat 1 ILS	200 ft	550 m RVR or 800m visibility	Manual or auto to a landing (manual or auto)
Cat 2 ILS	Between 100 ft – 200 ft	350 m RVR *	Auto for manual land or autoland
Cat 3a ILS	Less than 100 ft	200 m RVR *	Auto to Autoland
Cat 3b ILS	Less than 50 ft	Less than 200 m RVR * but not less than 50 m	Auto to Autoland
Cat 3b ILS - Nil DH	0 ft wheels on ground	0 metres	Auto to Autoland

See **Precision Approach - Category I & II Operations** for variation of RVR depending upon Approach lighting.

END OF SECTION 2 - EU-OPS 1 Subpart E Regulations - (AOM & AWOPS) extract

**SECTION 3 - EU-OPS 1 REGULATIONS – Subpart E (Means of Compliance) with reference to SECTION 2 above
 ACJ/AMC/IEM E — ALL WEATHER OPERATIONS**

**3.1 AMC OPS 1.430(b)(4) - Effect on Landing Minima of temporarily failed or downgraded Ground Equipment
 (See EU-OPS 1.430(b)(4))**

1. Introduction

- 1.1 This AMC provides operators with instructions for flight crews on the effects on landing minima of temporary failures or downgrading of ground equipment.
- 1.2 Aerodrome facilities are expected to be installed and maintained to the standards prescribed in ICAO Annexes 10 and 14. Any deficiencies are expected to be repaired without unnecessary delay.

2. General

These instructions are intended for use both pre-flight and in-flight. It is not expected however that the commander would consult such instructions 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 Tables 1A and 1B below, and the approach may have to be abandoned to allow this to happen.

3. Operations with No Decision Height (DH)

- 3.1 An operator should ensure that, for aeroplanes authorised to conduct no DH operations with the lowest RVR limitations, the following applies in addition to the content of Tables 1A and 1B, below:
 - i. RVR. At least one RVR value must be available at the aerodrome;
 - ii. Runway lights
 - a. No runway edge lights, or no centre lights – Day – RVR 200 m; Night – Not allowed;
 - b. No TDZ lights – No restrictions;
 - c. No standby power to runway lights – Day – RVR 200 m; Night – not allowed.

4. Conditions Applicable to Tables 1A & 1B

- i. Multiple failures of runway lights other than indicated in Table 1B are not acceptable.
- ii. Deficiencies of approach and runway lights are treated separately.
- iii. Category II or III operations. A combination of deficiencies in runway lights and RVR assessment equipment is not allowed.
- iv. Failures other than ILS affect RVR only and not DH.

TABLE 1A - Failed or downgraded equipment - effect on landing minima

FAILED OR DOWNGRADED EQUIPMENT	EFFECT ON LANDING MINIMA EQUIPMENT				
	CAT III B (Note 1)	CAT III A	CAT II	CAT I	NON PRECISION
ILS stand-by 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 assessment system	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 Stop-end RVR	No effect				
Anemometer for R/W in use	No effect if other ground source available				
Celiometer	No effect				

Note 1: For Cat III B operations with no DH see also paragraph 3.3 above

TABLE 1B - Failed or downgraded equipment - effect on landing minima

FAILED OR DOWNGRADED EQUIPMENT	EFFECT ON LANDING MINIMA EQUIPMENT				
	CAT III B (Note 1)	CAT III A	CAT II	CAT I	NON PRECISION
Approach lights	Not allowed for operations with DH > 50ft		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				No effect
Whole runway light system	Not allowed			Day - AOM 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			
Touch Down 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				

Note 1: For Cat III B operations with no DH, see also paragraph 3, above.

3.2 IEM OPS 1.430

Documents containing information related to All Weather Operations (See EU-OPS 1 Subpart E)

1. The purpose of this IEM is to provide operators with a list of documents related to AWO.
 - a. ICAO Annex 2 / Rules of the Air;
 - b. ICAO Annex 6 / Operation of Aircraft, Part I;
 - c. ICAO Annex 10 / Telecommunications Vol 1;
 - d. ICAO Annex 14 / Aerodromes Vol 1;
 - e. ICAO Doc 8186 / PANS - OPS Aircraft Operations;
 - f. ICAO Doc 9365 / AWO Manual;
 - g. ICAO Doc 9476 / SMGCS Manual (Surface Movement Guidance And Control Systems);
 - h. ICAO Doc 9157 / Aerodrome Design Manual;
 - i. ICAO Doc 9328 / Manual for RVR Assessment;
 - j. ECAC Doc 17, Issue 3 (partly incorporated in EU-OPS); and
 - k. EU-AWO (Airworthiness Certification).

3.3 IEM to Appendix 1 to EU-OPS 1.430 Aerodrome Operating Minima (See Appendix 1 to EU-OPS 1.430)

The minima stated in this Appendix are based upon the experience of commonly used approach aids. This is not meant to preclude the use of other guidance systems such as Head Up Display (HUD) and Enhanced Visual Systems (EVS) but the applicable minima for such systems will need to be developed as the need arises.

3.4 IEM to Appendix 1 to EU-OPS 1.430, paragraphs (d) and (e) Establishment of minimum RVR for Category II and III Operations See Appendix 1 to EU-OPS 1.430, paragraphs (d) and (e)

1. General

- 1.1 When establishing minimum RVR for Category II and III Operations, operators should pay attention to the following information which originates in ECAC Doc 17 3rd Edition, Subpart A. It is retained as background information and, to some extent, for historical purposes although there may be some conflict with current practices.

- 1.2 *Since the inception of precision approach and landing operations, various methods have been devised for the calculation of aerodrome operating minima in terms of decision height and runway visual range. It is a comparatively straightforward matter to establish the decision height for an operation, but establishing the minimum RVR to be associated with that decision height (-) so as to provide a high probability that the required visual reference will be available at that decision height (-) has been more of a problem.*
- 1.3 The methods adopted by various States to resolve the DH/RVR relationship in respect of Category II and Category III operations have varied considerably. In one instance, there has been a simple approach which entailed the application of empirical data based on actual operating experience in a particular environment. This has given satisfactory results for application within the environment for which it was developed. In another instance, a more sophisticated method was employed which utilised a fairly complex computer programme to take account of a wide range of variables. However, in the latter case, it has been found that with the improvement in the performance of visual aids, and the increased use of automatic equipment in the many different types of new aircraft, most of the variables cancel each other out and a simple tabulation can be constructed which is applicable to a wide range of aircraft. *The basic principles which are observed in establishing the values in such a table are that the scale of visual reference required by a pilot at and below decision height depends on the task that he has to carry out, and that the degree to which his vision is obscured depends on the obscuring medium, the general rule in fog being that it becomes more dense with increase in height.* Research using flight simulators coupled with flight trials has shown the following:
 - a. Most pilots require visual contact to be established about 3 seconds above decision height though it has been observed that this reduces to about 1 second when a fail-operational automatic landing system is being used;
 - b. To establish lateral position and cross-track velocity, most pilots need to see not less than a 3 light segment of the centre line of the approach lights, or runway centre line, or runway edge lights;
 - c. For roll guidance, most pilots need to see a lateral element of the ground pattern, i.e. an approach lighting cross bar, the landing threshold, or a barrette of the touchdown zone lighting; and
 - d. To make an accurate adjustment to the flight path in the vertical plane, such as a flare, using purely visual cues, most pilots need to see a point on the ground which has a low or zero rate of apparent movement relative to the aircraft.
 - e. With regard to fog structure, data gathered in the United Kingdom over a twenty-year period have shown that in deep stable fog there is a 90% probability that the slant visual range from eye heights higher than 15ft above the ground will be less than the horizontal visibility at ground level, i.e. RVR. There are at present no data available to show what the relationship is between the Slant Visual Range and RVR (if) in other low visibility conditions such as blowing snow, dust or heavy rain, but there is some evidence in pilot reports that the lack of contrast between visual aids and the background in such conditions can produce a relationship similar to that observed in fog.

2. Category II Operations

- 2.1 The selection of the dimensions of the required visual segments which are used for Category II operations is based on the following visual requirements:
 - a. A visual segment of not less than 90 metres will need to be in view at and below decision height for pilot to be able to monitor an automatic system;
 - b. A visual segment of not less than 120 metres will need to be in view for a pilot to be able to maintain the roll attitude manually at and below decision height; and
 - c. For a manual landing using only external visual cues, a visual segment of 225 metres will be required at the height at which flare initiation starts in order to provide the pilot with sight of a point of low relative movement on the ground.

3. Category III Fail Passive operations

- 3.1 Category III operations utilising fail-passive automatic landing equipment were introduced in the late 1960's and it is desirable that the principles governing the establishment of the minimum RVR for such operations be dealt with in some detail.
- 3.2 During an automatic landing the pilot needs to monitor the performance of the aircraft system, not in order to detect a failure which is better done by the monitoring devices built into the system, but so as to know precisely the flight situation. In the final stages he should establish visual contact

and, by the time he reaches decision height, he should have checked the aircraft position relative to the approach or runway centre-line lights. For this he will need sight of horizontal elements (for roll reference) and part of the touchdown area. He should check for lateral position and cross-track velocity and, if not within the pre-stated lateral limits, he should carry out a go-around. He should also check longitudinal progress and sight of the landing threshold is useful for this purpose, as is sight of the touchdown zone lights.

- 3.3 In the event of a failure of the automatic flight guidance system below decision height, there are two possible courses of action; the first is a procedure which allows the pilot to complete the landing manually if there is adequate visual reference for him to do so, or to initiate a go-around if there is not; the second is to make a go-around mandatory if there is a system **disconnect, regardless** of the pilot's assessment of the visual reference available.
- a. If the first option is selected then the overriding requirement in the determination of a minimum RVR is for sufficient visual cues to be available at and below decision height for the pilot to be able to carry out a manual landing. Data presented in Doc 17 showed that a minimum value of 300 metres would give a high probability that the cues needed by the pilot to assess the aircraft in pitch and roll will be available and this should be the minimum RVR for this procedure.
- b. The second option, to require a go-around to be carried out should the automatic flight-guidance system fail below decision height, will permit a lower minimum RVR because the visual reference requirement will be less if there is no need to provide for the possibility of a manual landing. However, this option is only acceptable if it can be shown that the probability of a system failure below decision height is acceptably low. It should be recognised that the inclination of a pilot who experiences such a failure would be to continue the landing **manually; but** the results of flight trials in actual conditions and of simulator experiments show that pilots do not always recognise that the visual cues are inadequate in such **situations. Present** recorded data **reveal(s)** that pilots' landing performance reduces progressively as the RVR is reduced below 300 metres. *It should further be recognised that there is some risk in carrying out a manual go-around from below 50ft in very low visibility and it should therefore be accepted that if an RVR lower than 300 metres is to be authorised, the flight deck procedure should not normally allow the pilot to continue the landing manually in such conditions and the aeroplane system should be sufficiently reliable for the go around rate to be low.*
- 3.4 *These criteria may be relaxed in the case of an aircraft with a fail-passive automatic landing system which is supplemented by a head-up display which does not qualify as a fail-operational system but which gives guidance which will enable the pilot to complete a landing in the event of a failure of the automatic landing system.* In this case it is not necessary to make a go-around mandatory in the event of a failure of the automatic landing system when the RVR is less than 300 metres.

4. **Category III Fail Operational operations - with a Decision Height**

- 4.1 For Category III operations utilising a fail-operational landing system with a Decision Height, a pilot should be able to see at least 1 centre line light.
- 4.2 For Category III operations utilising a fail-operational hybrid landing system with a Decision Height, a pilot should have a visual reference containing a segment of at least 3 consecutive lights of the runway centre line lights.

5. **Category III Fail Operational operations - with No Decision Height**

- 5.1 For Category III operations with No Decision Height the pilot is not required to see the runway prior to touchdown. The permitted RVR is dependent on the level of aeroplane equipment.
- 5.2 A CAT III runway may be assumed to support operations with no Decision Height unless specifically restricted as published in the AIP or NOTAM.

3.5 **IEM to Appendix 1 to EU-OPS 1.430, paragraph (e)(5) - Table 7 Crew actions in case of autopilot failure at or below decision height in fail-passive Category III operations. See Appendix 1 to EU-OPS 1.430, paragraph (e)(5) Table 7**

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

This means that a go-around is the normal action. However the wording recognises that there may be circumstances where the safest action is to continue the landing. Such circumstances include the height at which the failure occurs, the actual visual references, and other malfunctions. This would typically apply to the late stages of the flare.

In conclusion it is not forbidden to continue the approach and complete the landing when the commander or the pilot to whom the conduct of the flight has been delegated, determines that this is the safest course of action.

Operational instructions should reflect the information given in this IEM and the operator's policy.

3.6 IEM to Appendix 1 to EU-OPS 1.430, paragraph (f)
Visual Manoeuvring (circling)
See Appendix 1 to EU-OPS 1.430, paragraph (f)

1. The purpose of this IEM is to provide operators with supplemental information regarding the application of aerodrome operating minima in relation to circling approaches.
2. **Conduct of flight – General**
 - 2.1 For these procedures, the applicable visibility is the meteorological visibility (VIS).
 - 2.2 The MDA/H and OCA/H minimums included in the procedure are related to aerodrome elevation.
3. **Missed approach**
 - 3.1 If the decision to carry out a missed approach is taken when the aircraft is positioned on the approach axis (track) defined by radio-navigation aids, the published missed approach procedure must be followed. If visual reference is lost while circling to land from an instrument approach, the missed approach specified for that particular instrument approach must be followed. It is expected that the pilot will make an initial climbing turn toward the landing runway and overhead the aerodrome (*from*) where he will establish the aeroplane in a climb on the missed approach track. Inasmuch as the circling manoeuvre may be accomplished in more than one direction, different patterns will be required to establish the aeroplane on the prescribed missed approach *course, depending* on its position at the time visual reference is *lost, unless* otherwise prescribed.
 - 3.2 If the instrument approach procedure is carried out with the aid of an ILS, the Missed Approach Point (MAPt) associated with an ILS procedure without glide path (GP out procedure) should be taken in account.
4. **Instrument approach followed by visual manoeuvring (circling) without prescribed tracks**
 - 4.1 Before visual reference is established, but not below MDA/H - The flight should follow the corresponding instrument approach procedure.
 - 4.2 At the beginning of the level flight phase at or above the MDA/H - From the beginning of the level flight phase, the instrument approach track determined by radio navigation aids should be maintained until:
 - a. The pilot estimates that, in all probability, visual contact with the runway or runway environment will be maintained during the entire procedure;
 - b. The pilot estimates that his aircraft is within the circling area before commencing circling; and
 - c. The pilot is able to determine his aircraft's position in relation to the runway with the aid of the external references.
 - 4.3 If the conditions in paragraph 4.2 above are not met by the MAPt, a missed approach must be carried out in accordance with the instrument approach procedure.
 - 4.4 After the aeroplane has left the track of the corresponding instrument approach procedure, the flight phase outbound from the runway should be limited to the distance which is required to align the aeroplane for the final approach. Flight manoeuvres should be conducted within the circling area and in such way that visual contact with the runway or runway environment is maintained at all times.
 - 4.5 Flight manoeuvres should be carried out at an altitude/height which is not less than the circling minimum descent/altitude height (MDA/H).
 - 4.6 Descent below MDA/H should not be initiated until the threshold of the runway to be used has been identified and the aeroplane is in a position to continue with a normal rate of descent and land within the touchdown zone.
5. **Instrument approach followed by a visual manoeuvring (circling) with prescribed track**
 - 5.1 Before visual reference is established, but not below MDA/H - The flight should follow the corresponding instrument approach procedure.

- 5.2 The aeroplane should be established in level flight at or above the MDA/H and the instrument approach track determined by the radio navigation aids **maintained, until** visual contact can be achieved and maintained. At the divergence point, the aeroplane should leave the instrument approach track and the published routing and heights followed.
- 5.3 If the divergence point is reached before the necessary visual reference is acquired, a missed approach procedure should be initiated not later than the MAPt and carried out in accordance with the instrument approach procedure.
- 5.4 The instrument approach track determined by radio navigation aids should only be left at the prescribed divergence point when only the published routing and heights should be followed.
- 5.5 Unless otherwise specified in the procedure, final descent should not be initiated until the threshold of the runway to be used has been identified and the aeroplane is in a position to continue with a normal rate of descent and land within the touchdown zone.

3.7 ACJ to Appendix 1 to EU-OPS 1.440 Operational Demonstrations See Appendix 1 to EU-OPS 1.440

1. General

- 1.1 Demonstrations may be conducted in line operations or any other flight where the Operator's procedures are being used.
- 1.2 *In unique situations where the completion of 100 successful landings could take an unreasonably long period of **time, due** to factors such as a small number of aeroplanes in the fleet, limited opportunity to use runways having Category II/III procedures, or inability to obtain ATS (or ATC) sensitive area protection during good weather conditions, and equivalent reliability assurance can be achieved, a reduction in the required number of landings may be considered on a case-by-case basis.* Reduction of the number of landings to be demonstrated requires a justification for the reduction, and prior approval from Authority. However, at the operator's option, demonstrations may be made on other runways and facilities. Sufficient information should be collected to determine the cause of any unsatisfactory performance (e.g. sensitive area was not protected).
- 1.3 If an operator has different variants of the same type of aeroplane utilising the same basic flight control and display systems, or different basic flight control and display systems on the same type/classes of aeroplane, the operator should show that the various variants have satisfactory performance, but the operator need not conduct a full operational demonstration for each variant.
- 1.4 Not more than 30% of the demonstration flights should be made on the same runway.

2. Data Collection for Operational Demonstrations

- 2.1 Data should be collected whenever an approach and landing is attempted utilising the Category II/III system, regardless of whether the approach is abandoned, unsatisfactory, or is concluded successfully.
- 2.2 The data should, as a minimum, include the following information:
 - a. Inability to initiate an Approach. Identify deficiencies related to airborne equipment which preclude initiation of a Category II/III approach.
 - b. Abandoned Approaches. Give the reasons and altitude above the runway at which approach was discontinued or the automatic landing system was disengaged.
 - c. **Touchdown, or Touchdown and Roll-out Performance.** Describe whether or not the aircraft landed satisfactorily (within the desired touchdown area) with lateral velocity or cross track error which could be corrected by the pilot or automatic system so as to remain within the lateral confines of the runway without unusual pilot skill or technique. The approximate lateral and longitudinal position of the actual touchdown point in relation to the runway centreline and the runway threshold, respectively, should be indicated in the report. This report should also include any Category II/III system abnormalities which required manual intervention by the pilot to ensure a safe touchdown or touchdown and roll-out, as appropriate.

3. Data Analysis

- 3.1 Unsuccessful approaches due to the following factors may be excluded from the analysis:
 - a. **ATS (Editor Note: also known as ATC)** Factors. Examples include situations in which a flight is vectored too close to the final approach fix/point for adequate localiser and glide slope

capture, lack of protection of ILS sensitive areas, or ATS (or ATC) requests the flight to discontinue the approach.

- b. Faulty Navaid Signals. Navaid (e.g. ILS localiser) irregularities, such as those caused by other aircraft taxiing, over-flying the navaid (antenna).
- c. Other Factors. Any other specific factors that could affect the success of Category II/ III operations that are clearly discernible to the flight crew should be reported

3.8 IEM to Appendix 1 to EU-OPS 1.440, paragraph (b)
Criteria for a successful CAT II/III approach and automatic landing
See Appendix 1 to EU-OPS 1.440, paragraph (b)

1. The purpose of this IEM is to provide operators with supplemental information regarding the criteria for a successful approach and landing to facilitate fulfilling the requirements prescribed in Appendix 1 to EU-OPS 1.440, paragraph (b).
2. An approach may be considered to be successful if:
 - 2.1 From 500 feet to start of flare:
 - a. Speed is maintained as specified in ACJ-AWO 231, paragraph 2 'Speed Control'; and
 - b. No relevant system failure occurs; and
 - 2.2 From 300 feet to DH:
 - a. No excess deviation occurs; and
 - b. No centralised warning gives a go-around command (if installed).
3. An automatic landing may be considered to be successful if:
 - a. No relevant system failure occurs;
 - b. No flare failure occurs;
 - c. No de-crab failure occurs (if installed);
 - d. Longitudinal touchdown is beyond a point on the runway 60 metres after the threshold and before the end of the touchdown zone lighting (900 metres from the threshold);
 - e. Lateral touchdown with the outboard landing gear is not outside the touchdown zone lighting edge;
 - f. Sink rate is not excessive;
 - g. Bank angle does not exceed a bank angle limit; and
 - h. No roll-out failure or deviation (if installed) occurs.
4. More details can be found in EU-AWO 131, EU-AWO 231 and ACJ-AWO 231.

3.9 IEM OPS 1.450(g)(1)
Low Visibility Operations - Training & Qualifications
See Appendix 1 to EU-OPS 1.450

The number of approaches referred to in 1.450(g)(1) includes one approach and landing that may be conducted in the aeroplane using approved Category II/III procedures. This approach and landing may be conducted in normal line operation or as a training flight. It is assumed that such flights will only be conducted by pilots qualified in accordance EU-OPS 1.940 and qualified for the particular category of operation.

END OF SECTION 3 - EU-OPS 1 – Subpart E (AOM & AWOPS)
Means of Compliance extract relating to SECTION 2 above

SECTION 4 EU-OPS 1 - Subpart N (Flight Crew Training) - Selected Extracts on AWOPS training aspects

4.1 EU-OPS 1 Subpart N - FLIGHT CREW - OPS 1.965 Recurrent Training and Checking

(See Appendices 1 and 2 to OPS 1.965)

(a) General. An operator shall ensure that

1. Each flight crew member undergoes recurrent training and checking and that all such training and checking is relevant to the type or variant of aeroplane on which the flight crew member operates;
2. a recurrent training and checking programme is established in the Operations Manual and approved by the Authority;
3. recurrent training is conducted by the following personnel:
 - (i) ground and refresher training — by suitably qualified personnel;
 - (ii) aeroplane/STD training — by a type rating instructor (TRI), class rating instructor (CRI) or in the case of the STD content, a synthetic flight instructor (SFI), providing that the TRI, CRI or SFI satisfies the operator's experience and knowledge requirements sufficient to instruct on the items specified in paragraphs (a)1.(i)(A) and (B) of Appendix 1 to OPS 1.965;
 - (iii) emergency and safety equipment training — by suitably qualified personnel; and
 - (iv) crew resource management (CRM):
 - (A) integration of CRM elements into all the phases of the recurrent training — by all the personnel conducting recurrent training. The operator shall ensure that all personnel conducting recurrent training are suitably qualified to integrate elements of CRM into this training;
 - (B) modular CRM training — by at least one CRM trainer acceptable to the Authority who may be assisted by experts in order to address specific areas;
4. recurrent checking is conducted by the following personnel:
 - (i) operator proficiency checks — by a type rating examiner (TRE), class rating examiner (CRE) or, if the check is conducted in a STD, a TRE, CRE or a synthetic flight examiner (SFE), trained in CRM concepts and the assessment of CRM skills;
 - (ii) line checks — by suitably qualified commanders nominated by the operator and acceptable to the Authority;
 - (iii) emergency and safety equipment checking — by suitably qualified personnel.

(b) Operator proficiency check (OPC)

1. An operator shall ensure that:
 - (i) each flight crew member undergoes operator proficiency checks to demonstrate his/her competence in carrying out normal, abnormal and emergency procedures; and
 - (ii) the check is conducted without external visual reference when the flight crew member will be required to operate under IFR;
 - (iii) each flight crew member undergoes operator proficiency checks as part of a normal flight crew complement.
2. The period of validity of an operator proficiency check shall be six calendar months in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous operator proficiency check, the period of validity shall extend from the date of issue until six calendar months from the expiry date of that previous operator proficiency check.

(c) Line Check.

An operator shall ensure that each flight crew member undergoes a line check on the aeroplane to demonstrate his/her competence in carrying out normal line operations described in the Operations Manual. The period of validity of a line check shall be 12 calendar months, in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous line check the period of validity shall extend from the date of issue until 12 calendar months from the expiry date of that previous line check.

(d) Emergency and Safety Equipment training and checking.

An operator shall ensure that each flight crew member undergoes training and checking on the location and use of all emergency and safety equipment carried. The period of validity of an emergency and safety equipment check shall be 12 calendar months in addition to the remainder of the month of issue. If issued within the final three calendar months of validity of a previous emergency and safety check, the period of validity shall extend from the date of issue until 12 calendar months from the expiry date of that previous emergency and safety equipment check.

(e) **CRM.**

An operator shall ensure that:

1. elements of CRM are integrated into all appropriate phases of the recurrent training, and;
2. each flight crew member undergoes specific modular CRM training. All major topics of CRM training shall be covered over a period not exceeding three years;

(f) **Ground and refresher training.**

An operator shall ensure that each flight crew member undergoes ground and refresher training at least every 12 calendar months. If the training is conducted within 3 calendar months prior to the expiry of the 12 calendar months period, the next ground and refresher training must be completed within 12 calendar months of the original expiry date of the previous ground and refresher training.

(g) **Aeroplane/STD training.**

An operator shall ensure that each flight crew member undergoes aeroplane/STD training at least every 12 calendar months. If the training is conducted within 3 calendar months prior to the expiry of the 12 calendar months period, the next aeroplane STD training must be completed within 12 calendar months of the original expiry date of the previous aeroplane/STD training.

4.2 Recent experience

(a) An operator shall ensure that:

1. a pilot is not assigned to operate an aeroplane as part of the minimum certificated crew, either as pilot flying or pilot non-flying unless he/she has carried out three take-offs and three landings in the previous 90 days as pilot flying in an aeroplane, or in a flight simulator of the same type/class.
2. a pilot who does not hold a valid instrument rating is not assigned to operate an aeroplane at night as commander unless he/she has carried out at least one landing at night in the preceding 90 days as pilot flying in an aeroplane, or in a flight simulator, of the same type/class.

(b) The 90-day period prescribed in subparagraphs (a)1 and 2 above may be extended up to a maximum of 120 days by line flying under the supervision of a type rating instructor or examiner. For periods beyond 120 days, the recency requirement is satisfied by a training flight or use of a flight simulator of the aeroplane type to be used.

4.3 Route and aerodrome competence qualification (OPS 1.975)

(a) An operator shall ensure that, prior to being assigned as commander or as pilot to whom the conduct of the flight may be delegated by the commander, the pilot has obtained adequate knowledge of the route to be flown and of the aerodromes (including alternates), facilities and procedures to be used.

(b) The period of validity of the route and aerodrome competence qualification shall be 12 calendar months in addition to the remainder of:

1. the month of qualification; or
2. the month of the latest operation on the route or to the aerodrome.

(c) Route and aerodrome competence qualification shall be revalidated by operating on the route or to the aerodrome within the period of validity prescribed in subparagraph (b) above.

(d) If revalidated within the final three calendar months of the validity of the previous route and aerodrome competence qualification, the period of validity shall extend from the date of revalidation until 12 calendar months from the expiry date of that previous route and aerodrome competence qualification.

4.4 Alternative training and qualification programme (ATQP)

Appendix 1 to OPS 1.978

(a) An operator's ATQP may apply to the following requirements that relate to

1. OPS 1.450 and Appendix 1 to OPS 1.450 - Low Visibility Operations - Training and Qualifications;
2. OPS 1.945 Conversion training and checking and Appendix 1 to OPS 1.945;
3. OPS 1.950 Differences training and familiarisation training;
4. OPS 1.955 paragraph (b) — Nomination as commander;
5. OPS 1.965 Recurrent training and checking and Appendices 1 and 2 to OPS 1.965;
6. OPS 1.980 Operation on more than one type or variant and Appendix 1 to OPS 1.980.

(b) Components of the ATQP — an alternative training and qualification programme shall comprise the following:

1. Documentation that details the scope and requirements of the programme;
 2. A task analysis to determine the tasks to be analysed in terms of:
 - (i) knowledge;
 - (ii) the required skills;
 - (iii) the associated skill based training; and, where appropriate
 - (iv) the validated behavioural markers.
 3. Curricula — the curriculum structure and content shall be determined by task analysis, and shall include proficiency objectives including when and how those objectives shall be met. The process for curriculum development shall be acceptable to the Authority;
 4. A specific training programme for:
 - (i) each aeroplane type/class within the ATQP;
 - (ii) the instructors (Class rating instructor rating/Synthetic flight instructor authorisation/Type rating instructor rating — CRI/SFI/TRI), and other personnel undertaking flight crew instruction;
 - (iii) the examiners (Class rating examiner/Synthetic flight examiner/Type rating examiner — CRE/SFE/TRE); to include a method for the standardisation of the instructors and examiners;
 5. A feedback loop for the purpose of curriculum validation and refinement, and to ascertain that the programme meets its proficiency objectives;
 6. A method for the assessment of flight crew both during conversion and recurrent training and checking. The assessment process shall include event-based assessment as part of the LOE. The method of assessment shall comply with the provisions of OPS 1.965;
 7. An integrated system of quality control, that ensures compliance with all the requirements processes and procedures of the programme;
 8. A process that describes the method to be used if the monitoring and evaluation programmes do not ensure compliance with the established proficiency and qualification standards for flight crew;
 9. A data monitoring/analysis programme.
- (c) **Implementation** — The operator shall develop an evaluation and implementation strategy acceptable to the Authority; the following requirements shall be fulfilled:
1. The implementation process shall include the following stages:
 - (i) a safety case that substantiates the validity of:
 - (A) the revised training and qualification standards when compared with the standards achieved under OPS 1 prior to the introduction of ATQP.
 - (B) any new training methods implemented as part of ATQP. If approved by the Authority the operator may establish an equivalent method other than a formal safety case.
 - (ii) Undertake a task analysis as required by paragraph (b)2 above in order to establish the operator's programme of targeted training and the associated training objectives.
 - (iii) A period of operation whilst data is collected and analysed to ensure the efficacy of the safety case or equivalent and validate the task analysis. During this period the operator shall continue to operate to the pre-ATQP OPS 1 requirements. The length of this period shall be agreed with the authority;
 2. The operator may then be approved to conduct training and qualification as specified under the

END OF SECTION 4 - EU-OPS 1 - Subpart N (Flight Crew Training) Extract

5.1 SECTION 5 EU-OPS 1 Subpart N (Flight Crew training Extract) (Means Of Compliance)
ACJ/AMC/IEM N — FLIGHT CREW
AMC OPS 1.940(a)(4)

Crewing of inexperienced flight crew members
See JAR-OPS 1.940(a)(4)

1. An operator should consider that a flight crew member is inexperienced, following completion of a Type Rating or command course, and the associated line flying under supervision, until he has achieved on the Type either:
 - a. 100 flying hours and flown 10 sectors within a consolidation period of 120 consecutive days; or
 - b. 150 flying hours and flown 20 sectors (no time limit).
2. A lesser number of flying hours or sectors, subject to any other conditions which the Authority may impose, may be acceptable to the Authority when:
 - a. A new operator is commencing operations; or
 - b. An operator introduces a new aeroplane type; or
 - c. Flight crew members have previously completed a type conversion course with the same operator; or
 - d. The aeroplane has a Maximum Take-off Mass below 10 tonnes or a Maximum Approved Passenger Seating Configuration of less than 20.

5.2 AMC OPS 1.945
Conversion Course Syllabus
See JAR-OPS 1.945 and Appendix 1 to JAR-OPS 1.945

1. General
 - 1.1 Type rating training when required may be conducted separately or as part of conversion training. When the type rating training is conducted as part of conversion training, the conversion training programme should include all the requirements of JAR-FCL.
2. Ground training
 - 2.1 Ground training should comprise a properly organised programme of ground instruction by training staff with adequate facilities, including any necessary audio, mechanical and visual aids. However, if the aeroplane concerned is relatively simple, private study may be adequate if the operator provides suitable manuals and/or study notes.
 - 2.2 The course of ground instruction should incorporate formal tests on such matters as aeroplane systems, performance and flight planning, where applicable. 3 Emergency and safety equipment training and checking
3. Emergency and safety equipment training and checking
 - 3.1 On the initial conversion course and on subsequent conversion courses as applicable, the following should be addressed:
 - a. Instruction on first aid in general (Initial conversion course only); Instruction on first aid as relevant to the aeroplane type of operation and crew complement including where no cabin crew are required to be carried (Initial and subsequent);
 - b. Aeromedical topics including:
 - i. Hypoxia;
 - ii. Hyperventilation;
 - iii. Contamination of the skin/eyes by aviation fuel or hydraulic or other fluids;
 - iv. Hygiene and food poisoning; and
 - v. Malaria;
 - c. The effect of smoke in an enclosed area and actual use of all relevant equipment in a simulated smoke-filled environment;
 - d. The operational procedures of security, rescue and emergency services.
 - e. Survival information appropriate to their areas of operation (e.g. polar, desert, jungle or sea) and training in the use of any survival equipment required to be carried.

- f. A comprehensive drill to cover all ditching procedures should be practised where flotation equipment is carried. This should include practice of the actual donning and inflation of a lifejacket, together with a demonstration or film of the inflation of life-rafts and/or slide-rafts and associated equipment. This practice should, on an initial conversion course, be conducted using the equipment in water, although previous certificated training with another operator or the use of similar equipment will be accepted in lieu of further wet-drill training.
 - g. Instruction on the location of emergency and safety equipment, correct use of all appropriate drills, and procedures that could be required of flight crew in different emergency situations. Evacuation of the aeroplane (or a representative training device) by use of a slide where fitted should be included when the Operations Manual procedure requires the early evacuation of flight crew to assist on the ground.
4. Aeroplane/STD training
- 4.1 Flying training should be structured and sufficiently comprehensive to familiarise the flight crew member thoroughly with all aspects of limitations and normal /abnormal and emergency procedures associated with the aeroplane and should be carried out by suitably qualified Type Rating Instructors and/or Type Rating Examiners. For specialised operations such as steep approaches, ETOPS, [] All Weather Operations, or [QFE operations.] additional training should be carried out.
 - 4.2 In planning aeroplane/STD training on aeroplanes with a flight crew of two or more, particular emphasis should be placed on the practice of Line Orientated Flying Training (LOFT) with emphasis on Crew Resource Management (CRM).
 - 4.3 Normally, the same training and practice in the flying of the aeroplane should be given to co-pilots as well as commanders. The 'flight handling' sections of the syllabus for commanders and co-pilots alike should include all the requirements of the operator proficiency check required by JAR-OPS 1.965.
 - 4.4 Unless the type rating training programme has been carried out in a Flight Simulator usable for zero flight-time (ZFT) conversion, the training should include at least 3 takeoffs and landings in the aeroplane.
5. Line flying under supervision
- 5.1 Following completion of aeroplane/STD training and checking as part of the operator's conversion course, each flight crew member should operate a minimum number of sectors and/or flying hours under the supervision of a flight crew member nominated by the operator and acceptable to the Authority.
 - 5.2 The minimum sectors/hours should be specified in the Operations Manual and should be determined by the following:
 - a. Previous experience of the flight crew member;
 - b. Complexity of the aeroplane; and
 - c. The type and area of operation.
 - 5.3 A line check in accordance with JAR-OPS 1.945(a)(8) should be completed upon completion of line flying under supervision.
6. System Panel Operator
- 6.1 Conversion training for system panel operators should approximate to that of pilots.
 - 6.2 If the flight crew includes a pilot with duties of a systems panel operator, he should, after training and the initial check in these duties, operate a minimum number of sectors under the supervision of a nominated additional flight crew member. The minimum figures should be specified in the Operations Manual and should be selected after due note has been taken of the complexity of the aeroplane and the experience of the flight crew member.

5.3 IEM OPS 1.945
Line Flying under Supervision
See JAR-OPS 1.945

- 1. Introduction
 - 1.1 Line flying under supervision provides the opportunity for a flight crew member to carry into practice the procedures and techniques he has been made familiar with during the ground and flying training of a conversion course. This is accomplished under the supervision of a flight crew member specifically nominated and trained for the task. At the end of line flying under supervision the

respective crew member should be able to perform a safe and efficient flight conducted within the tasks of his crew member station.

- 1.2 The following minimum figures for details to be flown under supervision are guidelines for operators to use when establishing their individual requirements.

2. Turbo jet aircraft

- a. Co-pilot undertaking first conversion course:
 - i. Total accumulated 100 hours or minimum 40 sectors;
- b. Co-pilot upgrading to commander:
 - i. Minimum 20 sectors when converting to a new type;
 - ii. Minimum 10 sectors when already qualified on the aeroplane type.

5.4 Line checks

See JAR-OPS 1.965(c)

1. Where a pilot is required to operate as pilot flying and pilot non-flying, he should be checked on one sector as pilot flying and on another sector as pilot non-flying.
2. However, where an operator's procedures require integrated flight preparation, integrated cockpit initialisation and that each pilot performs both flying and non-flying duties on the same sector, then the line check may be performed on a single sector.

5.5 IEM OPS 1.965

Recurrent training and checking

See JAR-OPS 1.965

1. Line checks, route and aerodrome competency and recent experience requirements are intended to ensure the crew member's ability to operate efficiently under normal conditions, whereas other checks and emergency and safety equipment training are primarily intended to prepare the crew member for abnormal/emergency procedures.
2. The line check is performed in the aeroplane. All other training and checking should be performed in the aeroplane of the same type or an STD or, an approved flight simulator or, in the case of emergency and safety equipment training, in a representative training device. The type of equipment used for training and checking should be representative of the instrumentation, equipment and layout of the aeroplane type operated by the flight crew member.
3. Line Checks
 - 3.1 The line check is considered a particularly important factor in the development, maintenance and refinement of high operating standards, and can provide the operator with a valuable indication of the usefulness of his training policy and methods. Line checks are a test of a flight crew member's ability to perform a complete line operation satisfactorily, including pre-flight and post-flight procedures and use of the equipment provided, and an opportunity for an overall assessment of his ability to perform the duties required as specified in the Operations Manual. The route chosen should be such as to give adequate representation of the scope of a pilot's normal operations. When weather conditions preclude a manual landing, an automatic landing is acceptable. The line check is not intended to determine competence on any particular route. The commander, or any pilot who may be required to relieve the commander, should also demonstrate his ability to 'manage' the operation and take appropriate command decisions.
4. Proficiency Training and Checking
 - 4.1 When an STD is used, the opportunity should be taken, where possible, to use Line Oriented Flying Training (LOFT).
 - 4.2 Proficiency training and checking for System Panel Operators should, where practicable, take place at the same time a pilot is undergoing proficiency training and checking.

END OF SECTION 5 - EU-OPS 1 – Subpart N (Flight Crew Training)

Means of Compliance extract relating to SECTION 4 above

END OF APPENDIX A

APPENDIX B - REGULATORY REQUIREMENTS - AWOPS PROCEDURES & TRAINING

STAGES IN AN APPLICATION FOR AWOPS

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SECTION 2	TECHNICAL CERTIFICATION
SECTION 3	OPERATION OF THE AEROPLANE
SECTION 4	AERODROME REQUIREMENTS
SECTION 5	INITIAL CERTIFICATION AND AUTHORISATION
SECTION 6	AERODROME OPERATING MINIMA (AOM)
SECTION 7	CAT 2 & 3 SUBMISSION FRAMEWORK
SECTION 8	SUMMARY OF TRAINING REQUIREMENTS
SECTION 9	FORMS

PREAMBLE

Low Visibility Operations guidance in this document is based on Requirements that satisfy ICAO Standards and Recommended Practices in ICAO Doc 8168 (PANS-OPS) & ICAO Doc 9365 (Manual of all Weather Operations) also EU-OPS 1 (in particular Sub Part E) & TGL 44. In addition, it satisfies the UK Air Pilot relating to Low Visibility and All Weather Operations (LVO/AWOPS).

The general information relating to AWOPS training and the sample Standard Operating Procedures (SOP) contained herein, should also satisfy other National Regulatory Authority (NAA) Air Safety Department (ASD) requirements for Low Visibility and All Weather Operations.

Low Visibility Procedures come into effect when the Reported Visibility is less than 400m for take-off or below 800m (RVR 550m) for approach and landing.

This Appendix is developed from a UK CAA document that is no longer available. It covers the various stages of introduction to AWOPS that need to be addressed by an operator before Low Visibility Operations are authorised. The requirements need to be met for each aircraft type operated.

SECTION 1 - GLOSSARY OF TERMS

GLOSSARY OF LVO/AWOPS AOM & OTHER TERMS

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100 GLOSSARY OF LVO / AWO & OTHER TERMS

101 ALERT HEIGHT

The Alert height is a specified radio altimeter height, based on the characteristics of the aeroplane and its fail operational landing system. In operational use, if one of the required redundant operational systems in the aeroplane failed above the Alert Height (including where appropriate, ground roll-out guidance and the reversionary mode in a hybrid system) the approach would be discontinued and a go around executed; unless reversion to a higher Decision Height was possible.

If a failure in one of the required redundant operational systems occurred below Alert Height, it would be ignored and the approach continued.

A typical Alert Height for an aircraft with a fail operational, triple autopilot installation is 200 feet.

102 CATEGORY 1, CATEGORY 2, CATEGORY 3a and 3b Operations

Category 1 Operation

A precision approach and landing using ILS, MLS GLS (GNSS/GBAS) or PAR with Decision Height not lower than 60m (200 feet) and with either a visibility of 800 metres or a Runway Visual Range of not less than 550 metres (where full Cat 2/3 runway lighting is available).

Category 2 Operation

A precision approach and landing using ILS or MLS with a Decision Height lower than 200 feet (60m) but not lower than 100 feet and a Runway Visual Range of not less than 300 metres.

Category 3a Operation

A precision approach and landing using ILS or MLS with a Decision Height lower than 100 feet (30m) and a Runway Visual Range of not less than 200 metres.

Category 3b Operation

A precision approach and landing using ILS or MLS with a Decision Height lower than 50 feet (15m) or no decision height and a Runway Visual Range of less than 200 metres but not less than 75 metres.

Category 3b No decision height operations.

Operations with no decision height may only be conducted if:

- (i) The operation with no decision height is authorised in the AFM;
- (ii) The approach aid and the aerodrome facilities can support operations with no decision height; and
- (iii) The operator has an approval for CAT III operations with no decision height.

Low visibility in the context of requiring approval from EASA, is taken to mean landing with a visibility less than 800 metres (550m RVR); or taking-off with visibility less than 400 metres.

Lower than Standard Category I Operation

A Cat 1 Instrument Approach and Landing Operation using Cat 1 DH, with an RVR lower than would normally be associated with the applicable DH of 200ft but not lower than 100 ft & RVR of not less than 350/400 m.

Other than Standard Category II Operation

A Category II Instrument Approach and Landing Operation to a runway where some or all of the elements of the ICAO Annex 14 Precision Approach Category II lighting system are not available.

Precision approach and landing operation

Is an instrument approach and landing using precision lateral and vertical guidance with minima as determined by the category of operation.

Operators must also establish the current EASA AWO certification requirements that apply. Contact UK CAA at +44 (0) 1293 573 909 or by Fax to +44 (0) 1293 573 991; alternatively, send an E-mail to:

FOP.Admin@caa.co.uk (attention Flight Operations Policy, Aviation House, Gatwick).

Note: Where decision height (DH) and runway visual range (RVR) fall into different categories of operation, the instrument approach and landing must be conducted according to the requirements of the most demanding category (e.g. an operation with a DH in the range of Cat 3a but with an RVR in the range of Cat 3b shall be considered a Cat 3b operation, or an operation with a DH in the range of Cat 2 but with an RVR in the range of Cat 1 shall be considered a Cat 2 operation).

103 **DECISION HEIGHT**

Decision Height (DH) 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 safely.

104 **FAIL OPERATIONAL AUTOMATIC LANDING SYSTEM**

An automatic landing system is fail operational if, in the event of a failure below Alert Height, the approach and flare can be completed by the remaining part of the automatic system. Note that in the event of a failure, the automatic landing system will operate as a fail passive system.

105 **FAIL OPERATIONAL HYBRID LANDING SYSTEM**

It is a system which consists of a primary fail-passive automatic landing system and a secondary independent guidance system enabling the pilot to complete a landing manually after failure of the primary system.

Note: A typical secondary independent guidance system consists of a monitored head-up display providing guidance which normally takes the form of command information but it may alternatively be situation (or deviation) information.

106 **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. Note that for a fail passive automatic system, the pilot assumes control of the aircraft after a failure.

107 **ICING CONDITIONS**

Icing conditions exist whenever the Outside Air Temperature is less than +5°C and there is visible moisture present or in trend, down to -5°C below which any liquid water 'moisture' cannot be present at ground level. (Also see Appendix C - Winter Operations). There are several types of specific descriptors used and it is the responsibility of the flight crew to determine which of these should be considered:

Rain (RA) – Rain showers (RA SH) - (Drizzle (DZ), Continuous (CNS), Intermittent (INTER), Heavy (HVY) and Very Heavy, Torrential)

Hail (GR or Hail)

Freezing Rain (FZ RA)

FOG (FG)

Freezing FOG (FZ FG)

Snow (SN) – with several levels of severity – Snow Grains (SG), Flurries, Light (-), Medium (No qualifier) and Heavy (+), Blizzard (BLZD)

Thunderstorm (TS)

108 **LOW VISIBILITY OPERATIONS / PROCEDURES**

Low visibility procedures (LVPs) are introduced when the Runway Visual Range (RVR) is reduced to less than 550 metres or is forecast to fall below 550 metres RVR, or when the cloud ceiling is reduced to 200 feet or below or is forecast to fall to 200 feet or below. The decision to declare LVPs is taken and initially notified by ATC.

109 **OBSTACLE CLEARANCE ALTITUDE (OCA) or HEIGHT (OCH)**

The lowest height above the elevation of the relevant runway threshold used in establishing compliance with appropriate obstacle clearance criteria when calculating AOM.

110 **OBSTACLE CLEARANCE LIMIT (OCL)**

Published height for certain aerodromes used when calculating Aerodrome Operating Minima where OCH and OCA is not available

111 OBSTACLE FREE ZONE (OFZ)

A volume of airspace extending upwards from an inner portion of the runway strip to specified upper limits, which is kept clear of all obstacles except for minor specified items. For details see CAP 168 (Licensing of Aerodromes).

112 RUNWAY VISUAL RANGE (RVR)

The range over which the pilot of an aircraft on the centreline of a runway can see the runway surface markings or the lights delineating the runway or identifying its centreline.

When the Meteorological Visibility is below 1500m, RVR is reported instead; in metres rounded down to:

- a. the nearest 25 metres for RVR below 400m
- b. the nearest 50 metres for RVR between 400m and 800m.
- c. the nearest 100 metres for RVR above 800m

113 PREVAILING VISIBILITY

As given in METAR observations, horizontal **prevailing visibility** is representative of the airfield in metres, up to 9 km (9000m); if the prevailing visibility (as defined below) is 10 km or more, this group is given as 9999 & if <50m, it is coded 0000.

The '**prevailing visibility**' is defined as the value that is reached or exceeded over at least 50% of the horizon (contiguous or in fragments), or within at least half of the airfield/airport surface, but note that prior to November 2004, the convention long adopted (except in the US & Canada), was to report the *lowest* visibility as the primary value, with 'better' values appended, to defined rules. This older rule may still be applied for some time, particularly from some military airfields.

114 SPECIFIED VISUAL REFERENCE

For Category 2 Operations: enough sight of the aerodrome visual aids, which together with ASI and Altimeter indications, will enable pilots to assess aircraft position and progress in relation to the desired flight path, throughout the instrument to visual transition and landing phase. For Cat 3a & 3b operations with a DH: enough sight of the visual aids to confirm the onboard system indications that a safe landing can be made.

115 VISIBILITY

For aeronautical purposes, Visibility is the greater of:

- a. the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background; and
- b. the greatest distance at which lights in the vicinity of 1,000 candelas can be seen and identified against an unlit background.

Note 1: The two distances have different values in air of a given extinction coefficient. The latter, (b) varies with the background illumination. The former, (a) is represented by the Meteorological Optical Range (MOR).

Note 2: When the approach visibility is less than 1,500m, RVR readings are given instead.

End of Section 1

SECTION 2 - TECHNICAL CERTIFICATION

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Decision Height below 50 ft	233
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Radio Altimeter Decision Height (DH)	235

200 THE AEROPLANE

- 201 Aircraft to be used for Category 2 and 3 operations must have an "AWOPS Certificate" issued by the State of Registry, according to criteria based on the ICAO All Weather Operations (AWO) Manual, reflected in EU OPS 1 as the EASA Requirements.
- 202 Other State Certifications may be acceptable to the EU Registry National Aviation Authority (NAA), if they are proved to be to an equivalent standard as the Airworthiness Requirements mentioned in 201.
- 203 The aircraft flight deck must clearly show by way of a placard, the serviceability state of the aircraft equipment relative to Category 2 or 3 operations.
- 204 The Minimum Equipment List (MEL) should be revised to establish what "Allowable Deficiencies" are permissible with respect to LVO. It is especially important to ensure that an allowable deficiency is compatible with the operating procedure. For example, if it is allowable to operate to Category 2 with only one radio altimeter, it follows that the Minimum Equipment List (MEL) must be specific as to which one must be serviceable.

210 AIRWORTHINESS CERTIFICATION

- 211 The basic Requirements that are to be met by any aeroplanes for Category 2 and 3 operations are specified in documents that may be obtained from the National Aviation Authority (NAA) of an aircraft's State of Registry. For example, guidance on AWOPS on-board hardware and its required serviceability according to EASA, can be obtained from the UK Civil Aviation Authority Airworthiness Division for UK registered aircraft operated by a third party on a dry lease outside the EU area.

220 IN-SERVICE PROVING

- 221 The operator will be required to carry out a proving programme to demonstrate that, when in 'Line Service', the performance and reliability of the aircraft and its systems meet the criteria on which the Airworthiness Certification was based. For aeroplanes registered by the NAA issuing the AOC, the programme should be agreed in detail with its Airworthiness Division before it commences.

For aeroplanes not registered in the State issuing the AOC but who may wish to operate in weather conditions that are below Cat 1, the operator should provide evidence that a suitable programme has been satisfactorily completed, to satisfy the NAA of the State of registration of the aircraft operated by the company on a leased basis as well as the NAA of the State issuing the AOC

- 222 Equipment Proving Programme

To assist operators in planning In-Service proving of All Weather Operations systems by way of an aircraft equipment proving programme, the following notes give information on the nature and extent of the programme that is likely to be requested. What follows is applicable to the first introduction of a new aeroplane into service.

Where an operator introduces an aeroplane that has already been shown to be satisfactory in the service of another operator, it is likely that a lesser programme than as indicated hereafter will be acceptable

223 Decision Height between 200 feet and 50 feet

The aeroplane type should be operated for a period of at least six months in Category 1 or better weather conditions, with a Decision Height (DH) of 200 ft or more, with the operating and maintenance procedures which are intended to be used when the DH is lowered whilst using runways that are suitably equipped and authorised for Cat 2 and Cat 3 operations,

During this period, a pilot's report should be obtained for each approach, whether successful or unsuccessful. Suitable forms to use for such reporting will be found at the end of this Section (912 in Section 9 refers).

All such reports must be copied to the NAA for analysis; at the same time as the operator uses these returns to prepare the required in-service proving summary.

Other Regulatory Authorities may require copies of auto-approach results, as part of their procedure for authorizing Cat 2 and/or 3 operations by a particular operator.

Each report should include the following information:

- a. Airport and runway used;
- b. Wind speed and direction;
- c. Minimum height to which system was used;
- d. Pilot's opinion of the system's behaviour and, if unsatisfactory, the reason for his/her judgement.

All reports should be analysed and a summary report sent to the Regulatory Authority. The report should show that, to a 90% confidence level, 95% of the approaches made using the lower DH would be successful.

224 Number of practise approaches required for equipment proving

Using a DH of between 200 feet and 50 feet, in the absence of any failure, the minimum number of acceptable approaches required for equipment proving could be demonstrated by

- a. 30 successful approaches on each aircraft of the type on the inventory that is intended to be operated whilst using Category 2 DH of 100 feet, with no autoland, but with autopilot disconnect by 50 feet for a manual landing; or
- b. 40 successful approaches on each aircraft of the type on the inventory that is intended to be operated whilst using a Category 3A DH of not less than 50 feet, with autoland.

Unsuccessful approaches must also be reported, to permit an analysis of the reasons why the approach was not successful.

Any approaches which are unsuccessful due to causes which would not be present during operations with the lower DH may be excluded from the evaluation; for example where the ILS was unsuitably protected from the effects of ground vehicles manoeuvring across the localiser beam or from an aeroplane overflying the ILS localiser transmitter aerial. It may however be preferable to include such unsuccessful approach reports, to permit a better analysis of equipment capability overall.

It is anticipated that the required total number of approaches that are required to be made in three months will exceed the minimum numbers quoted.

The report should also show that operating and maintenance procedures specified as a result of the constructor's demonstration were found to be adequate and practical.

- c. Data should be collected from all aeroplanes intended for operation with DH less than 200 feet but not less than 50 feet. If the number of aeroplanes used of any one type is less than six, then additional aeroplanes of that type which are introduced subsequently should be the subject to a period of reporting; to achieve 30 or 40 successful approaches each depending upon the LVO Category permission sought.

225 Decision Height below 50 feet or No Decision Height

- a. For a period which should be six months, the aeroplane type should be operated with DH of 50 feet or more, AFTER having first completed the programme outlined in paragraphs 223 and 224; using agreed system operating procedures and maintenance procedures that are intended to be used when flying to a DH of 50 feet and below, or Nil (0) DH.

During this period a pilot's report should be obtained for each approach whether successful or unsuccessful, supported by flight data recorder information. The pilots' reports should include the same information as in paragraph 223 (a), (b), (c) and (d). Suitable forms to use for such reporting will be found in **Section 9 in this Appendix B**.

The information needed from the Flight Data Recorder (FDR) may vary from one aircraft type to another, but should be sufficient to provide the information specified in (d), (e) and (f) which follow

- b. Data should be gathered from all aeroplanes intended for operation with DH less than 50 feet or no DH.
- If the number of aeroplanes of any one type is less than 10, then additional aeroplanes of that type which are to be introduced subsequently should be subject to a limited period of reporting, until reports from at least 10 aircraft are available.
- c. The NAA might require that data should cover a significant number of landings (400 to 500) for operations with a DH and up to 1000 landings for operations with NO DH. Records of equipment defects and the resulting maintenance action should also be obtained and made available.
- d. To verify performance, data from at least half of the recorded landings should be analysed to determine the statistical distribution of:
- i. Lateral position at touchdown relative to ILS null;
 - ii. Flare time;
 - iii. Rate of descent at touchdown;
 - iv. Pitch and bank angles at touchdown;
 - v. Speed loss in flare;
 - vi. Maximum deviation during the ground run (for aircraft with automatic ground roll control or ground roll guidance intended for operation with No DH).
- These distributions should be consistent with flight test results upon which Airworthiness Certification is based.
- e. The rate at which system warnings, alert indication or partial disengagements occur and the effectiveness of maintenance procedures in tracing and rectifying their causes, should be consistent with the Airworthiness Certification objective in that no more than one approach in one million should loss of automatic control occur below the Alert Height.
- f. The cause of any of the following unusual events should be established and it should be shown that their occurrence does not invalidate the analyses called for in (d) and (e) above.
- i. Pilot report of unsatisfactory performance;
 - ii. Pilot intervention due to performance or failure;
 - iii. Any parameters listed in (d) differing from its mean value by more than three standard deviations;
- g. Rules require that where the outboard wheel touches down, lateral dispersions must not be greater than 70 feet from the runway centreline more than once in 10^{-6} , that is, only once in 1 million occurrences.

For comparison purposes, it may be worth mentioning that the USA FAA state that on 95% of occasions, touchdown should not exceed 27 feet from centreline.

Additional information on acceptable dispersions from the target flight test data may be obtained from the Regulatory Authority on request.

226 Flight Data Recording for System Monitoring

For operation with DH less than 50 feet or no DH, it is advisable that flight data recording should be continued after completion of the In-Service programme.

By so doing, were there to be any pilot reports of system degradation causing unsatisfactory system performance, pilot intervention due to the system's performance or any system failure, the cause can be identified and corrective action taken.

If the cause of anomalous system behaviour cannot be established, continued operation with low DH or no DH may be in doubt and must be discontinued.

230 AIRBORNE EQUIPMENT

The following items of equipment will be required for operations to the Decision Heights specified, unless it is shown that the intended level of safety is achieved with alternative equipment, or the deletion of some items. This list is based on experience with conventional medium and large jet transports and it is recognised that variations may be appropriate in significantly different applications.

231 DH of 199 feet to 100 feet

- a. Autopilot with an ILS coupling mode.

Note: A Flight Director System (head up or head down) with an ILS coupling mode may be approved for use following failure or disconnect of the autopilot.

- b. Auto-throttle; unless it can be shown that speed control does not add excessively to the crew workload.
 - c. Radio Altimeters (minimum of 2).
 - d. Excess ILS deviation warning and instruments comparator warning device
- 232 DH of 99 feet to 50 feet
- a. Equipment required in paragraph 231.
 - b. Autopilot with automatic landing mode.
- 233 DH below 50 feet
- a. Equipment required in paragraph 231.
 - b. Autopilot equipment to be as follows
 - i. Autopilot with a Fail-Operational automatic landing mode and an automatic Missed Approach mode; or
 - ii. Autopilot with automatic landing and missed approach modes and a landing guidance display.
- 234 No DH
- a. Equipment required in 233 above; and
 - b. Autopilot equipment to be as follows
 - i. Autopilot with Fail-Operational ground roll mode; or
 - ii. Fail-Operational head-up ground roll guidance display; or
 - iii. Autopilot with a ground roll mode and a head-up ground roll guidance display;
 - c. Anti-skid braking system.
- 235 Radio Altimeter Decision Height (DH)
- Note that a Radio Altimeter DH may only be used when a RAD ALT OCH or State Minima RAD ALT DH is published. However, because a RAD ALT OCH is calculated and published as a height above the runway threshold, mental adjustments may be necessary during the approach to take account of the terrain in the approach area and when initially determining a RAD ALT DH for publication. The pre-descent briefing should include words of caution regarding Radio Altimeters readings, if the terrain under the approach path is not level ground all the way to the threshold. RA DH "bugs" must be set as published on each Radio Altimeter and never be changed to another figure by the pilots.

It is therefore necessary for operators to consult the NAA before publishing any RAD ALT DH in their Operations Manuals.

Operators are also reminded of the existence of Precision Approach Terrain Charts published by ICAO States for all Cat 2 and Cat 3 runways. These are similar to UK aerodromes Type A charts which are listed in Annexe 4 of the current UK AIC (Green) which has as title "Catalogue of Aeronautical Charts for Civil Aviation". Note that SID and STAR charts for the UK are listed in a separate Annexe.

End of Section 2

SECTION 3 - OPERATION OF THE AEROPLANE

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300 OPERATION OF THE AEROPLANE

301 Complementary information which may be of use to operators, who are preparing an application for submission to a Regulatory Authority for Category 2 or 3 operations within its airspace, may be found in the ICAO All Weather Operations Manual and in EU-OPS 1.

310 GENERAL

311 Aircraft Operators seeking agreement from the NAA of their Aircraft State of Registry, for Category 2 and 3 operations will be expected to

- a. Demonstrate that flight crews have carried out an agreed programme of training which reflects the content of this document.
- b. Offer specific detailed procedures and instructions for flight crew in their Operations Manual, which should reflect the mandatory procedures and limitations notified in the Flight Manual.
- c. Demonstrate that the training programme, operating procedures and instructions, result in a standard of operations conforming to the safety level established for the aeroplane and the applicable system, in the course of the certification procedure; and
- d. Produce evidence that proposed operational techniques have been satisfactorily used to the higher minima.

312 Operational Demonstration (Introduction and Approval of Low Visibility Operations)

The purpose of the operational demonstration is to determine or validate the use and effectiveness of the applicable aircraft flight guidance systems, training, flight crew procedures, maintenance programme, and manuals applicable to the Category II/III programme being approved.

- (1) At least 30 approaches and landings must be accomplished in operations using the Category II/III systems installed in each aircraft type if the requested DH is 50 ft or higher. If the DH is less than 50 ft, at least 100 approaches and landings will need to be accomplished unless otherwise approved by the Authority.
- (2) If an operator has different variants of the same type of aircraft utilising the same basic flight control and display systems, or different basic flight control and display systems on the same type of aircraft, the operator must show that the various variants have satisfactory performance, but the operator need not conduct a full operational demonstration for each variant. The Authority may also accept a reduction of the number of approach and landings based on credit given for the experience gained by another operator with an AOC issued in accordance with EU-OPS 1 using the same aeroplane type or variant and procedures.
- (3) If the number of unsuccessful approaches exceeds 5% of the total (e.g. unsatisfactory landings, system disconnects) the evaluation programme must be extended in steps of at least 10 approaches and landings until the overall failure rate does not exceed.

314 See Appendix 1 to EU-OPS 1.440 - Low Visibility Operations – General Operating Rules at (2.5) in *Appendix A* for additional guidance.

320 FLIGHT CREW TRAINING

(Appendix 1 to EU-OPS 1.450 Low Visibility Operations - Training & Qualifications at (2.6A & 2.6B) in *Appendix A*)

321 General

Detailed requirements for special flight crew training may vary from one operator to another, depending upon the particular systems and procedures

An operator must ensure that flight crew member training programmes for Low Visibility Operations include structured courses of ground, Flight Simulator and/or flight training. The operator may abbreviate the course

content as prescribed by sub-paragraphs (b) and (c) below provided the content of the abbreviated course is acceptable to the authority.

- a. Flight crew members with no Category II or Category III experience must complete the full training programme prescribed in sub-paragraphs 322, 323 and 324 below.
- b. Flight crew members with Category II or Category III experience with another JAA operator may undertake an abbreviated ground training course.
- c. Flight crew members with Category II or Category III experience with the operator may undertake an abbreviated ground, Flight Simulator and/or flight training course. The abbreviated course is to include at least the requirements of sub-paragraphs 324(a), 324(b)(i) or 324(b)(ii) as appropriate and 324(c)(i).

Before a crew is considered competent to operate to Category 2 or Category 3 minima, every crew member on the crew must have completed all the stages of conversion and LVO training (including Route Training) and he/she will also have achieved the necessary aircraft type experience level. Aircraft type experience can be obtained whilst pursuing the necessary LVO consolidation practise approaches after initial LVO training has been completed.

In addition to the completion and retention of normal conversion or recurrent crew training records, a special Low Visibility Operations Competency Certificate will be issued to each individual. It will show the level of competency achieved as every stage of progress through LVO training is attained; and it will indicate the level of LVO that the person is allowed to participate in and in what capacity.

Competency Certificates include room to record practise and actual LVO approaches and landings, for qualification purposes, or to maintain 'recency' thereafter.

Examples of suitable certificates will be found at the back of this document in an Addendum where other relevant LVO documentation is also illustrated; for adoption or to be adapted as necessary by the operator.

322 Ground Training

An operator must ensure that the initial ground training course for Low Visibility Operations covers at least:

- a. Flight crew duties.
- b. The characteristics and limitations of the ILS and/or MLS; Automatic landing equipment, system limitations, monitoring and warning devices, with emphasis on those elements which, if failed or degraded, necessitate reversion to higher minima or initiation of a missed approach.
- c. Action in the event of failures above and below DH, if any DH is specified.
- d. Action in the event of any failure above and below the Alert Height.
- e. Variation in the height at which visual reference will be acquired and in the visual sequences to be expected, in varying weather conditions.
- f. Approach and runway lighting systems that will be encountered.
- g. The effect on aeroplane systems of interference to the ILS signal caused by other aeroplanes landing, taking off or overflying; and the effect of infringement of ILS critical and sensitive areas by aircraft or vehicles in the ground manoeuvring area.
- h. Concepts of obstacle clearance and Obstacle Free Zones and their effect on AOM when related to the system and to procedures to be used.
- i. The effect of terrain profile in the approach area on radio altimeter readings and on the automatic landing system.
- j. Use of multiple RVR reports.
- k. The characteristics of the visual aids;
- l. The characteristics of fog;
- n. The operational capabilities and limitations of the particular airborne system;
- o. The effects of precipitation, ice accretion, low level wind shear and turbulence;
- p. The effect of specific aeroplane malfunctions;
- q. The use and limitations of RVR assessment systems;
- r. The principles of obstacle clearance requirements;
- s. Recognition of and action to be taken in the event of failure of ground equipment;
- t. The procedures and precautions to be followed with regard to surface movement during operations when the RVR is 400 m or less and any additional procedures required for take-off in conditions below 150 m (200 m for Category D aeroplanes);
- u. The significance of decision height based upon radio altimeters and the effect of terrain profile in the approach area on radio altimeter readings and on the automatic approach/landing systems;
- v. The importance and significance of Alert Height if applicable and the action in the event of any failure above and below the Alert Height;

- w. The qualification requirements for pilots to obtain and retain approval to conduct Low Visibility take-offs and Category II or III operations; and
- x. The importance of correct seating and eye position.
- y. Viewing of recordings of actual approaches and landing in the relevant weather minima.

In addition, flight crew could be usefully given practical training in the use of the system in conditions appropriate to the lowest minima to be specified. Such training and tests will normally necessitate the use of a flight simulator with visual attachment approved for simulating such minimum conditions. Such training should emphasise the probability of success of the system rather than the system faults. The syllabus could include the following:

- i. Approach, landing and missed approach from the lowest DH to be used, in the lowest visibility condition.
- ii. The handling of system failures arising in the course of an approach, a landing and on a missed approach.
- iii. The handling of engine and equipment failures during the take off when low take-off minima require the use of the system.
- iv. Rejected take-off(s) when departing in the lowest visibility permitted.

323 Flight Simulator training and/or flight training

- a. An operator must ensure that Flight Simulator and/or flight training for Low Visibility Operations includes:
 - i. Checks of satisfactory functioning of equipment, both on the ground and in flight;
 - ii. Effect on minima caused by changes in the status of ground installations;
 - iii. 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;
 - iv. Actions to be taken in the event of failures such as engines, electrical systems, hydraulics or flight control systems;
 - v. The effect of known unserviceabilities and use of minimum equipment lists;
 - vi. Operating limitations resulting from airworthiness certification;
 - vii. Guidance on the visual cues required at decision height together with information on maximum deviation allowed from glidepath or localiser; and
 - viii. The importance and significance of Alert Height if applicable and the action in the event of any failure above and below the Alert Height.
- b. An operator must ensure that each flight crew member is trained to carry out his duties and instructed on the coordination required with other crew members. Maximum use should be made of flight simulators.
- c. Training must be divided into phases covering normal operation with no aeroplane or equipment failures but including all weather conditions which may be encountered and detailed scenarios of aeroplane and equipment failure which could affect Category II or III operations. If the aeroplane system involves the use of hybrid or other special systems (such as head up displays or enhanced vision equipment) then flight crew members must practise the use of these systems in normal and abnormal modes during the Flight Simulator phase of training.
- d. Incapacitation procedures appropriate to Low Visibility Take-offs and Category II and III operations shall be practised.
- e. For aeroplanes with no Flight Simulator operators must ensure that the flight training phase specific to the visual scenarios of Category II operations is conducted in a specifically approved Flight Simulator. Such training must include a minimum of 4 approaches. The training and procedures that are type specific shall be practised in the aeroplane.
- f. Initial Category II and III training shall include at least the following exercises:
 - i. Approach using the appropriate flight guidance, autopilots and control systems installed in the aeroplane, to the appropriate decision height and to include transition to visual flight and landing;
 - ii. Approach with all engines operating using the appropriate flight guidance systems, autopilots and control systems installed in the aeroplane down to the appropriate decision height followed by missed approach; all without external visual reference;
 - iii. Where appropriate, approaches utilising automatic flight systems to provide automatic flare, landing and rollout; and
 - iv. Normal operation of the applicable system both with and without acquisition of visual cues at decision height.
- g. Subsequent phases of training must include at least:
 - i. Approaches with engine failure at various stages on the approach;
 - ii. Approaches with critical equipment failures (e.g. electrical systems, auto flight systems, ground and/or airborne ILS/MLS systems and status monitors);
 - iii. Approaches where failures of auto flight equipment at low level require either:
 - (A) Reversion to manual flight to control flare, landing and roll out or missed approach; or

- (B) Reversion to manual flight or a downgraded automatic mode to control missed approaches from, at or below decision height including those which may result in a touchdown on the runway;
 - iv. Failures of the systems which will result in excessive localiser and/or glide slope deviation, both above and below decision height, in the minimum visual conditions authorised for the operation. In addition, a continuation to a manual landing must be practised if a head-up display forms a downgraded mode of the automatic system or the head-up display forms the only flare mode; and
 - v. Failures and procedures specific to aeroplane type or variant.
 - h. The training programme must provide practice in handling faults which require a reversion to higher minima.
 - i. The training programme must include the handling of the aeroplane when, during a fail passive Category III approach, the fault causes the autopilot to disconnect at or below decision height when the last reported RVR is 300 m or less.
 - j. Where take-offs are conducted in RVRs of 400 m and below, training must be established to cover systems failures and engine failure resulting in continued as well as rejected take-offs.
- 324 Conversion Training Requirements to conduct Low Visibility Take-off and Category II and III Operations.
- An operator shall ensure that each flight crew member completes the following Low Visibility Procedures training if converting to a new type or variant of aeroplane in which Low Visibility Take-off and Category II and III Operations will be conducted. The flight crew member experience requirements to undertake an abbreviated course are prescribed in subparagraphs 321(b) and 321(c), above:
- a. Ground Training. The appropriate requirements prescribed in subparagraph (b) above, taking into account the flight crew member's Category II and Category III training and experience.
 - b. Flight Simulator Training and/or Flight training.
 - (i) A minimum of 8 approaches and/or landings in a Flight Simulator.
 - (ii) Where no Flight Simulator is available to represent that specific aeroplane, a minimum of 3 approaches including at least 1 go-around is required on the aeroplane.
 - (iii) Appropriate additional training if any special equipment is required such as head-up displays or enhanced vision equipment.
 - c. Flight Crew Qualification. The flight crew qualification requirements are specific to the operator and the type of aeroplane operated.
 - (i) The operator must ensure that each flight crew member completes a check before conducting Category II or III operations.
 - (ii) The check prescribed in subparagraph (i) above may be replaced by successful completion of the Flight Simulator and/or flight training prescribed in sub-paragraph (d)(2) above.
 - d. Line Flying under Supervision. An operator must ensure that each flight crew member undergoes the following line flying under supervision:
 - (i) For Category II when a manual landing is required, a minimum of 3 landings from autopilot disconnect;
 - (ii) For Category III, a minimum of 3 autolands except that only 1 autoland is required when the training required in subparagraph (d)(2) above has been carried out in a Flight Simulator usable for zero flight time conversion.
- 325 Type and command experience
- Before commencing Category II/III operations, the following additional requirements are applicable to commanders, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type:
- a. 50 hours or 20 sectors on the type, including line flying under supervision; and (2) 100 m must be added to the applicable Category II or Category III RVR minima unless he has previously qualified for Category II or III operations with a JAA operator, until a total of 100 hours or 40 sectors, including line flying under supervision, has been achieved on the type.
 - b. 100 m must be added to the applicable Category II or Category III RVR minima unless previously qualified for Category II or III operations with a Community operator, until a total of 100 hours or 40 sectors, including line flying under supervision, has been achieved on the type.
 - c. The Authority may authorise a reduction in the above command experience requirements for flight crew members who have Category II or Category III command experience.

- 326 Low Visibility Take-Off with RVR less than 150/200 m
- a. An operator must ensure that prior to authorisation to conduct take-offs in RVRs below 150m (below 200m for Category D aeroplanes) the following training is carried out:
 - i. Normal take-off in minimum authorised RVR conditions;
 - ii. Take-off in minimum authorised RVR conditions with an engine failure between V1 and V2, or as soon as safety considerations permit; and
 - iii. Take-off in minimum authorised RVR conditions with an engine failure before V1 resulting in a rejected take-off.
 - b. An operator must ensure that the training required by sub-paragraph (1) above is carried out in a Flight Simulator. This training must include the use of any special procedures and equipment. Where no Flight Simulator is available to represent that specific aeroplane, the Authority may approve such training in an aeroplane without the requirement for minimum RVR conditions. (See Appendix 1 to EU-OPS1.965.)
 - c. An operator must ensure that a flight crew member has completed a check before conducting low visibility take-offs in RVRs of less than 150 m (less than 200 m for Category D aeroplanes) if applicable. The check may only be replaced by successful completion of the Flight Simulator and/or flight training prescribed in sub-paragraph (f)(1) on conversion to an aeroplane type.

327 Recurrent Training and Checking – Low Visibility Operations

- a. An operator must ensure that, in conjunction with the normal recurrent training and operator proficiency checks, a pilot's knowledge and ability to perform the tasks associated with the particular category of operation for which he is authorised is checked. The required number of approaches within the validity period of the operator proficiency check (as prescribed in EU-OPS 1.965(b)) is to be a minimum of three, one of which may be substituted by an approach and landing in the aeroplane using approved Category II or III procedures. One missed approach shall be flown during the conduct of the operator proficiency check. If the operator is authorised to conduct take-off with RVR less than 150/200 m, at least one LVTO to the lowest applicable minima shall be flown during the conduct of the operator proficiency check. (See IEM OPS 1.450(b)(i).)
- b. For Category III operations an operator must use a Flight Simulator.
- c. An operator must ensure that, for Category III operations on aeroplanes with a fail passive flight control system, a missed approach is completed at least once over the period of three consecutive operator proficiency checks as the result of an autopilot failure at or below decision height when the last reported RVR was 300 m or less.
- d. The Authority may authorise recurrent training and checking for Category II and LVTO operations in an aeroplane type where no Flight Simulator to represent that specific aeroplane or an acceptable alternate is available.

Note that Recency for LVTO and Category II/III based upon automatic approaches and/or auto-lands is maintained by the recurrent training and checking as prescribed in this paragraph.

330 OPERATING PROCEDURES

331 General. Low Visibility Operations include:

- a. Manual take-off (with or without electronic guidance systems);
- b. Auto-coupled approach to below DH, with manual flare, landing and roll-out;
- c. Auto-coupled approach followed by auto-flare, autoland and manual roll-out; and
- d. Auto-coupled approach followed by auto-flare, autoland and auto-roll-out, when the applicable RVR is less than 400 m.

Note 1: A hybrid system may be used with any of these modes of operations.

Note 2: Other forms of guidance systems or displays may be certificated and approved.

332 Procedures and Operating Instructions

- (1) The precise nature and scope of procedures and instructions given depend upon the airborne equipment used and the flight deck procedures followed. An operator must clearly define flight crew member duties during take-off, approach, flare, roll-out and missed approach in the Operations Manual. Particular emphasis must be placed on flight crew responsibilities during transition from non-visual conditions to visual conditions, and on the procedures to be used in deteriorating visibility or when failures occur. Special attention must be paid to the distribution of flight deck duties so as to ensure that the workload of the pilot making the decision to land or execute a missed approach enables him to devote himself to supervision and the decision making process.

- (2) An operator must specify the detailed operating procedures and instructions in the Operations Manual. The instructions must be compatible with the limitations and mandatory procedures contained in the Aeroplane Flight Manual and cover the following items in particular:
- i. Checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight;
 - ii. Effect on weather minima caused by changes in the status of the ground installations and airborne equipment;
 - iii. Procedures for the take-off, approach, flare, landing, roll-out and missed approach;
 - iv. Procedures to be followed in the event of failures, warnings and other non-normal situations;
 - v. The minimum visual reference required;
 - vi. The importance of correct seating and eye position;
 - vii. Action which may be necessary arising from a deterioration of the visual reference;
 - viii. Allocation of crew duties in the carrying out of the procedures according to sub-paragraphs (i) to (iv) and (vi) above, to allow the Commander to devote himself mainly to supervision and decision making;
 - ix. The requirement for all height calls below 200 ft to be based on the radio altimeter and for one pilot to continue to monitor the aeroplane instruments until the landing is completed;
 - x. The requirement for the Localiser Sensitive Area to be protected;
 - xi. The use of information relating to wind velocity, windshear, turbulence, runway contamination and use of multiple RVR assessments;
 - xii. Procedures to be used for practice approaches and landing on runways at which the full Category II or Category III aerodrome procedures are not in force;
 - xiii. Operating limitations resulting from airworthiness certification; and
 - xiv. Information on the maximum deviation allowed from the ILS glide path and/or localiser.

328 Recurrent training requirements (see 2.6A(g) Appendix 1 to OPS 1.450 - Low Visibility Operations - Training & Qualifications

There is no requirement for an operator to issue an AWOPS recency certificate, although many still do. Normally this is dealt with by conducting three approaches during an OPC; this may be reduced though to two approaches (one to a landing in the minimum authorised visibility and one to a Go Around) if both pilots have conducted at least one CAT 2/3 approach in the aircraft since the last OPC. The requirement is satisfied by 2 in the simulator plus 1 in the a/c, or 3 in the simulator.

The ongoing recency restriction is for take-off and landing. This requires that at least three take-offs and three landings are carried out in the previous 90 days. The 90-day period prescribed may be extended up to a maximum of 120 days by line flying under the supervision of a type rating instructor or examiner. For periods beyond 120 days, the recency requirement is satisfied by a training flight or use of a flight simulator of the aeroplane type to be used. A take-off and a landing in the previous 28 days may also be required by the operator.

Where this is impractical for operational reasons, such as on extended long haul programmes where there are insufficient sectors available for pilots to maintain the required "handling recency" for manual landings AND "Autoland recency", an Approved simulator may be used instead; or the recurrent AWO revalidation exercises period in the simulator that is part of the recurrent bi-annual Competency and Skill tests may be acceptable in lieu, with the approval of the Regulatory Authority issuing the Company's AOC.

The minimum number of auto approaches (and landings where applicable) to be flown between recurrent checks and the "extended" period, when more than the minimum of 3 is required, must be agreed with the NAA

330 TESTS OF COMPETENCE

331 After initial qualification, continued competence should be demonstrated in the course of tests covering the take off (when appropriate), approach, missed approach and landing in simulated conditions of the lowest AOM to be used in normal service. Use of a flight simulator with a visual attachment that is approved for the purpose is acceptable. Tests should include the handling of engine and equipment failures in such a way that all essential items, as agreed with the operator, are covered in the course of successive tests falling within an agreed period.

332 A sample minimum content syllabus for initial training and one for recurring training may be found in Section 5 of PART 3 in this AWO Guide.

340 FLIGHT CREW EXPERIENCE

341 As part of their training, flight crews should be given experience of the system and procedures during line operations in weather conditions that are better than those that will be experienced with the lowest minima, using runways cleared for Cat 2 and Cat 3 operations

The required amount of such experience will be determined by the NAA in consultation with the operator. During these practise operations, it will need to be borne in mind that ATC Low Visibility Procedures may not be in use and that ILS signals may thus be affected by multi-path interference.

To minimise such interference, ATC should be informed as early as possible of the pilot's intention to carry out a practise LVO approach; so that ATC can endeavour to minimise any possible interference by limiting ground movements through the normally protected LVO runway area.

- 342 Where the system includes an automatic landing facility, the operator will be expected to specific a minimum amount of actual practise in its use, between recurrent LVO training sessions; whether in actual, or better than, LVO conditions.

350 **OPERATIONAL PROCEDURES**

- 351 Category 2 and 3 operations are inherently complex. They place great reliance on automatic systems and allow the pilot in command limited time for decision making. It is essential therefore, to devise pre planned courses of action to cover as many possible of the very many situations that can occur.

- 352 The detailed operating procedures and instructions to be specified in the Operations Manual will vary depending on the aircraft equipment and the operator's procedures.

Instructions must be compatible with the limitations and mandatory procedures in the Flight manual and they must cover the following items in particular:

- a. Checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight whenever LVO approaches are contemplated.
- b. During normal operations; procedures for the approach, landing, roll-out and missed approach.
- c. Procedures to be followed in the event of failures of on board equipment, deviation from localiser warnings and any other warnings or abnormal situations.
- d. At and below DH, if any, the minimum visual reference required to complete the landing.
- e. Action which may be necessary in case of deterioration of the visual reference.
- f. Allocating of crew duties in the carrying out of procedures (a) to (e) above; to allow the commander to devote himself to supervision and decision making.
- g. The requirement for the Localiser Sensitive Area to be protected when take-off is to be made using the localiser signal for director guidance or automatic control.
- h. Use of available information relating to wind velocity, wind shear, turbulence, runway contamination and the use of multiple RVR assessments.
- i. Procedures to be used for an approach to land on a runway at which full Category 2 or Category 3 aerodrome procedures are not in use.
- j. Limits of permitted operation, where the crew is notified of the non availability of items of ground equipment; such as approach or runway lighting. Note that ECAC Document 17 contains some relevant guidance material in this context.
- k. There must also be a clear prohibition on crews calculating their own Cat 2 or 3 AOM.
- l. An aide-mémoire should be prepared for use when there is a need to brief the crew prior to a Category 2 or 3 Approach and landing. It will be used in addition to and in conjunction with the aircraft normal operations checklist and include reversion to higher AOM (E.g., Cat 2 or 3 to Cat 1) if equipment fails on the approach before 1000ft
- m. It is also recommended that simplified tables of faults that can occur to the automatic flight systems be prepared, with clear indications of crew actions required; for use as an aide-mémoire when preparing for an automatic approach.

360 **DEMONSTRATION OF OPERATING STANDARDS**

- 361 Operators seeking the regulatory Authority's agreement to Category 2 or 3 operations will be required to provide the following information, normally in two parts; First a GENERAL submission, then Specific Aerodrome Operating Minima for particular runways to be used.

- 362 The General Submission will detail the proposed operation and the steps taken to meet the Requirements of this document. This will include

- a. Details of flight crew training;
- b. Relevant extracts of the operations manual;
- c. A statement of the results achieved, whilst using the proposed techniques and procedures in conditions better than the planned minima.

- 363 The proposed AOM for each runway where operations are intended, should include evidence that:

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- a. The ground facilities and environment at the aerodrome concerned are adequate. Operators of "Home base" registered aircraft must also include in their AOM lists, foreign aerodromes that are to be used by their crews.
 - b. Aeroplanes can operate to the required level of safety in relation to the obstacle surfaces referred to in paragraph 420.
- 364 It is the operator's responsibility to ensure that the requirements set out in the General Submission, or as modified in consultation with the Regulatory Authority are complied with. The acceptance by the NAA State of AOC issue of specific minima for a particular runway will be subject to the operator's continuing responsibility in this respect; and to continued promulgation of that runway for the particular category of operation concerned.

End of Section 3

SECTION 4 - AERODROME REQUIREMENTS

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400 **THE AERODROME**

401 Operations below Category 1 AOM may only be carried out at approved airports.

411 **GENERAL**

412 Before a runway can be regarded as suitable for Category 2 or 3 operations, the following factors should be considered

- a. Obstacle Clearance including Obstacle Free Zone (OFZ);
- b. Glide path angle;
- c. Characteristics of the terrain on the approach;
- d. Runway profile and dimensions;
- e. ILS installation in terms of conformity with ICAO standards and recommended practises;
- f. Visual aids, their standards of performance and reliability;
- g. Meteorological service and the assessment and dissemination of runway visual range information;
- h. Air Traffic Control and Ground Movement Control.
- i. Airport Emergency Services Rescue and Fire cover.

413 The following criteria and requirements are related to aerodromes at which operators intend to use Category 2 or 3 aerodrome operating minima. These are similar standards as will be found at aerodromes worldwide.

420 **OBSTACLE SURFACES**

421 Obstacle clearance criteria for Category 2 operations are in ICAO PANS-OPS Doc 8168.

422 An Obstacle Free Zone (OFZ) is the airspace below 150 feet above the established airport elevation and along the runway and extended runway centreline, that is required to be kept clear of all objects; except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

423 If the Obstacle Free Zone (OFZ) requirements cannot be fully met, the National Regulatory Authority should be consulted as to the feasibility of specific aeroplane types carrying out Category 2 operations within the obstacle limitations pertaining. This applies particularly if a Category 2 DH exceeds 150ft, which is the top of an OFZ (see 422 above).

424 The obstacle clearance criteria for Cat 3 operations are satisfied by the provision of an OFZ.

430 **GLIDE PATH ANGLE**

431 The normal glide path angle is 3E. The runway may be unsuitable for Category 2 or Category 3 operations if the glide path angle is greater than 3E(See aircraft limitations regarding Glide Path angle restrictions).

440 **CHARACTERISTICS OF TERRAIN ON APPROACH**

- 441 Automatic pilots may make use of radio altimeter inputs during the approach, for example to introduce failure detection **monitors, or** to reduce the response of the aircraft to ILS deviation signals to compensate for the narrowing of the ILS beam. Before accepting Category 2 or 3 operations on runways where the approach terrain is sloping or irregular, the Regulatory Authority may require an operator to demonstrate that the performance or function of the automatic landing system is not adversely affected to the point where it would be unacceptable for the proposed operation. This demonstration may take the form of flight trials or an analysis of operations at a similar site.
- 442 Automatic landing systems may be affected by the profile of the terrain in an area 3000m (10,000ft) long by 60m (200ft) wide, centred on the extended runway centreline immediately prior to the threshold. Within this area:
- The mean profile of the terrain should be essentially flat, except that gentle undulations of ground height of plus or minus 1.5m (5ft) from the mean are acceptable.
 - A change in contour height or an object causing a single isolated pulse is acceptable provided that the feature or the object causing the pulse is less than 3 metres (10ft) in height/depth and the distance between the leading and the final edges of the feature or object is less than 15m (50ft) measured parallel to the runway centreline.
 - A single step change in height caused by a feature or object can be accepted provided the change does not exceed 1m (3ft).
 - There should be no features or objects which could cause repetitive changes in radio altimeter height.
- Since the effect of terrain profile irregularities on landing performance varies with the characteristics of an automatic landing system, special account will need to be taken in the safety assessment required in paragraph 9.1 of BCAR Section D6-4, of runways whose approach terrain characteristics do not satisfy conditions (a) to (d) above.
- 443 Where the characteristics of the terrain beneath the approach path in the region of the DH and immediately prior to it are such that the radio altimeter indications are unsatisfactory for determining DH, this might preclude the Regulatory Authority from accepting Category 2 or Category 3 operations. In particular, rapidly changing radio altimeter indications or any other significant conflicts between the radio and the pressure altimeter might be considered unsatisfactory.
- 444 To allow for the use of radio altimeters to indicate height during the approach, charts showing details of the pre-threshold terrain height related to the elevation of the runway threshold should be available. The area depicted on these charts should be in accordance with the Precision Approach Terrain Chart specification that is published in ICAO Annex 4.

450 **RUNWAYS**

451 Runway Dimensions

Landing distances required during Category 2 and 3 operations may be greater than normal and this factor should be taken into account when planning these types of operations. Runway width should normally be 45m (150ft) but narrower runways may be used provided that they have load bearing shoulders out to 7.5m (25ft) each side.

452 Runway Surface Profile

Automatic landing systems are sensitive to the runway surface profile. The Regulatory Authority Airworthiness Certification for automatic landing system operation assumes that the profile of the runway to be used is within the limits specified in ICAO Annex 14. If automatic landings are proposed on runways which do not meet these requirements, the NAA should be consulted.

460 **INSTRUMENT LANDING SYSTEMS**

461 General

- The ILS installation in Category 2 or 3 operations must conform to the appropriate specification contained in ICAO Annex 10, Volume 1, Part 1, Sections 2 and 3. It must also be designed and operated in accordance with guidance material contained in Attachment C to Part 1 of Annex 10. Further to this, it must meet the additional standards, including levels of Integrity and Continuity of Service, required by the National Regulatory Authority, from whom guidance should be sought.
- For UK installations, attention is drawn to the provisions of the UK ANO - Radio Equipment at Aerodromes. Both the technical characteristics of an ILS and its site location are important factors in achieving satisfactory guidance signals, particularly where Category 2 or 3 performance is required. The National Regulatory Authority should be consulted on the suitability of proposals relating to the type and site location of an ILS before these are settled.
- Proposals for the management of ILS services must be acceptable to the Regulatory Authority, from whom guidance should be sought; and

- d. An ILS Category 2 installation which meets the integrity and continuity requirements appropriate to Category 3a and is calibrated to the upwind end of the touchdown zone, may be suitable for Category 3a operations; but the Regulatory Authority's agreement for the particular case must be obtained before it is so used.
- 462 **Sensitive Areas**
Sensitive Areas for the ILS localiser and glide path are established in addition to their critical areas. Aeroplanes and vehicles in the vicinity of a runway may affect the localiser and glide path signal even when clear of the critical areas. In consequence, there is a requirement to protect the appropriate sensitive areas when the localiser is being used during automatic landing, roll-out or take-off. The dimensions of the sensitive area should be determined for each ILS installation by consultation with the Regulatory Authority.
- 463 **Flight Checks**
The Regulatory Authority will require the ILS to be flight checked in accordance with its flight inspection instructions; or equivalent procedures.
- 464 **Far Field Monitors**
Far field monitors are a requirement for Category 2 and 3 operations.
- 470 **VISUAL AIDS**
- 471 Category 2 and 3 operations require enhanced aerodrome visual aids (see ICAO Annex 14). When planning such developments, aerodrome operators should consider the installation of such aids appropriate to Category 3 operations from the outset. This would require only minor additional provisions over those required for Category 2 operations but could obviate the need for major works in any subsequent upgrading to Category 3 operations standards.
- 480 **METEOROLOGICAL REQUIREMENTS**
- 481 The aerodrome should be suitably equipped and manned to provide the pilot with meteorological information as laid down in ICAO Annex 3 and ICAO PANS-RAC.
- 482 **Runway Visual Range**
Runway Visual Range (RVR) should be measured by automatic instruments at three positions along the runway, covering the Touchdown Zone (TDZ), the Mid Point (MID) and the Stop End (STP). Automatic displays should be provided to enable RVR to be passed to the pilot within 15 seconds of any change. The TDZ RVR should always be passed, but the values for other positions should only be passed either on request or when either or both values are
- Less than TDZ RVR... AND less than 800m; or
 - Less than 400m.
- 483 The TDZ RVR is the governing value. In the event of failure, any RVR passed should be identified by position. Failure of the TDZ instrument should be reported specifically. Category 3c NIL DH (zero feet) operations may continue in the absence of RVR information.
- 484 Exceptionally, observer reports covering the TDZ RVR and the MID RVR may be acceptable for Category 2 operations, providing the RVR can be passed to the pilot within 30 seconds of the observations.
- 490 **CONTROL OF AIR AND GROUND TRAFFIC**
- 491 Special procedures for the control of air and ground traffic in low visibility are required. Such procedures are known as ATC Low Visibility Procedures (LVP). They are additional to and dependent on normal ATC procedures and are designed to satisfy the requirements of both Category 2 and 3 operations. LVP will normally be implemented when the RVR reduces to less than 550 m OR when the cloud ceiling lowers to less than 200 ft. However, in rapidly deteriorating conditions and earlier decision to implement LVP may be made. Responsibility for the initiation and subsequent cancellation of LVO will clearly be allocated and, typically, will rest with the ATC Approach Control supervisor.
- 492 There are two basic principles on which LVP are based; first that the OFZ must remain free of obstacles during Category 2 or 3 operations and second, that the Localiser Sensitive Area (LSA) must be protected to ensure the integrity of the ILS signals. In practice, the LSA encompasses the OFZ with respect to ground movements, and so, one set of procedures satisfies both requirements. Protection of the ILS signal requires that no vehicle or taxiing aeroplane should be within the LSA from the time when
- A departing aircraft has commenced its take off run, until it is airborne
 - An arriving aircraft is within 1nm from touchdown until it has completed its landing run.

- 493 LSA protection procedures are designed first to ensure that an aeroplane making a missed approach from a low height has adequate clearance from obstacles and second, that distortion of the localiser signals by multi-path interference does not occur at a critical point in the approach. The Glide path Sensitive Area will be given similar protection if it is not contained within the LSA.
- 494 When Low Visibility Procedures (LVP) are implemented, all relevant aerodrome services are to be informed. When the RVR or cloud ceilings require the application of LVP, the flight crew may assume that all promulgated aerodrome facilities are available and that all safeguarding checks are complete. Deficiencies are notified to crews as soon as possible either by RTF or by arrival/departure terminal broadcasts (ATIS) and NOTAM if necessary.
- 495 Spacing between aeroplanes on final approach may have to be greater than normal to allow landed aeroplanes to clear the LSA before approaching aeroplanes reach 1 nm from touchdown. The aim is to give landing clearance by 2 nm. An initial spacing of about 10 nm may be necessary to achieve this. If landing clearance cannot be given by 2 nm, pilots will be warned to expect "Late Landing Clearance", in which case clearance to land or the instruction to initiate a missed approach will be given by 1 nm. Landed or crossing traffic should clear the LSA without delay. Traffic should exit the runway at designated points.
- 496 Low Visibility Take-off
Low Visibility Take-off Operations (LVTO) is a term used by Aviation Regulatory Authorities in relation to flight operations referring to a take-off on a runway where the RVR is less than 400 m.

End of Section 4

SECTION 5 - CERTIFICATION & AUTHORISATION

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THE AEROPLANE OPERATOR	520
OPERATIONS WITH NO DECISION HEIGHT	530
FAIL PASSIVE CATEGORY 3 OPERATIONS	540

500 THE AEROPLANE

501 Approval of an aeroplane registered for Category 2 and 3 operations is affected by appropriate entries in the Flight Manual. The aeroplane Certificate of Airworthiness remains valid for Category 2 and 3 operations only so long as compliance is established and maintained, with all the conditions included in such entries.

502 The philosophy for Cat 2 & 3 has now moved such that it is considered a normal part of an aircraft's operation and needs no more restrictive training/checking/recency requirements than any other element of the aircraft's operation. Recency for Cat 2 & 3 is covered by the recurrent training that is carried out as part of the OPC.

510 THE AERODROME

511 The operator of an aerodrome which complies with the requirements of Section 4 of this document should apply to the Regulatory Authority for approval and the promulgation of the availability of facilities for Category 2 or 3 operations. Promulgation will be through the AIP system, initially by NOTAM, followed by annotations in the COM, AGA, RAC and MET sections of the National AIP.

520 THE AEROPLANE OPERATOR

521 An operator's competence to adopt aerodrome operating minima for Category 2 or 3 operations is regarded as part of his general competence to secure the safe operation of the aeroplane and is therefore subject to the Normal Air Operators Certificate procedure.

522 Category 2 or 3 operations at State aerodromes by operators of aeroplanes not registered in that State will be considered under the requirements of the Current National Legislation for the time being in force. Proposal of intent to operate should be addressed to that NAA.

523 Before carrying out Cat 2 or 3 operations at foreign airports, an operator must establish that the ground installation and environment at the airport, jointly with his airborne equipment and operating techniques, are a system capable of supporting operations down to the proposed minima; at the safety level of similar operations at National State airports and elsewhere.

530 OPERATIONS WITH NO DECISION HEIGHT

531 Category 3b operations with no DH may be specified.

540 FAIL PASSIVE CATEGORY 3 OPERATIONS

541 A Cat 3 operation by aircraft with fail-passive capability may be specified. Such an operation may also be performed on an ILS suitable for Cat 2 operations, provided that it has integrity appropriate to Cat 3 and is calibrated to the upwind end of the touch-down zone.

End of Section 5

SECTION 6 - AERODROME OPERATING MINIMA

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600 AERODROME OPERATING MINIMA CALCULATIONS

601 Calculation of Decision Height and Runway Visual Range

The calculation and use of non-precision and other Aerodrome Operating Minima is covered comprehensively in EU-OPS 1 REGULATIONS - Subpart E (All Weather Operations) and EU-OPS 1 - Sub-part E (Means of Compliance). This subject is covered in *Appendix A* which reflect the relevant ICAO AWOPS Requirements. However, there are a number of points of administrative import that operators need to be aware of and to apply, as indicated hereunder.

602 Recording Temporary Special AOM

AOM for aerodromes which are not regularly used by an operator need not be published in the Company operations manual but should be contained in the commander's flight brief. In this connection, the flight brief includes a prepared navigation flight plan on which this information has been inserted. However, where flights are permitted without the provision and retention of individual navigation flight plans, the AOM for the aerodrome concerned should be placed in the company's operations manual.

603 The information relative to AOM contained in this Document, emphasises factors that are to be considered when establishing AOM for Category 2 and 3 operations.

610 INTRODUCTION TO AWO AOM

611 This Section indicates the factors considered in establishing minimum values of Decision Height (DH) and Runway Visual Range (RVR) acceptable to the NAA for Category 2 and 3 operations.

612 These minimum values are acceptable only when factors such as the composition, competence and experience of the flight crew are at an optimum level, and when all the parts of the system are functioning normally

620 ESTABLISHMENT OF DECISION HEIGHT

621 For a Category 2 operation, the factors to be taken into account when establishing the DH are:

- a. The minimum DH authorised in the Airworthiness Certification of the aircraft for that operation, normally 100 feet;
- b. The minimum DH for the particular operation, if one is promulgated by the appropriate Authority;
- c. The published OCH or OCA (OCL where these are not promulgated) for the runway and for the appropriate approach category of aircraft, as appropriate.
- d. The DH to which the flight crew is authorised to operate down to, or 100 feet; and
- e. The minimum DH to which the precision approach aid can be used without the required visual reference

622 The minimum DH for Category 2 operations is the highest of the values resulting from the application of the factors in paragraph 621.

623 For a Category 3a operation, the minimum DH must not be less than any value specified in the Airworthiness Certification of the aircraft for such operations. For an operation utilising a Fail-Passive automatic landing system, the DH must not be less than 50ft.

630 DETERMINATION OF RUNWAY VISUAL RANGE (RVR) MINIMA

631 For Category 2 operations, the primary factor determining minimum RVR is the visual reference required by the pilot to carry out the task dictated by the aeroplane mode of operation.. In general, greater use of the automatic equipment implies a lesser visual reference; but to obtain the necessary visual reference from greater eye heights implies greater RVR. The converse is true in both cases.

632 The RVR generally acceptable for Category 2 operations are

Decision Height	Manual Control below DH	Automatic Control below DH
------------------------	--------------------------------	-----------------------------------

DH 100-120 ft	400m	350m
DH 121-140 ft	450m	400m
DH 140 ft plus	500m	450m

- 633 For Category 3a operations involving the use of fail-passive automatic landing equipment, the minimum RVR which is normally acceptable for operations with small or medium size aircraft is 300 metres. If the aircraft system demonstrates an in-service record of high reliability, such that the probability of a system failure during the early part of the landing flare can be shown to be very low, consideration may be given to a reduction in the RVR.
- 634 For Category 3a operations using fail-operational automatic landing equipment which does not include automatic roll-out control or guidance, the minimum RVR is 200 metres.
- 635 For Category 3a operations using fail-operational automatic landing equipment with fail-passive roll-out control or guidance, the minimum RVR is 150 metres.
- 636 For Category 3b operations using fail-operational automatic landing equipment with fail-operational control or guidance during roll-out, there is no requirement for a DH to be specified nor for a minimum RVR; unless a minimum visibility is required to facilitate taxiing.
- 637 The generalised DH/RVR relationships given above are subject to alteration for specific operations at the NAA's discretion; to take account of the characteristics of the particular runway and/or aeroplane.

640 TAKE-OFF MINIMA

- 641 Operators wishing to use Take Off minima below 150 m RVR require formal DCA approval to use a take off RVR of not less than 125m RVR.
- 642 Take off minima of 125m RVR shall only be used when the following requirements have been satisfied:
- a. Low Visibility Procedures (LVP) are in force;
 - b. High intensity runway centre line lights spaced 15m or less and high intensity runway edge lighting spaced 60m or less are installed;
 - c. The mid-point RVR must be available and shall not be less than 125m;
 - d. Crews shall have satisfactorily completed appropriate simulator training as per a syllabus agreed with the NAA of the State issuing the AOC, as well as that of the State of Aircraft Registry, if different.
- 643 The requirements for LVPs in this document, originate from ECAC Document 17 recommendations that special precautions are necessary when low visibility operations are in progress. In addition to the need to protect the ILS signal from interference, there is also a need to protect the aircraft manoeuvring area from unwarranted vehicle intrusions. This effectively restricts the use of 125m RVR take off minima to those aerodromes currently approved for Cat 2 and 3 operations.

650 AERODROMES WITHOUT APPROACH AIDS

- 651 Existing Regulations are intended to prohibit the use by an aeroplane to which they apply, of any aerodrome for which there is no recognised instrument approach or let down procedure.
- 652 Other specific rules state that the commander of an aircraft shall not make use of any radio navigation aid without complying with such restrictions and appropriate procedures as may be notified in relation to that aid unless authorised by an Air Traffic Control unit.
- 653 Operators wishing to develop an Instrument Approach Procedure at an aerodrome without approach aids must contact the NAA of the State of aircraft Registry for advice; and for the grant of any exemption required from Regulations relative to the in-house development of Instrument Approach procedures

660 REVERSION TO HIGHER MINIMA DURING CAT 2 & 3 APPROACHES

- 661 The Approach Ban prohibits the descent below 1000ft Above Aerodrome Level (AAL) unless the reported RVR is equal to or better than the RVR specified for the approach. However, once the aircraft has started an approach and is below 1000ft AAL, the approach may continue down to the specified DH regardless of the reported RVR. The reason that the RVR may be ignored in this situation is to prevent unnecessary missed approaches being caused by a reduction in RVR which may well be temporary.
- 662 An aircraft carrying out a precision approach should not, in the event of aircraft equipment failure, revert to a higher minima once the aircraft has descended below 1000ft AAL. The required action is to carry out an immediate go-around except in the following circumstances:

THE ALL WEATHER OPERATIONS GUIDE

- a. When a Category 3 approach is being made in Category 2 conditions, or when a Category 2 approach is being made in Category 1 conditions, as reported before the aircraft descended below 1000ft AAL, and all the crew have been briefed for the reversion procedures for each approach, the approach may continue.
- b. During a Category 3 approach, when the aircraft is below the Alert Height, if a failure occurs in one of the aircraft's required redundant operational systems, it may be ignored; and if the required visual reference system exists, the landing may be completed.

663 Summarising

Below 1000ft AAL any equipment failure requiring reversion to higher minima demands a go-around unless:

- a. The RVR associated with a reversion to a higher minima existed before the aircraft descended below 1000ft AAL; or
- b. A failure occurs below Alert Height.

End of Section 6

**SECTION 7 - APPLYING FOR ALL WEATHER OPERATIONS
CATEGORY 2 & 3 SUBMISSION FRAMEWORK**

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SECTION 7 Addendum - (APPLICATION FOR CAT 2 & 3 AWOPS THROUGH UK CAA)

700 APPLICATION REQUIREMENTS

701 When applying for permission to conduct LVO and AWO, the relevant Regulatory Authority will expect a comprehensive submission that will include all of the following details, under each heading shown in the listing hereunder

702 A sample application form may be found in the Appendix at the end of this Part, to show what information is required from an operator wanting to conduct Cat 2 and/or Cat 3 operations at airports within another State's NAA Regulatory control, following the grant of the initial AWO authorisation by the NAA of the State supervising the applicant's AOC activities. The State of aircraft Registry must also grant its authorisation if the aircraft are registered outside the State issuing the AOC.

710 INTRODUCTION

- a. The aim;
- b. The category of operation intended;
- c. Interim minima during familiarisation; and
- d. The eventual AOM desired.

720 DEFINITIONS

- a. Categories of operation;
- b. Fail operational;
- c. Fail Passive;
- d. Alert Height; and
- e. Decision Height.

730 AERODROME EQUIPMENT AND PROCEDURES

731 A brief description of all the equipment and its characteristics, provided at aerodromes which are approved in accordance with ICAO criteria for Category 2 and 3 operations. It will include

- a. Descriptive details of approach lighting, runway and taxiway markings and lighting,
- b. Holding position indicators;
- c. RVR assessment systems and the types and categories of ILS installations provided.
- d. A statement must also be made to indicate the minimum facilities that are acceptable for Cat 2 and Cat 3 operations.

732 A statement of the functions and principles of

- a. Obstacle clearance criteria;
- b. Obstacle Free Zones;
- c. Precision approach terrain charts; and
- d. Sensitive areas.

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

740 AEROPLANE EQUIPMENT

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

742 Minimum Equipment Lists (MEL) and Allowable Deficiencies Lists (ADL)

A Minimum Equipment List for All Weather Operations must be available to the pilots indicating what aircraft equipment is necessary for AWO, and the conditions when take-off, auto-approach and auto-landing operations may be carried out with unserviceable equipment. For example, if one of the Radio Altimeters controlling the autothrottle is inoperative, the approach may be flown, provided that the "pilot flying the landing" knows he will have to manually close the throttles on touchdown; or if the autothrottle system is inoperative, then an approach may be started but the power will need to be set and adjusted by the "pilot flying" all the way to touchdown. (Also see 776)

750 MODES OF OPERATION

751 A description of the modes of operation to be used

- a. Manual approach and landing;
- b. Coupled approach to Decision Height (DH);
- c. Fail Passive and fail Operational automatic landing;
- d. Automatic roll-out;
- e. Automatic go-around.

760 OPERATING PROCEDURES

761 The detailed operating procedures and instructions specified in the Operations Manual will vary depending on the aeroplane equipment and the operator's procedures. The instructions must be compatible with the limitations and mandatory procedures in the Flight Manual and they must cover the following items in particular:

- a. Checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight.
- b. A statement of the minimum reference required at and below DH.
- c. Action in the event of deterioration of the visual references for landing; before and after passing the approach ban point.
- d. Action to be taken in relation to wind velocity, wind shear and turbulence information.
- e. Fuel policy - especially requirements to allow for ATC delays associated with Low Visibility Operations.
- f. Procedure for an approach to land on a runway at which aerodrome low visibility procedures are not in force; such as when a practice auto-approach and autoland is to be carried out.
- g. Autoland - a description of the sequence of events from 500 feet Radio Altimeter Height to touchdown; and roll out or go around.
- h. The land or go around decision to be made by the PIC.
 - i. Action in the event of:
 - i. Failures above and below Alert Height;
 - ii. ILS deviation warnings;
 - iii. An Autopilot disconnect;
 - iv. An Autothrottle disconnect;
 - v. An Autoland status change;
 - vi. Electrical failures;
 - vii. Engine failure;
 - viii. Failures at and below DH
 - ix. Incapacitation of the PIC
- j. All descriptions of procedures will need to include such aspects of crew co- ordination and distribution of flight deck duties as:
 - i. Handling the aeroplane, including designation of handling and non handling pilots. Where split approaches (monitored approaches) are used, the definition would probably require changing to flying (or handling) pilot and LANDING pilot.
 - ii. Tuning of navigation receivers;
 - iii. Use of autopilot/ automatic flight control system;
 - iv. Use of checklists;
 - v. Handling radio communication;
 - vi. Monitoring and cross checking of instruments;
 - vii. Flight Deck calls.

762 Monitoring Category 2 and 3 Operations

It is also necessary to give a description of the method to be used for monitoring the quality of Category 2 and 3 operations, to ensure that operating standards are maintained.

770 **LIMITATIONS**

771 Effect, if any of the use of low visibility aeroplane systems or handling procedures on aeroplane performance calculations; particularly landing distances required.

772 Maximum and minimum acceptable glide path angles.

773 Maximum allowable tail and cross wind components in Cat 2 and 3 weather conditions; and maximum permissible wind overall to complete an auto-approach and autoland.

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

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

776 The aeroplane MEL for Cat 2 and 3 operations covering :

- a. The start of a Cat 2 or 3 approach;
- b. The final approach for an automatic landing;
- c. The automatic landing, with or without automatic roll out control.

780 **FLIGHT CREW QUALIFICATION AND TRAINING**

781 Syllabus for a structured course of ground training including all the subjects mentioned in Part 8.

782 Syllabus for flight simulator and flight training, including the practical aspects of all subjects mentioned in Part 8.

783 Recency requirements. That is the Number of Cat 2 and 3 approaches to be made by each pilot in a stated calendar period, regardless of weather conditions as discussed in Part 8.

784 A Syllabus for recurrent/revalidation training and testing, including a statement of the period of validity of Category 2 and/or 3 checks.

785 Crew qualification and complement.

786 Description and example of the method to be used for the recording of pilot initial and recurrent training and testing and of 'recency'.

787 Issue of Competency certificates and Record of auto-landings cards

790 **AERODROME OPERATING MINIMA (AOM)**

791 AOM will comprise

- a. A statement of the lowest landing minima accepted or approved by the State of the operator (The State issuing the AOC).
- b. A statement of reversionary minima and the circumstances in which these are to be used.
- c. Minima to be applied at each runway to be used.
- d. A statement of the landing minima required for landing alternates.
- e. A statement of the landing minima for an engine inoperative landing; and
- f. A statement of the Approach Ban policy in each Destination State.

The following Appendix to Section 7 holds the UK CAA 7-Page AWOPS Application form that must be completed and returned by an operator, as part of the necessary procedure prior to the commencement of Low Visibility Operations (LVO), before the required formal approval authorisation to proceed is issued.

SECTION 7 ADDENDUM - APPLICATION FORM FOR AWOPS

UK Civil Aviation Authority

APPLICATION FOR ALL WEATHER OPERATIONS (AWOPS) APPROVAL

Applicants are strongly advised to read the 'AWOPS Notes for Completion' before completing the form.

Please complete the form in BLOCK CAPITALS using black or dark blue ink.



This form is designed to elicit all the required information from those operators wishing to gain operational approval to operate to:

- lower than Standard CAT I;
- CAT II;
- other than Standard CAT II; or
- CAT III

approach minima and to take off in less than 150 m visibility for Category A, B and C aircraft, and less than 200 m for Category D aircraft.

(Note: Take-off in less than 400 m visibility but more than 150 m/200 m is not subject to formal approval but requirements still apply. Please contact the CAA at the address given in Section II, paragraph 4.) The completed form and supporting documentation should be submitted to the Flight Operations Policy (Commercial) Section of the Safety Regulation Group at the address listed in the 'Notes for Completion'.

Section I	Page 1	Operator/Airframe Details	Completion mandatory
Section II	Page 2	AWOPS Notes For Completion	
Section III	Page 2	Signature Block	Completion mandatory
Section IV	Pages 3 to 7	Operator's AWOPS Submissions Matrix	Completion mandatory

SECTION I OPERATOR/AIRFRAME DETAILS

1 Applicant Details - required for all Approval requests	
Please give the official name and business or trading name(s), address, mailing address, e-mail address and contact telephone/fax numbers of the applicant. Note: For AOC holders - company name, AOC number and e-mail address will suffice.	
2 Aircraft Details - required for all Approval requests	
Aeroplane type(s) or fleets (if a fleet has more than one variant, complete second column).	
Aeroplane Type or Fleet	Variant

SECTION II AWOPS NOTES FOR COMPLETION

1 Applicability	
EU-OPS outlines the procedures, minima and training requirements for conducting approaches using: <ul style="list-style-type: none"> • lower than Standard CAT I; • CAT II; • other than Standard CAT II; and • CAT III approach minima. It also covers procedures, minima and training requirements for conducting take-offs in visibility less than 150 m (aircraft Category A, B and C) or 200 m (aircraft Category D). This application form should not be used for Enhanced Visual Systems (EVS) approval application (see Form SRG 1829) or RNP Approach Operations approval application (see Form SRG 1813). Reference material: <ul style="list-style-type: none"> • EU-OPS (in particular Subpart E) and TGL 44; • ICAO Doc. 8168 (PANS-OPS); • ICAO Doc. 9365 (Manual of All Weather Operations); and • UK Air Pilot. Formal approval will normally be subject to a flight and simulator observation.	
2 Operator's AWOPS Submissions Matrix	
Section IV of this application form is the Operator's AWOPS Submissions Matrix. All applicants should complete Column 4 of this matrix in full. Failure to complete the AWOPS Submissions Matrix may result in a delay in processing your application.	
3 Documents to be included with the application	
Copies of all documents referred to in Column 4 of the Operator's AWOPS Submissions Matrix should be included when returning the completed application form to the Civil Aviation Authority. Original documents should not be sent, photocopies are sufficient. Do not send complete manuals, only the relevant sections/pages will be required. Failure to include all relevant documentation may result in a delay in processing your application.	
4 Submissions and Enquiries	
Address for submissions: Civil Aviation Authority Safety Regulation Group Flight Operations Policy 1W, Aviation House Gatwick Airport South West Sussex RH6 0YR E-mail: FOP.Admin@caa.co.uk	Contact details for enquiries: Tel: +44 (0)1293 573909 Fax: +44 (0)1293 573991 E-mail: Jeremy.Stubbs@caa.co.uk
Note: Applications by companies for non-AOC operators must be accompanied by the appropriate fee. See Official Record Series 5 (General Aviation) (available via www.caa.co.uk/ors5).	

SECTION III SIGNATURE BLOCK

Signature: Name (BLOCK LETTERS):..... Appointment:..... Date:
Please note that a minimum of 60 working days will normally be required to check and confirm the information given above - if data is missing or omitted the process may take considerably longer.

SECTION IV APPLICANT'S AWOPS SUBMISSIONS MATRIX

Main Heading	Expanded areas to be addressed by application	Sub-requirement	Operator's Operations Manual Reference or Document Reference
<p>1.0 Reference Documents used in compiling submission</p>	<p>Your submission should be based on current up to date regulatory material.</p> <p>You should publish a compliance statement showing how the criteria of EU-OPS and ICAO Doc. 9365 (where appropriate) have been satisfied.</p> <p>You should state exactly what type of AWOPS approval you are applying for, e.g. CAT II or III, low visibility take-off arc, etc.</p>	<p>Include which version of EU-OPS Subpart E you will be using: old or new.</p>	
<p>2.0 Aircraft Flight Manual (AFM)</p>	<p>A copy of the relevant AFM entry showing the aircraft certification standard for AWOPS operations.</p>		
<p>3.0 Operational demonstration</p>	<p>Requirements given in EU-OPS (Appendix 1 to OPS 1.440).</p> <p>Continuous monitoring programme</p>	<p>Note: In particular, significant problems with the Autoland/HUDLS systems (as appropriate), in particular reporting on circumstances/locations where the Autoland/HUDLS was unsatisfactory.</p>	
<p>4.0 Operations Manuals</p>	<p>Outline your process for reporting of failures in the operational use of procedures.</p>		
<p>5.0 Approach plate supplier and Operating Minima</p>	<p>Who is your approach plate supplier?</p> <p>Eligible runways.</p> <p>Confirmation that all minima are calculated in accordance with EU-OPS Appendix 1 (Old or New) to OPS 1.430.</p>		

Main Heading	Expanded areas to be addressed by Application	Sub-requirement	Operator's Operations Manual Reference or Document Reference
<p>6.0 Operations Manual entries and Standard Operating Procedures</p>	<p>Manufacturer/operator developed Manufacturer's procedures recommended as starting point and must include at least the following.</p>	<p>Definitions. Crew qualifications for AWOPS operations. Equipment required for AWOPS operations. MEL handling. Low Visibility Take-Off:</p> <ul style="list-style-type: none"> • Taxiing in low visibility conditions. • Take-off minima and lighting. • Crew visual visibility assessment. • Crew responsibilities/handling. • Visual references required. • Approved lateral guidance system. • ATC calls. • Contingency procedures including: <ul style="list-style-type: none"> • engine failure between V1 and VR; and • rejected take-off. 	

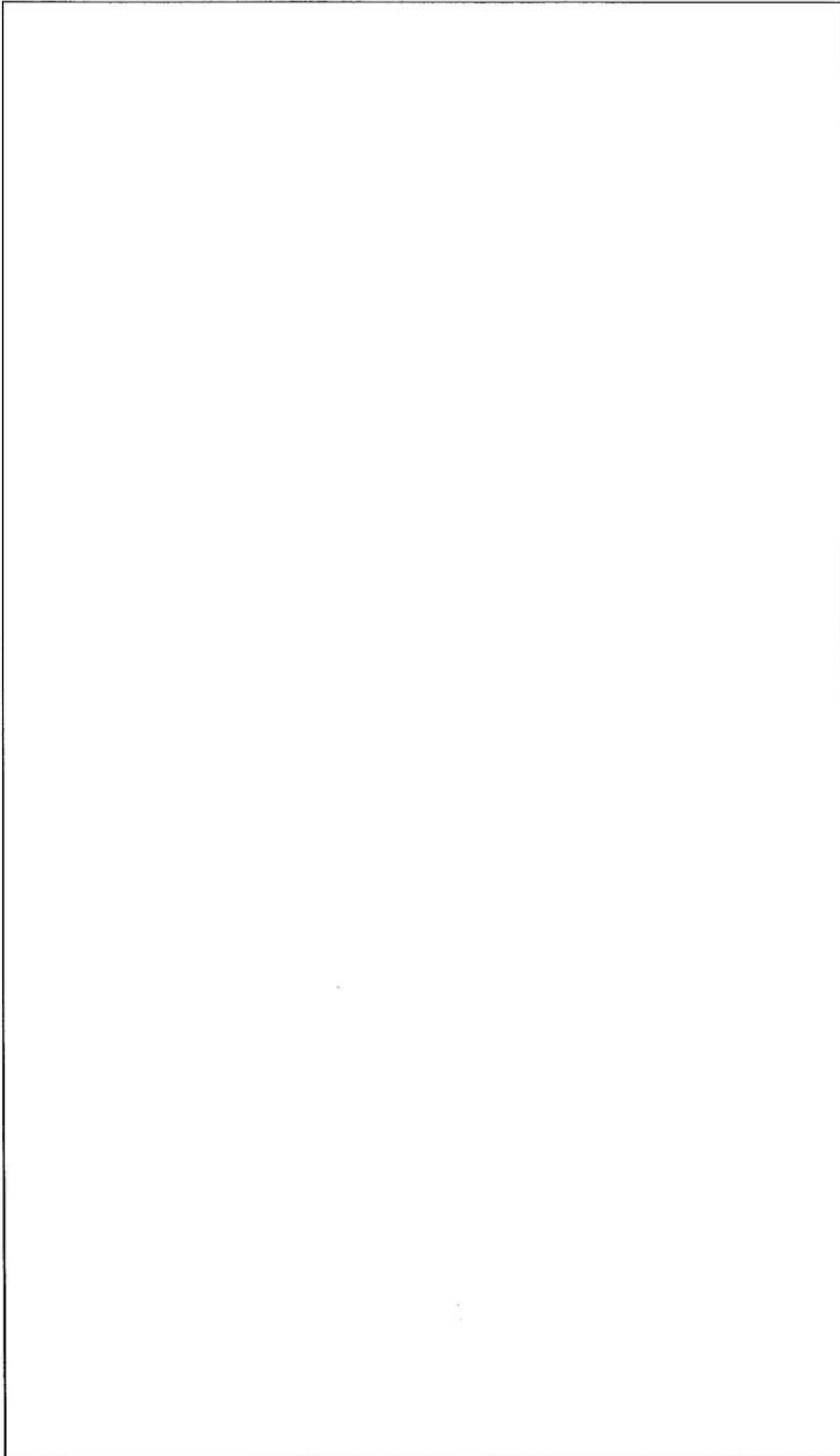
Main Heading	Expanded areas to be addressed by Application	Sub-requirement	Operator's Operations Manual Reference or Document Reference
<p>6.0 Operations Manual entries and Standard Operating Procedures</p>	<p>Manufacturer/operator developed Manufacturer's procedures recommended as starting point and must include at least the following.</p>	<p>Definitions. Crew qualifications for AWOPS operations. Equipment required for AWOPS operations. MEL handling. Low Visibility Take-Off:</p> <ul style="list-style-type: none"> • Taxiing in low visibility conditions. • Take-off minima and lighting. • Crew visual visibility assessment. • Crew responsibilities/handling. • Visual references required. • Approved lateral guidance system. • ATC calls. • Contingency procedures including: <ul style="list-style-type: none"> • engine failure between V1 and VR; and • rejected take-off. 	

Main Heading	Expanded areas to be addressed by Application	Sub-requirement Operator's Operations Manual	Reference or Document Reference
<p>6.0 Operations Manual entries and Standard Operating Procedures (continued)</p>		<p>Approach and landing:</p> <ul style="list-style-type: none"> • Modes of operation. • Statement that autopilot/flight director must be used whenever possible. • AWOPS fuel considerations. • Minimum visual references for landing. • Approach Ban and RVR. • Cross-wind limits. • Effect of irregular pre-threshold terrain. • Stabilised Approach Criteria. • Correct seating and eye position. • Designation of PF and PNF and their duties. • Use of automatic flight control system. • Checklist handling. • Approach briefing. • Radio communications handling. • Monitoring and cross-checking of instruments and radio aids. • Cockpit call outs. • Contingency procedures including: <ul style="list-style-type: none"> • Use of equipment downgrade list; • failures above and below decision height; • ILS deviation warnings; • autopilot disconnect; • auto-throttle disconnect; • electrical failures; • engine failure; • failures and loss of visual references at or below decision height; and • pilot incapacitation 	

AWOPS Modular Training Package

Type of Operation	Training Required	Training Means	Operator's Operations Manual Reference or Document Reference
Ground school training	Syllabus should follow guidelines in EU-OPS, in particular Subpart E (should also include all the items in paragraph 6 above).		
Flight crew qualification and training (simulator/flight training)	Syllabus should follow guidelines in EU-OPS, in particular Subpart E. Initial qualification requirements. Recurrent/revalidation requirements. Recency requirements.		

Any Further Comments to Support Your Application



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CHAPTER 8 - TRAINING REQUIREMENTS SUMMARY

AWO TRAINING	800
INITIAL TRAINING PHASES	810
INITIAL TRAINING SYLLABUS CONTENT	820
RECURRENT REFRESHER AND REGENCY TRAINING	830
AUTOLAND REGENCY	840

800 AWOPS TRAINING

801 Initial All Weather Operations training may be part of an aircraft type conversion course, or it may be given as a separate stand-alone module.

810 INITIAL TRAINING PHASES

811 Ground School

Ground school items are listed in Section3

812 Simulator Training

Simulator training must take place in an approved simulator. If the simulator approval document does not provide for Category 2 or 3 training, the advice of the NAA that has issued the AOC and the NAA of the aircraft's State of Registry must be sought.

813 For category 2 training, one simulator detail of four hours should be sufficient to achieve both the training and the first proficiency check for one crew.

814 Upgrade to Category 3 operations should be possible in half this time, dependent upon the experience of the crews. Basic details of the items to be included can be found in Part 3 but the General Submission appended to the Application for AWO, may require more detailed guidance for the NAA from which approval is sought.

815 A common fault is to over emphasise the failure situation. In consequence, Operators should emphasise the probability of success in their initial and recurrent training; instead of concentrating on equipment failures, without showing how these can be overcome; and/or explaining when completion of an approach is feasible in unusual situations.

816 In amplification and in addition to the training requirement listed in paragraphs 320 onwards, the following points must be considered.

820 INITIAL TRAINING SYLLABUS CONTENT

821 Category 2 LVO only, (no autoland), will also include

- a. A hand-flown ILS to a DH of 100 feet in 400m RVR; and
- b. The exercises listed at 822 hereunder for Category 2 or 3 (with autoland); with DH of 100 ft and the autopilot down to not below 50 feet before a 'disconnect' to complete the landing manually.

822 Category 2 or 3 LVO (with autoland) will also include

- a. Two normal low visibility departures, followed by routine, **no problems and nil failures** autoland approaches to a full stop, to start and end the AWO training period;
- b. A manual go around;
- c. One automatic go around (if equipment fit permits);
- d. A rejected take off in minimum RVR conditions;
- e. An engine failure at take off after V1;
- f. An asymmetric automatic approach to auto land (or to a manual landing; if the Flight Manual and the equipment fitted permits, on multi engine aircraft such as the Boeing B747-400;
- g. As many auto approaches and landings as may be required, to make up 6 autolands for initial qualification; and the issue of a restricted clearance certificate.

823 Equipment failures

Various equipment failures will be demonstrated whilst separate approaches are in progress; to illustrate those that can be completed to a successful landing (automatic or manual), or to emphasise the need for a go around when it is clearly impossible to continue with the approach, because of equipment degradations or the particular failure.

824 Autothrottle failures will illustrate one situation when the approach may be continued whilst the throttles are operated by hand; whereas an engine failure may require a go around at any time.

830 **RECURRENT REFRESHER AND REGENCY TRAINING**

831 Ideally, the minimum contents of the initial and recurring syllabus could include

- a. Two normal low visibility departures, followed by autoland approaches to a full stop; one to start and one to end the session;
- b. A manual go around;
- c. An automatic go around (if fitted equipment permits);
- d. A rejected take off in minimum RVR conditions;
- e. One engine failure at take off after V1;
- f. An asymmetric automatic approach to autoland (or to a manual landing, if the Flight Manual and the installed equipment allows).
- g. As many auto approaches and landings as may be required, to make up any shortfall in the minimum number between recurrent refresher/check periods.

Note 1: A list of faults that can occur during LVO operations will need to be drawn up and offered to instructors as optional exercises to be included during LVO refresher training. In rotation, a selection of these faults will be offered during refresher training, so that the complete list is covered over three or four semi annual recurrent check and refresher periods.

Note 2: All AWO training sessions should start and end with a normal approach to a successful autoland; **one to start and one to end the session**, so that trainees are left with the mindset that Autoland works, regardless of the fact that time was spent demonstrating equipment failures and practising necessary crew actions in the event of such failures, or being shown reasons for the need to discontinue an approach by way of a go-around, between the first and last normal AWO approach and automatic landing.

840 **AUTOLAND REGENCY**

841 For Recurrent training requirements, see Part 3 – at 2.6A(g) Appendix 1 to OPS 1.450 - Low Visibility Operations - Training & Qualifications.

There is no requirement for an operator to issue an AWOPS recency certificate, although many still do. Normally this is dealt with by conducting three approaches during an OPC; this may be reduced though to two approaches (one to a landing in the minimum authorised visibility and one to a Go Around) if both pilots have conducted at least one CAT 2/3 approach in the aircraft since the last OPC. The requirement is satisfied by 2 in the simulator plus 1 in the a/c, or 3 in the simulator.

The ongoing recency restriction is for take-off and landing. This requires that at least three take-offs and three landings are carried out in the previous 90 days. The 90-day period prescribed may be extended up to a maximum of 120 days by line flying under the supervision of a type rating instructor or examiner. For periods beyond 120 days, the recency requirement is satisfied by a training flight or use of a flight simulator of the aeroplane type to be used. A take-off and a landing in the previous 28 days may also be required by the operator.

842. Where this is impractical for operational reasons, such as on extended long haul programmes where there are insufficient sectors available for pilots to maintain the required “handling recency” for manual landings AND “Autoland recency”, an Approved simulator may be used instead; or the recurrent AWO revalidation exercises period in the simulator that is part of the recurrent bi-annual Competency and Skill tests may be acceptable in lieu, with the approval of the Regulatory Authority issuing the Company’s AOC.

The minimum number of auto approaches (and landings where applicable) to be flown between recurrent checks and the “extended” period, when more than the minimum of 3 is required, must be agreed with the NAA

843 A clearance to operate to Cat 2 and/or Cat 3 minima whilst in Category 1 or better conditions will be issued prior to any practise Low Visibility Operations. This will be in the form of an appropriate certificate.

End of Chapter 8

CHAPTER 9 - RECORD FORMS EXAMPLES

900 FORMS AND CERTIFICATES

- 901 A number of crew training certification and autoland record forms must be provided by the Operator to satisfy NAA requirements for:
- a. Certifying the satisfactory completion of AWOPS Training by individual flight deck Crew-members for
 - i. Initial AWOPS Training Clearance; and
 - ii AWOPS Authority Renewal during 'Continuation training' periods
 - b. Recording participation in an autoland operation in a 'Personal log';
 - c. An Aircraft Autoland Record for each Autoland carried-out or attempted and the result, to form an Autoland history for each aircraft. This record is necessary to monitor performance and for ongoing maintenance purposes.
- 902 Sample Procedures and Forms that can be adopted or adapted, may be found in PART 3 as follows
- a. Aircraft Autoland reporting procedure: (PART 3 - Section 3 (3.1.2), Autoland Report Form (3.1.5))
 - b. Autoland report distribution procedure: (PART 3 - Section 3 (3.1.4))
 - c. Personal AWOPS clearance/renewal certificate & autolandings log: (PART 3 - Section 3 (3.1.6))
- 903 Personal Autoland record logs are no longer in general use, though some companies still issue them for pilots to record auto approaches and landings

END OF APPENDIX B

APPENDIX C - WINTER OPERATIONS

EU-OPS 1, SECTION 2 – ACCEPTABLE MEANS OF COMPLIANCE (AMC) & INTERPRETATIVE EXPLANATORY MATERIAL (IEM)

OPS 1.345 - Ice and other contaminants — ground procedures

- (a) An operator shall establish procedures to be followed when ground de-icing and anti-icing together with related inspections of the aeroplane(s) are necessary.
- (b) A commander shall not commence take-off unless the external surfaces are clear of any which might adversely affect the performance and/or controllability of the aeroplane except as permitted in the Aeroplane Flight Manual.

OPS 1.346 - Ice and other contaminants — flight procedures

- (a) An operator shall establish procedures for flights in expected or actual icing conditions.
- (b) A commander shall not commence a flight nor intentionally fly into expected or actual icing conditions unless the aeroplane is certificated and equipped to cope with such conditions.

OPS 1.675 - Equipment for operations in icing conditions

- (a) An operator shall not operate an aeroplane in expected or actual icing conditions unless it is certificated and equipped to operate in icing conditions.
- (b) An operator shall not operate an aeroplane in expected or actual icing conditions at night unless it is equipped with a means to illuminate or detect the formation of ice. Any illumination that is used must be of a type that will not cause glare or reflection that would handicap crew members in the performance of their duties.

MEANS OF COMPLIANCE

Acceptable Means of Compliance (AMC) illustrates the means, or several alternative means, but not necessarily the only possible means by which a requirement can be met. It should however be noted that where a new AMC is developed, any such AMC (which may be additional to an existing AMC) will be amended into the document following consultation under the NPA procedure.

Interpretative/Explanatory Material (IEM) helps to illustrate the meaning of a requirement

Pilots should make themselves thoroughly familiar with procedures that are to be followed when operating in icing conditions. Such pre flight and in-flight procedures must be covered in the Operations Manual. This should be so written as to satisfy EU-OPS 1.345 Requirements that are contained in the following AMC (Acceptable Means of Compliance) extract on the subject.

Icing Conditions

Icing conditions exist whenever the Outside Air Temperature is less than +5°C and there is visible moisture present or in trend, down to -5°C below which any liquid water 'moisture' cannot be present at ground level. There are several types of specific descriptors used and it is the responsibility of the flight crew to determine which of these should be considered:

Rain (RA) – Rain showers (RA SH) - (Drizzle (DZ), Continuous (CNS), Intermittent (INTER), Heavy (HVY) and Very Heavy, Torrential)
Hail (GR or Hail)
Freezing Rain (FZ RA)
FOG (FG)
Freezing FOG (FZ FG)
Snow (SN) – with several levels of severity – Snow Grains (SG), Flurries, Light (-), Medium (No qualifier) and Heavy (+),
Blizzard (BLZD) and Thunderstorm (TS)

Flight Crew Responsibilities

The Flight crew is responsible for carrying-out outside pre-flight checks prior to every flight. When the crew comprises two pilots and a Flight Engineer (F/E), the task is usually delegated to the F/E. On a two pilot crew, it becomes the task of the co-pilot to run the outside check though, on occasion, the captain may wish to carry out the check himself. In snow conditions, the outside check requires that certain particular aspects are addressed, in addition to the normal pre-flight check-list; for example, noting the amount of snow and/or or ice on the upper surfaces of the wing and cabin roof and the correct operation of the heated airspeed pitot-tube probes and also clear static vents.

One particular point that crews should remain alive to, is to clean footwear on re-entry into the cabin during inclement weather conditions, so as not to bring snow and/or de-icing fluids clinging to shoes/boots conditions on return to the flight deck after completing external checks of the aircraft, hence minimising contamination of flight deck floors and flying control pedals.

The Company type-specific Operations Manual will contain the details of outside pre-flight checks required in all weather conditions, an example of which may be studied elsewhere in this Appendix.



Winter operations – Aircraft before take-off

Photo from GAPAN – The Log

Procedures

1. General

- a. Any deposit of frost, ice, snow or slush on the external surfaces of an aeroplane may drastically affect its flying qualities, because of reduced aerodynamic lift and increased drag that modify stability and control characteristics. Furthermore, freezing deposits may cause moving parts, such as elevators, ailerons, flap actuating mechanism etc., to jam and create a potentially hazardous condition. Propeller and engine or APU systems performance may deteriorate due to the presence of frozen contaminants to blades, intakes and components. Also, engine operation may be seriously affected by the ingestion of snow or ice, thereby causing engine stall or compressor damage. In addition, ice/frost may form on certain external surfaces (e.g. wing upper and lower surfaces, etc.) due to the effects of cold fuel and structures, even in ambient temperatures well above 0° C.
- b. The procedures established by the operator for de-icing and/or anti-icing in accordance with EU-OPS 1.345 and 1.346 are intended to ensure that the aeroplane is clear of contamination. This is necessary so that degradation of aerodynamic characteristics or mechanical interference will not occur and, following anti-icing, to maintain the airframe in that condition during the appropriate holdover time. The de-icing and/or anti-icing procedures should therefore include requirements, including type-specific, taking into account manufacturer's recommendations and cover:
 - (i) Contamination checks, including detection of clear ice and under-wing frost. (Note: limits on the thickness/area of contamination published in the AFM or other manufacturers' documentation must be followed);
 - (ii) De-icing and/or anti-icing procedures, including procedures to be followed if de-icing and/or anti-icing procedures are interrupted or unsuccessful; or the prevailing conditions have changed (see (c) below)
 - (iii) Post treatment checks;
 - (iv) Pre take-off checks;
 - (v) Pre take-off contamination checks;
 - (vi) The recording of any incidents relating to de-icing and/or anti-icing; and
 - (vii) The responsibilities of all personnel involved in de-icing and/or anti-icing.
- c. Under certain meteorological conditions de-icing and/or anti-icing procedures may be ineffective in providing sufficient protection for continued operations. Examples of these conditions are freezing rain, ice pellets and hail, heavy snow, high wind velocity, fast dropping OAT or any time when freezing precipitation with high water content is present. No holdover- time guidelines exist for these conditions.

- d. Material for establishing operational procedures can be found, for example, in:
- ICAO Annex 3, Meteorological Service for International Air Navigation;
 - ICAO Doc 9640-AN/940 "Manual of aircraft ground de-icing/anti-icing operations";
 - ISO 11075 (*) ISO Type I fluid;
 - ISO 11076 (*) Aircraft de-icing/anti-icing methods with fluids;
 - ISO 11077 (*) Self propelled de-icing/anti-icing vehicles-functional requirements;
 - ISO 11078 (*) ISO Type II fluid;
 - AEA "Recommendations for de-icing/anti-icing of aircraft on the ground";
 - AEA "Training recommendations and background information for de-icing/anti-icing of aircraft on the ground";
 - EUROCAE ED-104/SAE AS 5116 Minimum operational performance specification for ground ice detection systems;
 - SAE ARP 4737 - Aircraft de-icing/anti-icing methods;
 - SAE AMS 1424 - Type I fluids;
 - SAE AMS 1428 - Type II, III and IV fluids;
 - SAE ARP 1971 - Aircraft De-icing Vehicle, Self-Propelled, Large and Small Capacity;
 - SAE ARD 50102 - Forced air or forced air/fluid equipment for removal of frozen contaminants;
 - SAE ARP 5149 - Training Programme Guidelines for De-icing/Anti-icing of Aircraft on Ground.
- (*) *The revision cycle of ISO documents is infrequent and therefore the documents quoted may not reflect the latest industry standards.*

2. Terminology

Terms used in the context of this ACJ have the following meanings. Explanations of other definitions may be found elsewhere in the documents listed in 1d. In particular, meteorological definitions may be found in ICAO Doc. 9640.

- a. Anti-icing: The procedure that provides protection against the formation of frost or ice and snow accumulation on treated surfaces of the aeroplane for a limited period of time (holdover time).
- b. Anti-icing fluid: Anti-icing fluid includes but is not limited to the following:
- (i) Type I fluid if heated to min 60° C at the nozzle;
 - (ii) Mixture of water and Type I fluid if heated to min 60°C at the nozzle;
 - (iii) Type II fluid;
 - (iv) Mixture of water and Type II fluid;
 - (v) Type III fluid;
 - (vi) Mixture of water and Type III fluid;
 - (vii) Type IV fluid;
 - (viii) Mixture of water and Type IV fluid.
- Note:** On uncontaminated aeroplane surfaces Type II, III and IV anti-icing fluids are normally applied unheated.
- c. Clear ice: A coating of ice, generally clear and smooth, but with some air pockets. It forms on exposed objects, the temperature of which are at, below or slightly above the freezing temperature, by the freezing of super-cooled drizzle, droplets or raindrops.
- d. Conditions conducive to aeroplane icing on the ground: Freezing fog, freezing precipitation, frost, rain or high humidity (on cold soaked wings), mixed rain and snow and snow.
- e. Contamination: Contamination in this context is understood as all forms of frozen or semi-frozen moisture such as frost, snow, slush, or ice.
- f. Contamination check: Check of aeroplane for contamination to establish the need for de-icing.
- g. De-icing: The procedure by which frost, ice, snow or slush is removed from an aeroplane in order to provide uncontaminated surfaces.
- h. De-icing fluid: Such fluid includes, but is not limited to, the following:
- (i) Heated water;
 - (ii) Type I fluid;
 - (iii) Mixture of water and Type I fluid;

- (iv) Type II fluid;
- (v) Mixture of water and Type II fluid;
- (vi) Type III fluid;
- (vii) Mixture of water and Type III fluid;
- (viii) Type IV fluid;
- (ix) Mixture of water and Type IV fluid.

Note: De-icing fluid is normally applied heated, to ensure maximum efficiency.

- i. De-icing/anti-icing. This is the combination of de-icing and anti-icing performed in either one or two steps.
- j. Ground Ice Detection System (GIDS). System used during aeroplane ground operations to inform the ground crew and/or the flight crew about the presence of frost, ice, snow or slush on the aeroplane surfaces.
- k. Holdover time (HOT). The estimated period of time for which an anti-icing fluid is expected to prevent the formation of frost or ice and the accumulation of snow on the treated surfaces of an aeroplane, on the ground, in the prevailing ambient conditions.
- l. Lowest Operational Use Temperature (LOUT). The lowest temperature at which a fluid has been tested and certified as acceptable; in accordance with the appropriate aerodynamic acceptance test and whilst still maintaining a freezing point buffer of not less than:
10° C for a type I de-icing/anti-icing fluid; and
7° C for type II, III or IV de/anti-icing fluids
- m. Post treatment check. An external check of the aeroplane after de-icing and/or anti-icing treatment accomplished from suitably elevated observation points (e.g. from the de-icing equipment itself or other elevated equipment) to ensure that the aeroplane is free from any frost, ice, snow, or slush.
- n. Pre-take-off check. An assessment normally performed from within the flight deck, to validate the applied holdover time.
- o. Pre-take-off contamination check. A check of the treated surfaces for contamination, performed when the hold-over-time has been exceeded or if any doubt exists regarding the continued effectiveness of the applied anti-icing treatment. It is normally accomplished externally, just before the commencement of the take-off run, by appropriately qualified ground staff.

3. Fluids

- a. Type I fluid. Due to its properties, Type I fluid forms a thin, liquid-wetting film on surfaces to which it is applied which, under certain weather conditions, gives a very limited holdover time. With this type of fluid, increasing the concentration of fluid in the fluid/water mix does not provide any extension in holdover time.
- b. Type II and type IV fluids contain thickeners which enable the fluid to form a thicker liquid-wetting film on surfaces to which it is applied. Generally, this fluid provides a longer holdover time than Type I fluids in similar conditions. With this type of fluid, the holdover time can be extended by increasing the ratio of fluid in the fluid/water mix.
- c. Type III fluid: a thickened fluid intended especially for use on aeroplanes with low rotation speeds.
- d. Fluids used for de-icing and/or anti-icing should be acceptable to the operator and the aeroplane manufacturer. These fluids normally conform to specifications such as SAE AMS 1424, 1428 or equivalent. Use of non-conforming fluids is not recommended, due to their characteristics not being known.

Note: The anti-icing and aerodynamic properties of thickened fluids may be seriously degraded by, for example, inappropriate storage, treatment, application, application equipment and age.

4. Communications

4.1 Before aeroplane treatment.

When the aeroplane is to be treated with the flight crew on board, the flight and ground crews should confirm the fluid to be used, the extent of treatment required, and any aeroplane type specific procedure(s) to be used. Any other information needed to apply the HOT tables should be exchanged. Particular attention must be paid to the provision of air conditioning services, to ensure that fluid application does not enter the aircraft pneumatic system.

4.2 Anti-icing code

- a. The operator's procedures should include an anti-icing code, which indicates the treatment the aeroplane has received. This code provides the flight crew with the minimum details necessary to estimate a holdover time (see in (5) below) and confirms that the aeroplane is free of contamination. Flight crew may find this code already entered into the Aircraft Technical Log, or on a note attached to the flight control system.
- b. The procedures for releasing the aeroplane after the treatment should therefore provide the Commander with the anti-icing code and it is essential that the Commander has a clear understanding of the commencement time.
- c. Anti-icing Codes to be used (examples):
 - (i) "Type I" at (start time) – To be used if anti-icing treatment has been performed with a Type I fluid;
 - (ii) "Type II/100" at (start time) – To be used if anti-icing treatment has been performed with undiluted Type II fluid;
 - (iii) "Type II/75" at (start time) – To be used if anti-icing treatment has been performed with a mixture of 75% Type II fluid and 25% water;
 - (iv) "Type IV/50" at (start time) – To be used if anti-icing treatment has been performed with a mixture of 50% Type IV fluid and 50% water.

Note1: When a two-step de-icing/anti-icing operation has been carried out, the Anti-Icing Code is determined by the second step fluid. Fluid brand names may be included, if desired

Note2: If the treatment is compromised by any **other factors**, such as the supply-side **running-out**, or the conditions changing then, unless the need for the treatment ceases, the whole process must re-commence with a revised start time passed to the flight crew.

4.2 After Treatment

Before reconfiguring or moving the aeroplane, the flight crew should receive a confirmation from the ground crew that all de-icing and/or anti-icing operations are complete and that all personnel and equipment are clear of the aeroplane.

5. Holdover protection

- a. Holdover protection is achieved by a layer of anti-icing fluid remaining on and protecting aeroplane surfaces for a specified period of time. With a one-step de-icing/anti-icing procedure, the holdover time (HOT) begins at the commencement of de-icing/anti-icing. With a two-step procedure, the holdover time begins at the commencement of the second (anti-icing) step. The holdover protection runs out:
 - (i) At the commencement of take-off roll (due to aerodynamic shedding of fluid), or
 - (ii) When frozen deposits start to form or accumulate on treated aeroplane surfaces, thereby indicating the loss of effectiveness of the fluid.
- b. The duration of holdover protection may vary, subject to the influence of factors other than those specified in the holdover time (HOT) tables. Guidance should be provided by the operator to take account of such factors which may include:
 - (i) Atmospheric conditions, e.g. exact type and rate of precipitation, wind direction and velocity, relative humidity and solar radiation and
 - (ii) The aeroplane and its surroundings, such as aeroplane component inclination angle, contour and surface roughness, surface temperature, operation in close proximity to other aeroplanes (jet or propeller blast) and ground equipment and structures.
- c. Holdover times are not meant to imply that flight is safe in the prevailing conditions if the specified holdover time has not been exceeded. Certain meteorological conditions, such as freezing drizzle or freezing rain, may be beyond the certification envelope of the aeroplane.
- d. The operator should publish in the Operations Manual the holdover times in the form of a table or diagram to account for the various types of ground icing conditions; together with the different types and concentrations of fluids used. However, the times of protection shown in these tables are to be used as guidelines only and are normally used in conjunction with pre-take-off check.
- e. References to usable HOT tables may be found in the 'AEA recommendations for de-/anti-icing aircraft on the ground'.
- f. Flight crew need to establish knowledge of their aircraft type and external locations where icing conditions will have the most significant impact. For instance 'dry bays' on the top surfaces of wings will not benefit from the heating effect of uploaded fuel and remain covered in frost or ice when surrounding wing surfaces will have become clear.

6. Procedures to be used

Operator's procedures should ensure that:

- a. When aeroplane surfaces are contaminated by ice, frost, slush or snow, they are de-iced prior to take-off; according to the prevailing conditions. Removal of contaminants may be performed with mechanical tools, fluids (including hot water), infra-red heat or forced air, taking account of aeroplane type-specific requirements.
- b. Account is taken of the wing skin temperature versus OAT, as this may affect:
 - (i) The need to carry out aeroplane de-icing and/or anti-icing; and
 - (ii) The performance of the de-icing/anti-icing fluids.
- c. When freezing precipitation occurs, or there is a risk of freezing precipitation occurring, which would contaminate the surfaces at the time of take-off, aeroplane surfaces should be anti-iced. If both de-icing and anti-icing are required, the procedure may be performed in a one or two-step process depending upon weather conditions, available equipment, available fluids and the desired holdover time. One-step de-icing/anti-icing means that de-icing and anti-icing are carried out at the same time using a mixture of de-icing/anti-icing fluid and water. Two-step de-icing/anti-icing means that de-icing and anti-icing are carried out in two separate steps. The aeroplane is first de-iced using heated water only or a heated mixture of de-icing/anti-icing fluid and water. After completion of the de-icing operation, a layer of a mixture of de-icing/anti-icing fluid and water, or of de-icing/anti-icing fluid only, is to be sprayed over the aeroplane surfaces. The second step will be applied, before the first step fluid freezes, typically within three minutes and, if necessary, area by area.
- d. When an aeroplane is anti-iced and a longer holdover time is needed or desired, the use of a less diluted Type II or Type IV fluid should be considered.
- e. All restrictions relative to Outside Air Temperature (OAT) and fluid application (including, but not necessarily limited to temperature and pressure), published by the fluid manufacturer and/or aeroplane manufacturer, must be followed. Procedures, limitations and recommendations to prevent the formation of fluid residues must also be followed.
- f. During conditions conducive to aeroplane icing on the ground, or after de-icing and/or anti-icing, an aeroplane is not dispatched for departure unless it has been given a contamination check or a post treatment check by a trained and qualified person. This check should cover all treated surfaces of the aeroplane and be performed from points offering sufficient accessibility to these parts. To ensure that there is no clear ice on suspect areas, it may be necessary to make a physical check (e.g. tactile).
- g. The required entry is made in the Technical Log. (See AMC OPS 1.915, paragraph 2, Section 3.vi.)
- h. The Commander continually monitors the environmental situation after the performed treatment. Prior to take-off he performs a pre-take-off check, which is an assessment whether the applied HOT is still appropriate. This pre-take-off check includes, but is not limited to, factors such as precipitation, wind and OAT.
- i. If any doubt exists as to whether a deposit may adversely affect the aeroplane's performance and/or controllability characteristics, the Commander should require a pre-take-off contamination check to be performed, in order to verify that the aeroplane's surfaces are free of contamination. Special methods and/or equipment may be necessary to perform this check, especially at night time or in extremely adverse weather conditions. If this check cannot be performed just prior take-off, re- treatment should be carried out.
- j. When re-treatment is necessary, any residue of the previous treatment should be removed and a completely new de-icing/anti-icing treatment applied.
- k. When a Ground Ice Detection System (GIDS) is used to perform an aeroplane surfaces check prior to and/or after a treatment, the use of GIDS by suitably trained personnel should be a part of the procedure.

7. Special operational considerations

- a. When using thickened de-icing/anti-icing fluids, the operator should consider a two-step de-icing/anti-icing procedure, the first step preferably with hot water and/or non thickened fluids.
- b. The use of de-icing/anti-icing fluids has to be in accordance with the aeroplane manufacturer's documentation. This is particular true for thickened fluids to assure sufficient flow-off during take-off.
- c. The operator should comply with any type-specific operational requirement(s) such as an aeroplane mass decrease and/or a take-off speed increase associated with a fluid application.

- d. The operator should take into account any flight handling procedures (stick force, rotation speed and rate, take-off speed, aeroplane attitude etc.) laid down by the aeroplane manufacturer when associated with a fluid application.
- e. The limitations or handling procedures resulting from (c) and/or (d) above should be part of the flight crew pre take-off briefing. For example, Graduated/Reduced Take-off Power should not be used unless specifically aircraft type-approved.
- f. There may be 'aircraft type-specific', passenger and crew air conditioning procedures during de-icing/anti-icing and passengers will need to be prepared by a PA call, made by the flight or cabin crew

8. Special maintenance considerations

a. General

The operator should take proper account of the possible side-effects of fluid use. Such effects may include, but are not necessarily limited to, dried and/or re-hydrated residues, corrosion and the removal of lubricants. Appropriate Personal Protective Equipment must be provided and used.

b. Special considerations due to residues of dried fluids.

The operator should establish procedures to prevent or detect and remove residues of dried fluid. If necessary the operator should establish appropriate inspection intervals based on the airframe manufacturers and/or own experience and recommendations:

- (i) *Dried fluid residues:* Dried fluid residue could occur when surfaces **have** been treated but the aircraft has not been flown subsequently and not been subject to precipitation. The fluid may then have dried on the surfaces;
- (ii) *Re-hydrated fluid residues:* Repetitive application of thickened de-icing/anti-icing fluids may lead to the subsequent formation/build up of a dried residue in aerodynamically quiet areas, such as cavities and gaps. This residue may re-hydrate if exposed to high humidity conditions, precipitation, washing, etc., and increase to many times its original size/volume. This residue will freeze if exposed to conditions at or below 0° C. This may cause moving parts such as elevators, ailerons, and flap actuating mechanisms to stiffen or jam in flight.

Re-hydrated residues may also form on exterior surfaces, which can reduce lift, increase drag and stall speed.

Re-hydrated residues may also collect inside control surface structures and cause clogging of drain holes or imbalances to flight controls.

Residues may also collect in hidden areas: around flight control hinges, pulleys, grommets, on cables and in gaps.

(iii) Recommendation

Operators are strongly recommended to request information about the fluid dry-out and of the rehydration characteristics from the fluid manufacturers and to select products with optimised characteristics;

(iv) Additional information

Additional information should be obtained from fluid manufacturers for handling, storage, application and testing of their products.

9. Training

- a. An operator must establish appropriate initial and recurrent de-icing and/or anti-icing training programmes (including communication training) for flight crew; and those of his ground crew who are involved in de-icing and/or anti-icing.
- b. These de-icing and/or anti-icing training programmes must include additional training if any of the following will be introduced:
 - (i) A new method, procedure and/or technique;
 - (ii) A new type of fluid and/or equipment; and
 - (iii) A new type(s) of aeroplane.

10. Subcontracting (see AMC OPS 1.035 sections 4 and 5)

The operator must ensure that the subcontractor complies with the operator's quality and training and qualification requirements, together with the special requirements in respect of:

- a. De-icing and/or anti-icing methods and procedures;

- b. Fluids to be used, including provision and availability of supplies, precautions for storage and preparation for use;
- c. Specific aeroplane requirements (e.g. no-spray areas, propeller/engine de-icing, APU operation etc.);
- d. Checking and communications procedures.

**11. ACJ OPS 1.346
Flight in expected or actual icing conditions
See JAR-OPS 1.346**

- 11.1 The procedures to be established by an operator should take account of the design, the equipment or the configuration of the aeroplane and also of the training which is needed. For these reasons, different aeroplane types operated by the same company may require the development of different procedures. In every case, the relevant limitations are those which are defined in the Aeroplane Flight Manual (AFM) and other documents produced by the manufacturer.
- 11.2 For the required entries in the Operations Manual, the procedural principles which apply to flight in icing conditions are referred to under Appendix 1 to OPS 1.1045, A8.3.8 and should be cross-referenced, where necessary, to supplementary, type-specific data under B4.1.1.

11.3. Technical content of the Procedures.

The operator should ensure that the procedures take account of the following:

- a. OPS 1.675;
- b. The equipment and instruments which must be serviceable for flight in icing conditions;
- c. The limitations on flight in icing conditions for each phase of flight. These limitations may be imposed by the aeroplane's de-icing or anti-icing equipment, or the necessary performance corrections which have to be made;
- d. The criteria the Flight Crew should use to assess the effect of icing on the performance and/or controllability of the aeroplane;
- e. The means by which the Flight Crew detects, by visual cues or the use of the aeroplane's ice detection system, that the flight is entering icing conditions; and
- f. The action to be taken by the Flight Crew in a deteriorating situation (which may develop rapidly) resulting in an adverse affect on the performance and/or controllability of the aeroplane, due to either:
 - (i) the failure of the aeroplane's anti-icing or de-icing equipment to control a build-up of ice, and/or
 - (ii) ice build-up on unprotected areas.

12. Training for despatch and flight in expected or actual icing conditions.

The content of the Operations Manual, Part D, should reflect the training, both conversion and recurrent, which Flight Crew, Cabin Crew and all other relevant operational personnel will require in order to comply with the procedures for despatch and flight in icing conditions.

12.1 For the Flight Crew, the training should include:

- a. Instruction in how to recognise, from weather reports or forecasts which are available before flight commences, or during flight, the risks of encountering icing conditions along the planned route and on how to modify, as necessary, the departure and in-flight routes or profiles;
- b. Instruction in the operational and performance limitations or margins;
- c. The use of in-flight ice detection, anti-icing and de-icing systems in both normal and abnormal operation; and
- d. Instruction in the differing intensities and forms of ice accretion and the consequent action which should be taken.
- e. **Instruction on how to land on wet and slush-covered slippery runways causing reduced braking efficiency, to avoid aquaplaning-induced runway far-end over-runs and rubber-reversion tyre damage.**

- 12.2 For the Cabin Crew, the training should include;
- Awareness of the conditions likely to produce aircraft surfaces contamination; and
 - The need to inform the Flight Crew of significant ice accretion and how to do this.

13. Aquaplaning (Extracts from a Skybary article by Eurocontrol)

Aquaplaning – also known as hydroplaning – is a condition in which standing water causes the moving wheel of an aircraft to lose contact with the surface on which it is load bearing, with the result that braking action on the wheel is not effective in reducing the ground speed of the aircraft.

The continued incidence of aquaplaning reduces the braking co-efficient to that of an icy or "slippery" runway, which is less than 20% of that on a equivalent dry runway.

A layer of water builds up beneath the tyre in increasing resistance to displacement by the pressure of the wheel. Eventually, this results in the formation of a wedge between the runway and the tyre. This resistance to water displacement has a vertical component which progressively lifts the tyre and reduces the area in contact with the runway until the aircraft is completely water-borne. In this condition, the tyre is no longer capable of providing directional control or effective braking because the drag forces are so low. If such a runway surface state prevails, then flight crew are required to make their aircraft runway performance calculations using "slippery runway" data; this specifically allows for poor deceleration. They must also take account of crosswind component limits in the AFM which make allowance for less assured directional control.

Aquaplaning can occur when a wheel is running in the presence of water; it may also occur in certain circumstances when running in a combination of water and wet snow. Aquaplaning on runway surfaces with normal friction characteristics is unlikely to begin in water depths of 3mm or less. For this reason, a depth of 3mm has been adopted in Europe as the means to determine whether a runway surface is contaminated with water to the extent that aircraft performance assumptions are liable to be significantly affected. Once aquaplaning has commenced, it can be sustained over surfaces and in water depths which would not have led to its initiation.

In the case of the most common type of aquaplaning, called dynamic aquaplaning, a simple formula can calculate the minimum groundspeed for initiation of this type of aquaplaning on a sufficiently wet runway based upon tyre pressure. It is $V = 8.6 \times \sqrt{P}$ (where groundspeed in knots = V and tyre inflation pressure in psi = P). This formula is based upon the validation of hydrodynamic lift theory by experimental evidence. The formula gives Minimum Initiation Aquaplane Speed (MIAS) i.e. aquaplaning may occur above this value, (133kts for a 747), and can continue below it.

13.1 Types of Aquaplaning

Dynamic aquaplaning is that which does not begin unless the tyre-pressure moderated ground speed as determined above is exceeded. It leaves no physical evidence on tyre or runway surface.

Viscous aquaplaning arises in the same way as dynamic aquaplaning, but only on abnormally smooth surfaces such as touchdown zones contaminated with excessive rubber deposits where it may begin and continue at any ground speed. Typically, a small amount of water may mix with a surface contaminant. It too leaves no physical evidence on tyre or runway surface.

Reverted rubber aquaplaning occurs when the heat of friction from a locked wheel in contact with the surface causes the reversion of the rubber to its un-cured state and 'boils' the surface moisture into steam. The pressure of the steam raises the centre of the tyre off the surface whilst the edges remain in contact, forming a seal which temporarily traps the steam. The tyre will show clear evidence of rubber reversion and the runway surface will be clearly marked with the path of the wheels as a result of 'steam pressure cleaning' beneath the tyre. This is the only type of 'aquaplaning' which leaves physical evidence on the runway surface. It was much more common before antiskid units became widespread and usually only occurs to aircraft so fitted if an emergency brake, which is applied directly rather than through the anti skid units, is used.

13.2 Runway Surface State

The surface state of a wet runway can be assessed by either:

- The depth of water in the touchdown zone, or
- The measured or observed braking action.

Standard terminology which describes a runway as dry, damp, wet, wet with water patches or flooded is in use is often found in association with the use of 3mm water depth over a significant part of the runway as the division between a normal runway and a contaminated one for aircraft performance purposes.

The best information a pilot is likely to get is prior to landing is an informal braking action comment made to ATC by a previously landed aircraft. This should be passed by ATC with the time of the report, the aircraft type which made it and any significant change in precipitation since it was received. Prior to takeoff, direct observation should

enable the pilot to form a first hand impression of the surface state and the extent to which water is present on it. This will be particularly important in the event of a rejected take-off.

13.3 Avoiding Aquaplaning

If there is any doubt as to the probable extent of water of depth greater than 3mm on the landing runway, then an alternative runway should be chosen.

If the flight crew become aware, just before landing, that the depth of water on the runway has increased to an extent that the runway, especially in the touchdown zone, then a go-around should be flown. If this circumstance is not apparent until touchdown, then, provided it is permitted by the AFM, the landing should be promptly rejected from the runway.

A stabilised approach is required if it is decided that to continue an approach to a landing, so that the aircraft crosses the runway threshold at the correct airspeed and height, to achieve a touchdown within the TDZ. This is especially important when the landing distance required is close to the landing distance available.

13.4 General Airmanship Considerations

The pilot should be aware of the aquaplaning speed derived from the fully-inflated tyre pressure for both the maximum takeoff mass and maximum landing weight. Careful attention should be paid to the appearance of the tyres during the pre-flight external check, as far as possible, especially the depth of tread. Even though having the tyre pressure within allowable limits is important, it can be extremely difficult to assess this visually on multi-wheel landing gear.

The main gear touchdown on a wet runway should always be firm and made without any bounce in order to break through the surface water film and make effective contact with the runway surface.

13.5 Braking, Spoiler Deployment, Thrust Reversers and Control Column Handling

Once touchdown on all of the landing gear has been achieved and sustained, SOPs usually recommend application of positive forward control column pressure in order to reduce the wing incidence and therefore lift, to assist in imposing the full aircraft weight onto the landing gear.

A significant crosswind component may result in a difference between the amount of weight transferred onto each main gear assembly. This is because, even with the wings being held level by into-wind aileron, fuselage shielding partly blanks the downwind wing. This increases the likelihood of difficulties with directional control in a situation where the possibility of transient differential aquaplaning may also exist.

Full reverse thrust or reverse pitch should be selected whilst the ground speed is still high in order to gain maximum effect, if available. Full ground spoiler deployment should also be made as soon as all wheels are on the ground if manual selection is necessary. Auto deployment of ground spoilers may be delayed until a specific wheel rotational speed, perhaps 25 kts, is sensed. Brake Units are likely to have anti skid systems fitted so that any applied brake pressure by-passes the units until a specified wheel rotational speed is reached after touchdown. Typically, this could be 50 kts. Auto braking selection should follow AFM requirements and Operator SOPs; manual braking may be inhibited until a specific time after the final touchdown is sensed. It is important to understand how each of these contributions to deceleration work so that if aquaplaning should occur, it is recognised as such rather than mistaken for a system malfunction.

13.6 Recovery from Aquaplaning

Aquaplaning should be avoided if at all possible because, once it has started, there is no certain way of regaining control and establishing useful deceleration.

In the case of continued aquaplaning, deceleration can be expected to correspond to that for a slippery runway with braking coefficient of around 0.05. Around 50% more stopping distance will be needed if thrust reversers are not available and around 25% if they are (since account is not taken of their effect for normal landing performance calculations).

Prior to attempting a landing on a runway where aquaplaning is likely, check that sufficient 'slippery runway' landing distance exists so that a runway excursion will not follow if aquaplaning commences.

If there is a significant crosswind component, a landing on a potentially slippery runway should not be attempted. AFM limitations usually impose specific restrictions on allowable crosswind component for this case.

Apart from an immediate rejected landing where AFM limitations and Operator SOPs allow it, there is little that can be done if aquaplaning begins and continues. If manual braking is being used, then briefly releasing and then reapplying pressure may succeed in increasing braking effectiveness. However, under no circumstances (except gross malfunction) should anti skid be disabled since hard braking on a wet runway without this protection is certain to lead to reverted rubber aquaplaning and a decrease in deceleration due to locked wheels.

ADDITIONAL USEFUL INFORMATION ON WINTER OPERATIONS IN SNOW, SLUSH AND ICING CONDITIONS

In FODCOM 33/2008, Sub-section 6, captioned **Further Information**, the following entries help to provide reference material for de-icing/anti-icing training courses:-

- 6.1. The Winter Operations section contained within the Flight Operations part of the CAA website (under Types of Operation) is a source of more information.
- 6.2. EASA training material is available via the Winter Operations section of the CAA website.
- 6.3. Several FODCOMS, including 15/2006, 19/2006, and 36/2007, provide guidance for Winter Operations.
- 6.4. Notice to Aerodrome Licence Holders (NOTAL) 9/2006, captioned Winter Operations, also contains information and advice on contaminated runways and can be found on the CAA website.
- 6.5. AIC 118/2006 (Pink 106), provides recommendations for de-icing/anti-icing of aircraft on the ground.
- 6.6. The Association of European Airlines (AEA) is one of several organisations that provide guidance material. Their manuals, '*Recommendations for de-icing / anti-icing of Aircraft on the Ground*' and '*Background information for de-icing / anti-icing on the Ground*' are available via the website: www.aea.be.

The CAA website (www.caa.co.uk) also contains the following applicable information:-

Notices to Aerodrome Licence Holders (NOTAL)

NOTAL 2008/11 contains the following text which further expands FODCOM 31/2008 guidance.

UK Civil Air Publications (CAP)

CAP 168

1. **Appendix 3D:** National Snow Plan, including procedures for dealing with winter contamination of aerodrome surfaces.
2. **Appendix 3G:** Care of pavements during Winter Conditions - Improving surface friction by removal of contaminants.
3. **Chapter 10:** Aeronautical Information.

CAP 728 The Management of Safety: Guidance to Aerodromes and Air Traffic Service Units on the Development of Safety Management Systems.

CAP 493 Manual of Air Traffic Procedures - Part 1, Chapter 8. This is about Snow and Ice as it applies to an ATCO, but is interesting. In addition, the following information is available.

Flight Operations Department Communications (FODCOM)

FODCOM 31/2008 - Training for Ground De-icing and Anti-icing of Aircraft.

FODCOM 33/2008 - Winter Operations.

Aeronautical Information Circulars (AIC)

AIC 86/2007 (Pink 126) - Risks and Factors associated with Operations on runways contaminated by snow, slush or water.

AIC 93/2007 (Yellow 247) - Guidance for the Distribution & Completion of SNOWTAM Form (CA 1272).

AIC 118/2006 (Pink 106) - De-icing of Aircraft on the Ground, Recommendations for.

UK AIP

Licence holders' attention is also drawn to the UK AIP section AD 1.2.2, and particularly paragraphs 5.4 and 5.5, for guidance on the assessment and notification of a runway that is contaminated by slush or uncompacted snow. In addition, the following information is also available:

TRAINING MATERIAL

The CAA has created a Winter Operations training package. The CD/DVD is available free of charge from your Regional Office. Two web-based training packages produced by the NASA GRC icing branch are available:

- **A Pilot's Guide to In-flight Icing**
- **A Pilot's Guide to Ground Icing**

A web-based course to provide pilots with a way to help them avoid the hazards of ice contamination while their aircraft are on the ground has been launched by an international team of safety experts, including the UK Civil Aviation Authority (CAA).

The 'Pilot's Guide to Ground Icing' is a free online course intended primarily for professional pilots who make their own de-icing and anti-icing decisions. The self-guided course provides pilots with general ground icing knowledge, an understanding of freezing precipitation hazards and the ability to improve decision-making in ground icing operations.

It discusses the risks of contamination, provides cues to alert the pilot to ground icing conditions and offers actions that pilots can take to help ensure safe operations. Imagery, case studies, pilot testimonials and interactive elements are used to inform and help pilots make better operational decisions.

Ground icing accidents are often preventable and by providing pilots with the online training course, we hope to improve the safety of their flights.

An international team led by NASA researchers developed the new educational tool. The team included experts from NASA's Ames and Glenn Research Centres; UK CAA; US Federal Aviation Administration; Transport Canada; Canadian Armed Forces; the University of Oregon; a fractional jet provider and an airline.

'*A Pilot's Guide to Ground Icing*' and '*A Pilot's Guide to In-flight Icing*' courses are both available on the web, at: <http://aircrafticing.grc.nasa.gov/courses.html>

[Highlight link then press CTRL + Left click mouse or 'Return' to reach the web site]

The CAA has also re-released its Ice Aware DVD, which is also aimed at pilots and covers issues surrounding aircraft icing. Copies are available free of charge from Alison Jarvis email alison.jarvis@srg.caa.co.uk.

For more information, please contact CAA on +44 (0)20 7453 6027

De-icing in progress ...



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END OF APPENDIX C – WINTER OPERATIONS

APPENDIX D - USEFUL ADDRESSES AND CONTACT DETAILS

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The UK Air Accidents Investigation Branch (AAIB) is part of the Department for Transport and is responsible for the investigation of civil aircraft accidents and serious incidents within the UK.

Air Accidents Investigation Branch
Berkshire Copse Road
Aldershot
Hampshire
GU11 2HH

Tel: 01252 510 300
Fax: 01252 376 999
E-mail: enquiries@aaib.gov.uk
Website: [http:// www.aaib.dft.gov.uk](http://www.aaib.dft.gov.uk)

For all official requests for technical assistance please contact us by fax on number +44 (0)1252 376 999

AAIB Links

Please note that all links open in a new window.

UK Sites

UK - British Gliding Association (BGA)
UK - BGA Gliding Accidents Reports (User name: user, Password: risingmoon)
UK - British Hang Gliding and Paragliding Association
UK - British Microlight Aircraft Association
UK - British Helicopter Advisory Board
UK - Civil Aviation Authority (CAA)
UK - Civil Aviation Authority (CAA) - Responses to AAIB Safety Recommendations
UK - Confidential Human Factors Incident Reporting Programme (CHIRP)
UK - NATS - Aeronautical Information Service (AIS)
UK - Defence Aviation Safety Centre
UK - Airprox Board (UKAB)

CIVIL AVIATION AUTHORITY (UK)

Civil Aviation Authority Headquarters

CAA House
45-59 Kingsway
London
WC2B 6TE
T: 020 7379 7311 (This telephone number can also be used for all out of hours emergencies)

CAA Departments (in Alphabetical order)

Airspace Policy Directorate

CAA House
45-59 Kingsway
London
WC2B 6TE
T: 020 7453 6599
F: 020 7453 6593

Air Traffic Services Licensing: 01293 573355 or, by e-mail at: ats.licensing@srg.caa.co.uk

Consumer Protection Group

CAA House
45-59 Kingsway
London
WC2B 6TE
T: 020 7453 6430
F: 020 7453 6431

Directorate of Airspace Policy

CAA House
45-59 Kingsway
London
WC2B 6TE
T: 020 7453 6599
F: 020 7453 6593

Economic Regulation Group

CAA House
45-59 Kingsway
London
WC2B 6TE
T: 020 7453 6213
F: 020 7453 6244

Human Resources (HR) Department - *For job opportunities in the Economic Regulation Group, Consumer Protection Group, Directorate of Airspace Policy or Corporate Departments, contact :-*

Civil Aviation Authority HR Department - London Team

Room 216
CAA House
45-59 Kingsway
London
WC2B 6TE
T: 020 7453 6040
F: 020 7453 6045

Human Resources (HR) Department: *For job opportunities in the Safety Regulation Group, contact*

Civil Aviation Authority HR Department - Gatwick Team

Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
T: 01293 567171 (This telephone number can be used for all out of hours emergencies)
F: 01293 573940

Library and Information Centre

Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

Telephone: 01293 573725
Fax: 01293 573181
Email: library-enquiries@srg.caa.co.uk
Website: <http://www.caa.co.uk/library>

Medical Department: 01293 573700 or by e-mail to: medicalweb@srg.caa.co.uk

Personnel Licensing and Medicals: - Enquiries should be made to the following:-

Personnel Licensing Department: 01293 573700 or by e-mail: fclweb@srg.caa.co.uk or eldweb@srg.caa.co.uk

If you have not be able find the information you require from the web site and you would like further assistance please contact the CAA Enquiry Team: 01293 57 3725 or by e-mail: infoservices@caa.co.uk

Publications (to purchase CAA documentation)

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Telephone: 01242 283100
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Safety Regulation Group

Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
T: 01293 567171 (This telephone number can be used for all out of hours emergencies)
F: 01293 573940

EASA - EUROPEAN AVIATION SAFETY AGENCY

Contacting the EASA
The Agency moved on 3rd November 2004 to its final headquarters in Cologne.

New address in Cologne:

✉ Postal address for letters only
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Postfach 10 12 53
D-50452 Koeln, Germany

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+49 221 8999 0000
+49 221 8999 00000

General fax:
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D-50679 Köln, Germany 🇩🇪

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The Royal Aeronautical Society

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Tel: +44 (0)20 7670 4300
Fax +44 (0)20 7670 4309
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Website: <http://www.aerosociety.com>

The Guild of Air Pilots & Air Navigators (GAPAN)

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9 Warwick Court
Gray's Inn
London
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Tel: +44(0)20 7404 4032
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The UK Flight Safety Committee

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GU24 8HX
Tel: +44(0)1276 855193
E-mail: admin@ukfsc.co.uk
Website: <http://www.ukfsc.co.uk>

END OF APPENDIX D

APPENDIX E – BIBLIOGRAPHY (Useful References)

The Local Aeronautical Information Publication (AIP) – e.g., the UK "Air Pilot"

ECAC/CEAC Doc No. 17 (Issue 3), 9/88 - All Weather Operations (common European procedures for the Authorisation of Category 2 & 3 Low Visibility Operations - LVO)

ICAO ANNEXES to the Convention on International Civil Aviation

ICAO Annex 3 - Meteorological Services

ICAO Annex 4 - Aeronautical Charts

ICAO Annex 6 - Operation of Aircraft Part 1 - International Commercial Air Transport - Aeroplanes

ICAO Annex 10 - Aeronautical Telecommunications, Volume 1 (Radio Navigation Aids)

ICAO Annex 11 - Air Traffic Services

ICAO Annex 14 - Aerodromes Volume 1 (Aerodrome Design and Operations)

ICAO Annex 15 - Aeronautical Information Services

ICAO Documents

ICAO Document 4444-ATM/501 Procedures for Air Navigation Services

Air Traffic Management (PANS-ATM)

Rules of the Air and Air Traffic Services (PANS-RAC)

ICAO Document 8168 - ICAO PANS-OPS (Procedures for Air Navigation Services Aircraft Operations)

ICAO Document 8697 - Aeronautical Charts Manual

ICAO Doc 9157 Aerodrome Design Manual

Part 2 - Taxiways, Aprons and Holding Bays

Part 5 - Electrical systems

ICAO Doc 9328-AN/908 Manual of Runway Visual Range Observing and Reporting Practices

ICAO Doc 9365-AN/910 Manual of All-Weather Operations

ICAO Doc 9476-AN/927 Manual of Surface Movement Guidance & Control Systems

ICAO Doc 9830-AN/452 Manual of Advanced Surface Movement Guidance & Control Systems (ASMGS)

UK CAA Publications

BCAR Paper No 742 Approach and landing with DH below 200 ft or no DH

BCAR Chapter D4 - Autopilots

CAP 169 - Licensing of Aerodromes

CAP 360 Parts 1 & 2 (UK CAA) Air Operation certificates - Guidance for Applicants and Holders

CAP 637 - Visual Aids Handbook

NTAOCH - Notices To AOC Holders; UK CAA

European Aviation Safety Agency & Joint Aviation Authority (JAA) Publications

EAPPRI European Action Plan for the Prevention of Runway Incursions

ESARR 3 Use of Safety Management Systems by ATM Service Providers

ESARR 4 Risk Assessment and Mitigation in ATM

EU-OPS 1 (Replaced JAR-OPS 1 in 2008)

JAR Airworthiness

JAR/FCL Licensing

JAR 145 Maintenance (Approved Organisations)

JAR-OPS - Operations, Commercial Air Transportation

JAR-OPS 1 - Aeroplanes

JAR-OPS 2 - Aerial Work & Corporate aviation

JAR-OPS 3 - Helicopters

JAR-OPS 4 - Medical

Subpart E of JAR-OPS 1 - Commercial Air Transportation (Aeroplanes) - AWOPS

Subpart E of JAR-OPS 2 - Aerial Work & Corporate aviation - AWOPS

Subpart E of JAR-OPS 3 - Commercial Air Transportation (Helicopters) - AWOPS

Where an EU-OPS document replacing a JAR document of the same name is not yet published, the JAA product shall be used until replaced.

All documents may be obtained from the issuing organisations (See Appendix D - ADDRESSES)

END OF APPENDIX E

APPENDIX F - MASTER GLOSSARY OF TERMS AND ABBREVIATIONS, ACRONYMS AND DEFINITIONS

The following terms and abbreviations may be found in this and other Civil Aviation Publications.

A	Aeroplane(s)
RAF	Royal Air Force
Raison d'être	Reason for being; French term
RDH	Reference Datum Height; ILS glide-slope reference datum
AA	Acceleration Altitude
AAL or aal	Above Aerodrome Level
Ab Initio	Latin for "From the beginning"; as in Elementary Flying Training.
ACF	Accepted Carried Forward (technical fault)
A/D	Aerodrome
ADD	Allowable Deferred Defect
Adequate A/D	Adequate Aerodrome; (ETOPS Term). In general terms, an operator may make an appraisal that an aerodrome has long enough runways, and is sufficiently equipped, to be considered adequate for his planned ETOPS routes. The commander must satisfy himself on the day, using criteria provided by the operator, that he has sufficient adequate aerodromes which, taking into account the weather and any equipment unserviceabilities, are suitable for his intended operation.
ADF	Automatic Direction Finder; needle over Compass card points at tuned radio-aid (NDB)
Ad hoc	Latin phrase; used to mean "in this context or circumstance. Sometimes used to mean a one-off or unusual situation; such as in ad hoc (one off) charter.
ADI	Attitude Display Indicator
ADL	Allowable Deficiency List
ADR	Advisory Routes (ATC Routeing)
ADT	Approved Departure Time; slot time
AE	Authorised Examiner
AERAD	References to AERAD mean the charting product of Navtech Inc., Canada; producer of the AERAD Flight Guide for British Airways, inter alia.
AFG	Aircraft Flight Guide (Aerad or Jeppesen etc.)
AFM	Aircraft Flight Manual
AGA	Aerodromes, let down aids & procedures; as in the UK AIP, AGA Section
AGNIS	Azimuth Guidance for Nose-in Parking at Stands
AIC	Aeronautical Information Circular (UK CAA)
Aide-Mémoire	Memory helper; French term
AIP	Aeronautical Information Publication; e.g., the UK CAA "Air Pilot" publication
AIP-AGA	UK AIP Section on Aerodromes, let-down aids & procedures
AIP-COM	UK AIP Section on Communications Services
AIP-GEN	UK AIP Section on Generalities
AIP-MAP	UK AIP Section on Maps & Charts
AIP-MET	UK AIP Section on Meteorological Services
AIP-RAC	UK AIP Section on Rules of Air Traffic Control & Services
AIP-SAR	UK AIP Section on Aeronautical Search and Rescue
AIREP	Air Report Form; for reporting position and meteorological conditions of flight
AIS	Aeronautical Information Service; Source of information via NOTAMS on the state of routes, airport runways & let-down aids inter alia
ALS	Approach Lights System
AME	Aviation Medical Examiner
AMSL or amsl	Above Mean Sea Level
ANO	Air Navigation Order (United Kingdom Air Legislation)
AOC	Air Operators' Certificate; for Commercial Air Transport Operations
AOM	Aerodrome Operating Minima
APU	Auxiliary Power Unit
ASL	Above Sea (mean) Level
ASR	Air Safety Report
ASR	Air Sea Rescue
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre
ATD	Actual Time of Departure
ATM	Air Traffic Management

ATIS	Automated Terminal Information Service; airport 'actual weather' report transmission on a dedicated VHF frequency
ATPL	Airline Transport Pilot Licence
ATR	Air (or Airline) Transport Rating (FAA licence)
ATS	Air Traffic Service(s); part of the ATC system
ATTITB	Air Transport and Travel Industry Training Board
AWO / AWOPS	All Weather Operation(s); another terminology for Low Visibility Operations (LVOs)
BALPA	British Air Line Pilots Association
BCAR	British Civil Aviation Requirement
BCPL	Basic Commercial Pilot Licence (UK CAA)
BD	Bomb Disposal
BOLDS	Burroughs Optical Lens Docking System
C or °C	Celsius; centigrade; (in degrees) temperature scale
CAA	Civil Aviation Authority (United Kingdom)
CAP	Civil Aviation Publication
Cat	Category
Cat 1	Category 1 landing AOM; DH 200 feet & above / RVR 600 metres & above
Cat 2	Category 2 landing AOM; DH 100-200 feet / RVR between 400 metres & 600 metres
Cat 3	Category 3 landing AOM; DH below 100 feet / RVR less than 400 metres
CAT	Clear Air Turbulence
CAVOK	Provided the visibility is ≥ 10 km, AND the height of the lowest cloud (any amount) is ≥ 5000 ft (or highest minimum sector altitude) AND there are no cumulonimbus clouds (CB, at any height) within sight, AND there is no significant weather (rain, snow, squalls, etc.) then the visibility and cloud reported is replaced by CAVOK (say "cav-oh-kay": 'Ceiling And Visibility OK '). (Not used by certain countries, e.g. the United States)
CCN	Cabin Crew Notice
CDU	Control Display Unit (FMS keyboard/screen)
CEAC	Conférence Européenne de l'Aviation Civile; (<i>Name for ECAC in French</i>)
CFIT	Controlled Flight Into Terrain
CFP	Computer Generated Navigation Flight Plan
CFS	Central Flying School; RAF school for Service Flight Instructors
CIS	Confederation of Integrated States; formerly the Soviet Union (USSR)
CIWS	Central Instrument Warning System; comparator of flight instruments for discrepancies
C/L	Centreline
CME	Central Medical Establishment; UK CAA, Gatwick
CMR	Company Minimum Reserve (defined in fuel policy)
CofA	Certificate of Airworthiness
CofE	Certificate of Experience
CofT	Certificate of Test
COM	Radio Communications & Navigation; as in AIP-COM (UK AIP Section)
COM or	
COMMS	Communications Facilities
COPI (CoPi)	Co-Pilot (First Officer)
CP	Critical Point; A groundspeed/distance equation - used when in flight over undeveloped territory or over the sea, to establish a point between two aerodromes from which it is equally quick to fly to either, following an engine failure.
CPL	Commercial Pilot Licence (UK CAA)
CRE	Class Rating Examiner
CRI	Class Rating Instructor
CRM	Crew Resources Management (was Cockpit Resources Management originally) (or Flight Deck Resources Management (FDRM))
CRS	Certificate of Release to Service
CRS Items	Items that require a CRS to be signed
CS-AWO	Certification Specifications for All Weather Operations; EASA document
CVR	Cockpit Voice Recorder
DA	Decision Altitude; Based on QNH (*): at which point a decision is taken to land or commence an immediate Go Around (term used for both Precision and non-precision approaches)

DAU	Data Adaptor Unit (Flight Management System)
DCA	Director of Civil Aviation
DD	Deferred defect
DDL	Deferred Defects List
DDM	Deferred Defects Manual
DfT	Department for Transport (UK);
DG	Directional Gyro
DH	Decision Height; based on QFE; used when on a Precision Approach
DME	Distance Measuring Equipment; usually paired with VOR or TACAN stations, gives distance readout from station; or when paired with an ILS (gives distance to threshold) when an aircraft is 'inbound' on the Localiser.
Doc	Document
DoT	Department of Transport (UK); now known as DfT
E	East; a point of the compass
EASA	European Aviation Safety Agency; (replacing JAA in the EC)
EAT	Expected Approach Time; given by ATC to inbound aircraft
EC	European Community; (or EU, European Union)
ECAC	European Civil Aviation Conference
EFB	Electronic Flight Bag; or
EFG	Electronic Flight Guide
EFIS	Electronic Flight Instruments System; flat screen display with system selection facility
EHS	Extremely High Frequency; radio communications band (from 30 to 300 GHz)
E.g., or eg	for example; (from the Latin <i>Exempli Gratia</i>)
EI or Elev	Elevation
EOD	Explosive Ordnance Device
EPIC	Emergency Procedures Information Centre at LHR
ERA	En Route Alternate
EROPS	Extended Range Twin Operations; (Another term for ETOPS). For which special power-plant demonstrated reliability, pre-flight required maintenance serviceability status and special MEL conditions apply.
ETA	Estimated Time of Arrival
et al	(from the Latin); and others;
etc.	(from the Latin <i>et cetera</i>) 'and so forth'; and the rest; and others
ETD	Estimated Time of Departure
ETOPS	Extended Range Twin Operations; (UK CAP 513 refers). For the purpose of this CAP, extended range operations are those operations intended to be, or being conducted over a route that contains a point further than one hour's flying time (or more as agreed by the NAA), in still air, at the normal one-engine-inoperative cruise speed from an adequate aerodrome . (Also see EROPS); Applies to any twin engine aircraft as per CAP 513 Rules.
ETP	Equal Time Point; also see Critical point. In the prevailing wind condition at a given altitude, the point at which the time taken to fly between two nominated points (one ahead and one behind) is the same. The ETP may be calculated with all engines running, or with one or more engines inoperative.
EU	European Union (also known as the European Community, EC)
Eurocontrol	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration (USA)
FAF	Final Approach Fix
FAR	Federal Aviation Regulation(s) (US FAA)
Fax	Facsimile; telephone service transmission by way of special equipment. Used to send copies of written pages or diagrams from one telephone subscriber's number to another, where suitable equipment is also on-line to receive the transmission.
FCL	Flight Crew Licensing (UK CAA, and others)
FCN	Flight Crew Notice (UK CAA, and others)
FCO	Flight Crew Order(s); airline method of circulating instructions to crews
FDP	Flying Duty Period; (definition used for Flight Times Limitations purposes /crew duty rules and rest calculations)
FDR	Flight Data Recorder
FDRM	Flight Deck Resources Management (or Crew Resources Management (CRM))

FGS	Flight Guidance System
FI	Flying Instructor
FIC	Flight Information Centre
FIR	Flight Information Region
FL	Flight Level
FM	Frequency Modulated (Radio) frequency; (76 to 108 MHz band)
FMA	Flight Mode Annunciator
FMC	Flight Management Computer (FMS)
FMS	Flight Management System
FOCA	Federal Office of Civil Aviation; Swiss National Aviation Authority
FODN	Flight Operations Department Notice
FOG	Flight Operations Group; one of 21 Specialist Groups of the Royal Aeronautical Society
Fog	The definition of fog for aviation purposes is a visibility of less than 1000 metres
FRAeS	Fellow of the Royal Aeronautical Society
FSE	Flight Simulator Examiner (see also TRE)
FSI	Flight Simulator Instructor (see also TRI)
Ft or ft	Feet
FTL	Flight Times Limitations (with reference to Flying, Duty and Rest)
FTO	Flying Training Organisation
GA	General Aviation
GAPAN	Guild of Air Pilots and Air Navigators, London
GASIL	General Aviation Safety Information Leaflet (UK CAA)
GD	Guidance Document
GEN	General; as in AIP-GEN (UK AIP Section)
GHZ	Gigahertz; a unit of Radio Frequency equal to 1000 MHz or 10 ⁹ Hertz (GHz = MHz x 1000).
GID	General Information Document (UK CAA)
GMT	Greenwich Mean Time (equal to UTC)
GP	General Practitioner; Doctor of Medicine
G/P	Glide Path
GPS	Global Positioning System; a system using signals received from a constellation of geostationary satellites to determine position anywhere on the Earth's surface
GPWS	Ground Proximity Warning System
H	Helicopter(s)
HAA	Height Above Airfield (that is, above Airfield Reference Point)
HF	High Frequency; radio communications band (3000 to 30,000 KHz)
HF	Human factors (ergonomics); the study of the efficiency of people in their working environment
HI	High Intensity (runway lighting)
HM	Her Majesty the Queen
HOWGOZIT	<i>How Goes It</i> ; a fuel-on-board record compared with fuel required to complete the flight.
HP	Handling Pilot
HQ	Head Quarters
HSI	Horizontal Situation Indicator
Hz	Hertz; a unit of radio wavelength frequency equal to 1 cycle per second
IAC	Instrument Approach Chart
IAP	Instrument Approach Procedure or Path
IAS	Indicated Air Speed
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICUS	In Charge Under Supervision; special procedure permitting co-pilots to fly as P1 under the supervision of the Captain, for licence upgrade purposes.
ID	Identity Document
i.e. or i.e.,	(from the Latin <i>Id Est</i>); 'that is'
I/F	Instrument Flying
IFR	Instrument Flight Rules
IFS	In-flight Supervisor; Cabin Crew
ILS	Instrument Landing System (VHF frequency, single path, single glide slope landing aid)
ILSC1	ILS Category 1 AOM

ILSC2	ILS Category 2 AOM
ILSC3x	ILS Category 3 AOM; (Where x = a for Cat3a, or b for Cat3b)
ILSH	ILS, Hand flown
IMC	Instrument Meteorological Conditions
INS	Inertial Navigation System (with electro-mechanical gyros)
Inter alia	Latin for "Amongst others"
I/R	Instrument Rating
IRE	Instrument Rating Examiner (Regulatory Authority Appointment)
IRI	Instrument Rating Instructor
IRR	Instrument Rating Renewal
IRS	Inertial Reference System (with Laser Gyros)
ISA	International Standard Atmosphere
IT	Inclusive Tour(s)
IT	Information Technology
ITC	Initial Terrain Clearance
JAA	Joint Aviation Authority; European Community organisation for the standardisation of Civil Aviation Requirements in Europe. The JAA is now transferring its oversight duties to the new European Aviation Safety Agency (EASA)
JAR	Joint Aviation Regulation(s)
JAR	Joint Aviation Requirement(s); standard(s) set by the JAA in consultation with European Community Regulatory Authorities and the US FAA.
JAR/FCL 1	JAA Flight Crew Licensing Requirements (Aeroplane pilots)
JAR/FCL 2	JAA Flight Crew Licensing Requirements (Helicopter pilots)
JAR/FCL 3	JAA Flight Crew Licensing Medical Requirements
JAR OPS 1	JAA Commercial Air Transport Requirements (Aeroplanes)
JAR OPS 3	JAA Commercial Air Transport Requirements (Helicopters)
JEPPESEN	Proprietary Brand name of JEPPESEN Inc; producer of Flight Guides
kHz	Kilo-Hertz; unit of Radio Frequency equal to 1000 Hertz (kHz = Hz x 1000)
Km km	or k.m; Kilometre(s)
(L)	Nil Roll-out ILS Runway Category
LAHSO	Land And Hold Short Operations lights; pulsating lights indicate the 'hold short' point on intersecting runways, thus allowing both intersecting runways to be active, subject to landing aircraft obeying the stop sign when required by ATC.
LASORS	Licensing, Administration & Standardisation, Operating Requirements & Safety manual (UK CAA Publication)
Lat	Latitude
LDA	Landing Distance Available
LF	Low Frequency (Long Waves); radio communications band (from 30 to 300 KHz)
LGW	London Gatwick Airport, UK
LHR	London Heathrow Airport, UK
LHS	Left Hand Seat or Left Hand Side
LLZ	Localizer; ILS Lateral Guidance beam (to establish runway approach centreline)
Loc	Locator beacon (NDB); or
LOC or Loc	Localiser (ILS centreline)
LOFT	Line Oriented Flight Training
Long	Longitude
LPC	Licence Proficiency Check; Annual revalidation test for a pilot's licence (JAATerm)
LR	Identifies a Runway with an ILS localiser suitable for the use of a PVD at take off and roll-out guidance during landing
LRBL	Least Risk Bomb Location; in aircraft construction terms with respect to the airframe
LRC	Long Range Cruise
LROPS	Long Range Operations; another acronym that refers to ETOPS (similarly to EROPS)
LRRA	Long Range Radio Altimeter
LSA	Localiser Sensitive Area
LVC	Low Visibility Conditions
LVO	Low Visibility Operation(s); operations in weather conditions below Cat 1 AOM. A more precise terminology for All Weather Operations (AWO); (see also All Weather Operations (AWO))

LVP	Low Visibility Procedures; specific procedures applied at an aerodrome for the purpose of ensuring safe operations during Category 2 & 3 approaches and/or departure operations in RVR conditions less than a value of 550 m.
LVTO	Low Visibility Take-off; a term used by the Joint Aviation Authorities (JAA) in relation to flight operations referring to a take-off on a runway where the RVR is less than 400m.
(M)	Magnetic; versus True as referring to Tracks, Headings, Bearings etc.,
m or mt	Metre(s)
MAO	Meal and Accommodation Order
MAP	Maps & Charts; as in AIP-MAP (UK AIP Section)
MAP	Missed Approach Point (Non Precision Approach)
MCC	Multi Crew Co-operation
MCP	Maximum Continuous Power; the power setting at which an engine can be set to operate continuously (without time limit) to compensate for the loss of another engine that has failed in flight.
MDA	Minimum Descent Altitude (based on QNH); only used for a Non-Precision cloud break procedure to be followed by a Circling Approach
MDH	Minimum Descent Height (based on QFE instead of QNH); used as MDA/MDH, if preferred instead of using QNH when on a Non-Precision cloud break procedure to be followed by a Circling Approach
ME	Multi-engine
MEL	Minimum Equipment List
MET	Meteorological Services; as in AIP-MET (UK AIP Section)
MET or Met	Meteorology, meteorological (report, office etc)
METAR	Meteorological Aviation Report
MF	Medium frequency (Medium waves); radio communications band (531 to 1620 KHz)
MHZ	MegaHertz; a unit of Radio Frequency equal to 1 million Hertz (MHZ = KHZ x 1000)
MID POINT	Mid-zone or middle third of the runway in relation to RVR transmissometer readings in LVO
MIFV	Minimum In-Flight Visibility
MLM	Maximum Landing Mass; JAA terminology for Maximum Landing Weight (MLW)
MLS	Microwave Landing System (UHF multi path, selectable glide slope landing aid)
MLW	Maximum Landing Weight (Structural limit); now MLM (Max Landing Mass)
MMEL	Master Minimum Equipment List
MNPS	Minimum Navigation Performance Specification Airspace
MOA	Minimum Operating Altitude
MOR	Mandatory Occurrence Report
MPA	Multi-Pilot Aeroplane
MRAeS	RAeS membership grade; Member of the Royal Aeronautical Society
MSA	Minimum Safe Altitude
MTOM	Maximum Take-Off Mass; JAA terminology for Maximum Take-off Weight (MTOW)
MTOW	Maximum Take-Off Weight (Structural Limit); now MTOM (Max Take-off Mass)
N	North; a point of the compass
NAA	National Aviation (Regulatory) Authority
NAM	North America
NAT	North Atlantic Track; or North Atlantic
NAV	Navigation; Mode, Facilities, et al
NAVAID	Navigation Aid (En Route or Terminal Area Radio aid); for example, VOR, DME, NDB etc,
ND	Navigation Display; 'Glass Cockpit' flat screen computer generated, En route Navigation situation display
NDB	Non Directional (radio location) Beacon
NHP	Non Handling Pilot (Monitoring pilot)
NHS	National Health Service (UK)
Nm, nm	or n.m; nautical Mile(s)
No.or N°.	Number
NOPAC	Northern Pacific
NOTAM	Notice(s) To Airmen
NOTOC	Notice To Captain (form); form issued whenever Dangerous Goods or other Special Loads such as livestock are carried. For the information of the Pilot in Command and his signature; to prove that he is aware of its contents

NPA	Non Precision Approach
NPPL	National Private Pilot Licence
NTAOCH	Notice To AOC Holders; (UK CAA publication)
°	Degree; of Temperature or of Longitude or Latitude
° C	Degree(s) Celsius (Centigrade); Temperature Scale.
OACI	Organisation de l'Aviation Civile Internationale; (<i>ICAO in French</i>)
OAT	Outside Air Temperature
OBS window	Omni Bearing Selector window (display) - VOR Radial Selected Display
OCA	Obstacle Clearance Altitude (based on QNH)
OCH	Obstacle Clearance Height (based on QFE)
OCIC	Operations Control Intelligence Centre at LHR
OCL	Obstacle Clearance Limit; old equivalent of OCH
OCS (mail)	On (Official) Company Service; (Internal Mail in transit to or from outstations)
OFZ	Obstacle Free Zone
OMEGA	Omega Navigation System (ONS) – ceased operation on 30 September 1997
ONS	Omega Radio Navigation System; airborne receivers operated in aircraft in conjunction with 8 ground transmitters; offering a global aircraft position/fix facility. Could also use the US Navy VLF transmitters for interrogation to obtain position fixes
OPS or Ops	Operations
OPC	Operators Proficiency Check; JAA Term for an Airline Pilot's 6 monthly check
OTS	Organised Track System; for example in NAT MNPS or across the Pacific between Tokyo (Japan) and Hawaii or Western USA gateways
P1 or PIC	Pilot In Command
P1 (S)	Pilot in Command (under supervision); or
P1 (ICUS)	Pilot (in Command under supervision); ; special procedures permitting co-pilots to fly as P1 under the supervision of the Captain, for licence upgrade purposes.
P2 or CoPI	Co-pilot
P3	Systems Panel Operator
PA	Passenger Address (Cabin public address radio facility, for on board voice transmissions to passengers in the cabin)
PA	Precision Approach
PANS -ATM	Procedures for Air Navigation Services - Air Traffic Management (ICAO term for Document 4444-ATM/501)
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations (ICAO term for Document 8168)
PANS-RAC	Procedures for Air Navigation Services - Rules of the Air and Air Traffic Services (ICAO term for Document 4444)
PAPA	Parallax Aircraft Parking Aid
PAPI	Precision Approach Path Indicator; a visual glide-slope indicator
PAR	Precision Approach Radar
Para	Paragraph
PEC	Position Error Correction
PFD	Primary Flying Display; 'Glass Cockpit' flat screen computer generated, Flight Instruments display
PIC	Pilot In Command
PLD	Personnel Licensing Department (UK CAA)
PNdB	or PNdb; Perceived Noise Decibel; measurement of noise
PNR	Point of No Return; a ground speed with fuel endurance navigation equation; to establish the time between two airfields at which return to the one behind is no longer possible, in fuel endurance terms.
PPL	Private Pilot Licence
PVD	Para-Visual Display; during very low visibilities, if selected on and tuned to the departure runway ILS frequency, this indicator shows deviation from the runway centreline during take-off. The display mounted on the coaming instrument console above the main instrument panel in front of each pilot, incorporates a horizontal 'barber pole'. The barber pole remains still if the aircraft runs straight during take-off. However, it starts to rotate towards the left if the aircraft swings towards the left or it rotates towards the right if the aircraft swings to the right such as after an engine fails, or in a crosswind. The pilot corrects yaw by pushing the rudder on the side towards which the barber-pole is rotating (screwing) until the pole stops rotating. A prompt corrective input keeps deviation from the centreline to a minimum. If necessary, very small corrective inputs may be made to ease

the aircraft back and regain the centreline if the departure from it is significant due to delayed pilot reaction to the direction of swing indication.

QSY	Q Code; for Change (radio) Frequency
RA	Radio Altimeter
RAC	Rules of Air Traffic Control (& Services); as in ICAO Document 4444-ATM/501 Procedures for Air Navigation Services (PANS-RAC)
RAC	Rules of Air Traffic Control; as in AIP-RAC (UK AIP Section)
RAD/NAV	Radio/Navigation; (for example, charts)
RAeS	Royal Aeronautical Society, London, England
RAF	Royal Air Force
RDH	Reference Datum Height; ILS glide-slope reference datum height (48 to 59 feet)
Raison d'être	Reason for being; French term
REIL	Runway End Identifier Lights
RHS	Right Hand Seat; or Right Hand Side
RLG	Automated Aircraft Docking Guidance System; (Uses 2 sets of red/green/amber lights)
RLM	Regulated Landing Mass; JAA terminology for Regulated Landing Weight (RLW)
RLW	Regulated Landing Weight; now referred to as the Regulated Landing Mass (RLM); Runway Performance limited weight
RMI	Radio Magnetic Indicator; a navigation aid which combines a DI, VOR or VDF display and which indicates the (both the relative and actual) bearing to selected station(s) together with aircraft heading; 'Live' compass card over which two pointers (needles) show the relative bearing of the aircraft from the tuned radio aid (VOR and/or NDB) depending upon the selection made
RMP	Radio Management Panel
RNP	Required Navigation Performance
ROC	Rate of Climb
R/T or r/t	Radiotelephony (radio communications)
RTF	Radio Telephone; radiotelephony
RTOM	Regulated Take-Off Mass; JAA Terminology for Regulated Take-off Weight (RTOW)
RTOW	Regulated Take-Off Weight; now referred to as the Regulated take-off Mass (RTOM); a Runway Performance Limitation
RVR	Runway Visual Range; the range over which the pilot of an aircraft on the centreline on a runway can see the runway surface markings or the lights delineating the runway or identifying its centreline (in meters, m); it is reported as RVR when the Approach visibility is less than 1500m
RVSM	Reduced Vertical Separation Minima (above FL 290)
R/W or r/w	Runway
S	South; a point of the compass
SAR	Search And Rescue
SAR	Search And Rescue; as in AIP-SAR (UK AIP Section)
SAR	Surveillance Approach Radar
SCCM	Senior Cabin Crew Member
SCPL	Senior Commercial Pilot Licence (BDA DCA & UK CAA; phased out in 1995)
SDO	Station Duty Officer
SE	Single-engine
SELCAL	Selective Calling; method of calling individual aircraft by way of a code which is particular to the aircraft. This activates a chime on the flight deck, alerting the crew that ATC wishes to make contact. Works both on VHF and HF frequencies, when installed
SEP or SEEP	Safety Equipment and Emergency Procedures
SET	Single engine turbo-propeller aircraft
SFE	Synthetic Flight Examiner
SFI	Synthetic Flight Instructor
SID	Standard Instrument Departure
SIGMET	Significant Weather Meteorological Report
SHF	Super High Frequency; radio communications band (from 3 to 30 GHz)
SITA	Société Internationale de Télécommunications Aéronautiques; a world-wide aeronautical communications service using telephone lines for the exchange of conversations, Fax messages and Telex transmissions.
SOP	Standard Operating Procedure(s)

SPA	Single Pilot Aeroplanes
SRA	Surveillance Radar Approach
SSA	Sector Safe Altitude
SSR	Secondary Surveillance Radar; transponder
STA	Scheduled Time of Arrival
STAR	Standard Arrival Routeing
STD	Scheduled Time of Departure
STOP END	Stopping area or last third of the runway in relation to RVR transmissometer readings in LVO
SWORD	Computer generated Navigation Flight Plan. As produced for British Airways by AERAD, the charting product of Navtech Inc.
(T)	True; versus Magnetic; referring to Tracks, Headings, Bearings etc.
TACAN	Military VHF navigation beacon similar to VOR
TAT	Total Air Temperature
TBF	Time Between Failures
TBN	To Be Notified
TBO	Time Between Overhauls
TDZ	Touch Down Zone
TDZ	Take-off area or first third of the runway in relation to RVR transmissometer readings in LVO
TDZL	Touch Down Zone Lights; a 3,000 feet carpet of white four-lights barrettes set flush with the runway on either side of the centre-lights, in the first half of long instrument runways, to identify the area where the aircraft is expected to touch-down.
Temp	Temperature
Telex	System for the transmission of messages by way of a teletype link; using punched tape for the transmission and a printer at the receiving end.
TMA	Terminal (Control) Areas (ATC)
TMG	Touring Motor Glider
TOB	Total On Board
TOD	Top of Descent
TO/GA	Take-off /Go-around; power setting selected via throttle mounted switches
TRE	Type Rating Examiner (Regulatory Authority Appointment)
TRI	Type Rating Instructor (see also FSI)
TRTO	Type Rating Training Organisation
TSI	Thrust Setting Index
TSO	Time Since Overhaul
TTI	Total Thrust Indicator
T-VASI	T shaped Visual Approach Slope Indicator; a glide-slope indicator
UAE	United Arab Emirates
UHF	Ultra High Frequency; radio communications band (from 300 to 3000 MHz)
UK	United Kingdom
UKFSC	United Kingdom Flight Safety Committee
UK/ATFMU	United Kingdom Air Traffic Flow Management Unit
USA	United States of America
USAF	United States Air Force
US	United States of America
U/s or us	Unserviceable
USSR	Union of Socialist Soviet Republics; Russia or the Soviet Union, now superseded by new alliance known as CIS (Confederation of Integrated States)
UTC	Co-ordinated Universal Time (equal to GMT)
Vade-mecum	Latin for "Go with me"; a useful handbook carried for constant reference (pocket companion)
VASI	Visual Approach Slope Indicator; a glide-slope indicator
Vat or Vth	Velocity at Threshold; Target Threshold Speed (or Vref)
Vat	Velocity at Threshold (1.3 Vs)
V1	See V speeds
V2	See V speeds
VDF	VHF Direction Finding equipment
VFR	Visual Flight Rules
VHF	Very High Frequency; radio communications band (from 108 to 136 MHz)

VIP	Very Important Person
Vis or viz	Visibility
Visibility	<p>Visibility for aeronautical purposes; it is the greater of</p> <ol style="list-style-type: none"> a. the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background; and b. the greatest distance at which lights in the vicinity of 1,000 candelas can be seen and identified against an unlit background. <p><i>Note 1:</i> -The two distances have different values in air of a given extinction coefficient. The former (a) is represented by the meteorological optical range (MOR). The latter (b) varies with the background illumination.</p> <p><i>Note 2:</i> - When the approach visibility is less than 1500m, RVR readings are given instead</p>
VLF	Very Low Frequency; radio communications band (from 3 to 30 KHz)
VMC	Visual Meteorological Conditions
Volmet	Aerodrome Current and forecast Meteorological information transmitted continuously or a given times for a group of airports as notified on specific frequencies for aircraft in flight.
V-Speeds	For a given aircraft weight:
V1	On a particular length of runway : Speed up to which take-off can be safely discontinued; or from which a safe take off can be continued and still achieve a safe climb-out clearing obstacles on the take-off flight path by the required margins, after accelerating to V2 and using V2 up to the flap clean-up (retraction to zero) height.
V1	The maximum speed during the take-off at which the pilot must take the decision and first action to discontinue the take-off (that is, close throttles as maximum braking is applied as speed-brakes are deployed, then full reverse applied on any live engine(s), to stop the airplane within the accelerate-stop distance. V1 also means the minimum speed in the take-off, following a failure of the critical engine at or at which the pilot can continue the takeoff and achieve the required height above the takeoff surface within the takeoff distance.
V2	Minimum climb-out speed after Rotation during take-off
V2	Minimum Safety speed after becoming airborne, to climb at on one engine after an engine failure during the take-off profile. If a higher speed has been attained during the initial climb out, maintain that speed and do not reduce to V2, since the higher speed will achieve a better rate of climb anyway.
Vmc	Defined in ICAO Annex 6 as Minimum Control speed with the critical engine inoperative.
Vmca	Minimum Control Speed (Air); the lowest speed to keep the aircraft straight in flight with the critical engine inoperative, using full rudder and a maximum of 5° of bank towards the live engine(s), using Maximum Continuous Power (MCP) on the live engine(s) to climb at a reduced from normal all engines Rate of Climb (ROC) or to fly straight and level in the cruise.
Vmcg	Minimum Control Speed (ground); the lowest speed to keep the aircraft straight on the runway, using full rudder, after an engine failure during a full power take-off.
VR or Vr	Rotation Speed; speed at which the aircraft is lifted off the ground and into the air during take-off
Vref, Vth or Vat	1.3 Vso; Landing-approach threshold reference speed (same as Vat & Vth)
Vs	Stalling speed for a given weight and configuration
Vs0	V_{S0} – (S, zero) Stalling Speed (or the minimum steady flight speed) in the Landing Configuration
Vs1	V_{S1} – (S, one) Stalling Speed (or the minimum steady flight speed) in a Specified Configuration e.g., flapless (1.2 Vso)
W	West; a point of the compass
ZFM	Zero Fuel Mass; JAA terminology for Zero Fuel Weight (ZFW)
ZFW	Zero Fuel Weight; or Zero Fuel Mass (ZFM). A structural airframe limit with commercial load on board, above which only fuel can be added to arrive at the maximum take off weight using a particular runway.

END OF APPENDIX F