SOUTH AFRICAN CIVIL AVIATION AUTHORITY

CAT II/III Advisory Circular

Subject: OPERATOR AIRCREW AND AIRCRAFT APPROVAL FOR REDUCED VISIBILITY FLIGHT OPERATIONS - CATEGORY II AND III OPERATIONS
CA AOC-AC-FO-011

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I. PURPOSE. This document provides guidance for all Flight Operations Inspectors and other assigned aviation safety inspectors who oversee and authorize operators to conduct reduced visibility flight operations, including instrument landing system (ILS) Category II/III (CAT II/III) operations in accordance with **CAR 91.07.5, 121.07.7** and **91.08.1 - 6.**

The document entitles Aircrew and Aircraft Approval for Reduced Visibility Flight Operations, including CATII/III Operations describes the evaluation and approval process to be used by Flight Operations Inspectors when evaluating CATII/CATIII applications.

2. ACTION.

a. Flight Operations Inspectors should provide this document to their respective operators when information is requested regarding the application, evaluation and approval process required by the SACAA for ILS CATII/III programs

b. Flight Operations Inspectors should become familiar with the document and adhere to the prescribed evaluation process as closely as possible to insure applications are processed in a standardized manner and with the requisite depth and detail.

ABBREVIATIONS

AC	Alternating Current
ANO	Air Navigation Orders
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
CAT	Category
DC	Direct Current
DFE	Designated Flight Examiner
CAR	Civil Aviation Regulation
NDOT	National Department of Transport
Ft.	Feet
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
KT	Knots
NOTAM	Notice to Airmen
RF	Radio Frequency
RTCA	Radio Technical Commission for Aeronautics
RVR	Runway Visual Range
VHF	Very High Frequency

DEFINITIONS

In this instruction, the following terms will have the meaning indicated:

OPERATIONAL CATEGORY I

Operation down to a minimum of 200 ft. decision height.

INTERIM CATEGORY II

Operation down to a minimum of 150ft. decision height.

OPERATIONAL CATEGORY II

Operation down to a minimum of 100ft. decision height.

OPERATIONAL CATEGORY III

A precision instrument approach and landing with operations to a minima as specified in:

a) the operations specifications for the operator of the aircraft where the operator is an air carrier;

b) the operations manual of the operator of the aircraft where the manual is required in terms of CAR Parts 121, 127 and 135

c) the operations manual, or equivalent document, is issued by the state of the operator of the aircraft and accepted by the Minister of Transport.

NON-CATEGORIZED ILS

An Instrument Landing System which, although monitoring to CAT I alarm tolerances, does not meet CAT I ICAO standards. Provided all other requirements are met, qualified operators may be authorized to use such systems to CAT I operating limits.

NOTE: When a CAT II/III system has been temporarily downgraded the Notices to Airmen (NOTAM), which announced the downgraded status, will also stipulate the authorized decision heights which applies.

DECISION HEIGHTS

Decision Height is a specified height at which a missed approach must be initiated during a precision approach if the required visual reference to continue the approach to land has not been established. Decision Heights are as specified in the operations specifications for the operator of the aircraft.

REQUIRED VISUAL REFERENCE

In respect of an aircraft on an approach to a runway, means that section of the approach area of the runway of those visual aids that, when viewed by the pilot of the aircraft, enables the pilot to make an assessment of the aircraft position and the rate of change of position, relative to the nominal flight path.

RUNWAY VISUAL RANGE (RVR)

In respect of a runway, means the maximum horizontal distance, as measured by an automated visual landing distance system and reported by an air traffic control unit or a flight service station for the direction of takeoff or landing, at which the runway, or the lights or markers delineating it, can be seen from a point above its center line at a height corresponding to the average eye of pilots at touchdown.

“RVR ‘A’ ”, in respect of a runway, means RVR detection equipment that is located adjacent to the runway threshold;

“RVR ‘B’ ”, in respect of a runway, means RVR detection equipment that is located adjacent to the runway midpoint.

NOTE: In practice, runway visual range cannot be measured directly from the position specified in the definition but is an assessment of what a pilot would see from that position.

ALERT HEIGHT

A height defined for operational use by pilots (100 ft. or less above the highest elevation in the touchdown zone) above which a CAT III approach would be discontinued and a missed approach initiated if a failure occurred in one of the required redundant operational systems in the airplane or in the relevant ground equipment. Below this height, the approach, flare, touchdown, and, if applicable, rollout may be safely accomplished following any failure in the airplane or associated CAT III systems not shown to be extremely improbable. This height is based on characteristics of an aircraft and its particular fail-operational airborne CAT III system.

FAIL-OPERATIONAL CAT III SYSTEM

An Airborne system which provides redundant operational capability down to touchdown and, if applicable, through rollout. Fail-operational capability may be provided by automatic systems, manually down systems, or a combination of both. The redundant operational systems must have no common failure modes and need not be the same. If one of the required CAT III systems fails below the alert height, the flare, touchdown, and rollout, if applicable, can be accomplished using the remaining operational system or systems. In manually flown systems, the remaining operational system or systems must be available to either pilot without pilot action.

AUTOMATIC FAIL-OPERATIONAL CAT III SYSTEM

A fail-operational system which provides redundant operational capability using automatic systems. If one of the automatic systems fails bellow the alert height, the flare, touchdown, and rollout, if applicable, can be accomplished using the remaining automatic system(s).

FAIL-PASSIVE AUTOMATIC FLIGHT CONTROL SYSTEM

An automatic flight control system which, upon occurrence of any single failure, should not:

a) cause significant displacement of the aircraft from its approach path or altitude loss below the normal glide path;

b) upon system disconnection, involve any out-of-trim condition not easily controlled by the pilot; or

c) cause any action of the flight control system that is not readily apparent to the parent, either by control movement or advisory display.

ROLLOUT CONTROL SYSTEM

A system which provides either automatic control or instrument guidance for manual control of lateral steering for rollout until manual control of the aircraft by visual reference is assured.

FAIL-PASSIVE CATEGORY III SYSTEM

Since a fail-pass CAT III system does not necessarily provide sufficient redundancy to successfully continue the approach and landing to touchdown following any failure in the flight control system not shown to be extremely improbable, a DH of 50 ft. is specified. A DH is established to ensure that, prior to passing 50ft., the pilot determines that adequate visual reference is available to verify that the aircraft is in position which will permit a successful landing in the touchdown zone. If this visual reference is not established prior to passing the DH, a go-around will be executed. A missed approach will also be initiated if, after passing the DH, visual cues are lost or a reduction in visual cues occurs which prevent the pilot from continuing to verify that the aircraft is in a position which will permit a successful landing in the touchdown zone. In the event of a failure of the system at any point in the approach to touchdown, a missed approach will normally be required.

CHAPTER 1

INTRODUCTION

1.1 GENERAL

1.1.1 the Commissioner for Civil Aviation authorizes CAT II/III operations in the Republic of South Africa. Lower landing limitations are contained in CAR 91.02.7 and CAR 91.07.5.

1.1.2 Certification of airports, aircraft systems and crews will be done using criteria contained in this manual. Any questions not covered herein, or any point of apparent conflict requiring resolution, should be referred to the Commissioner for Civil Aviation.

1.2 CRITERIA

1.2.1 Requests for landing operations in the CAT II/III range of weather minima will be considered if the following criteria (set out in greater detail in the chapters which follow) are met:

a) the aircraft has suitable flight characteristics, an approved list of equipment and acceptable continuing maintenance program;

b) the aircraft is operated by a qualified crew in conformity with laid down procedures; and

c) the airport is suitably equipped and maintained.

1.3 APPLICATION

1.3.1 These instructions are intended for application to South African airports and to aircraft registered in the Republic.

1.3.2 Conformity with these instructions will be prerequisite for an operator intending to include CAT II/III operations in the operating certificate.

1.3.3 Commercial operators of foreign registry, who operate a scheduled or regular service into South Africa and whose aircraft, equipment and crews meet or exceed the criteria described in Chapters 2 and 3 of this manual, may apply to the Minister of Transport for authority to conduct CAT II/III operations at South African airports deemed suitable. In such cases, approval for CAT II/III operations in the state of registry shall be a prior condition for approval to conduct CAT II/III operations in South Africa.

CHAPTER 2

AIRCRAFT REQUIREMENTS

2.1 CERTIFICATION

2.1.1 Certification of aircraft systems to CAT II/III standards will be by the Commissioner and the approval of an appropriate amendment to the aircraft flight manual. This amendment will include any aircraft limitations while conducting CAT II/III operations.

2.2 GENERAL APPROVAL CRITERIA

2.2.1 Approval of installed equipment is based, primarily, on the intended function of the installed systems, its accuracy and fail-safe features.

2.2.2 Approval of the installation is based on demonstrated compatibility with CAT II/III ground facilities.

2.2.3 A combination of airborne navigation, instrument and flight control systems, having individual approvals, may be approved as a CAT II installation when found to provide one of the following:

a) information to the flight crew with sufficient accuracy and dependability to permit the manual control of the aircraft along the desired flight path within prescribed limits; or

b) signals to the aircraft flight control systems with sufficient accuracy and dependability to maintain the aircraft along the selected approach flight path within prescribed limits.

c) a combination of automatic flight, propulsion control, and other information to the flight crew to permit manual control of the aircraft, supplemented by automatic control, along the desired approach flight path within prescribed limits.

NOTE: For fixed wing operations, coupled approaches are the only acceptable means of compliance.

2.2.4 To be approved for CAT III operations, the airplane and its associated systems should be shown to provide sufficient information to the flight crew to permit the safe completion of the approach, touchdown, and rollout or the safe completion of a go-around from any altitude to touchdown, following any failure in the flight control system not shown to be extremely improbable. Additionally, the design of the cockpit instrumentation, system comparators, and warning systems should be adequate in combination to assure that the pilot can verify that the aircraft will safely touchdown within the touchdown zone and safely rollout if the controlling runway visual range (RVR) is reported at or above visual minima. Although the primary mode is automatic to touchdown, these operational concepts do not preclude the use of systems to conduct CAT III operations with the pilot in the active control loop if it is demonstrated that these systems provide an equivalent level of safety.

2.3 AIRBORNE EQUIPMENT REQUIREMENTS

2.3.1 In addition to the normal instrumentation required for instrument flight in terms of the Civil Aviation Regulations, equipment listed in Table 2-1 is mandatory for CAT II/III certification.

2.3.2 EQUIPMENT FOR CATEGORY III - RVR 600 FT.

The following equipment, in addition to the instrument and radio equipment required by the CAR, is the minimum airborne equipment considered necessary:

a) two ILS localizer and glide slope receivers which meet the performance requirements outlined in paras. 2.4.4 and 2.4.5.

b) two approved radio (radar) altimeter systems which meet the performance requirements outlined in para. 2.4.6.

c) redundant flight control systems which meet the requirements of para. 2.4.12.

d) missed approach guidance appropriate for CAT III operations as follow:

   i) attitude gyro (or equivalent) indicators with calibrated 5° to 25° pitch attitude markings or pre-established computed pitch command display, or

   ii) attitude gyro (or equivalent) indicators with calibrated 5° to 25° pitch attitude markings or pre-established computed pitch command display, or

e) auto-throttle control system which meets the performance requirements (para. 2.4.9) for operations approved without a DH. For operations with a 50 ft. DH, auto-throttles are required unless it has been demonstrated that operations can be safely conducted without their use.

f) failure detection and warning capability as described in para. 2.4.3.

2.3.3 EQUIPMENT FOR CATEGORY III - RVR 300 - 150 FT

The additional equipment, over and above that specified para. 2.3.2 required for CAT III operations is:

a) automatic or manual rollout control system. The accuracy and reliability of the rollout control system when considered in combination with the available visual cues and the characteristics of the ground support system available will determine the lowest minima authorized for a particular operation. Additional criteria for approval of rollout control systems are contained in Appendix E and Appendix F.

b) fail-passive rollout control systems which meet the criteria of Appendix E are necessary to conduct operations below 600 ft. RVR (175 meters).

c) fail-operational rollout control systems which meet the criteria contained in Appendix F are necessary to conduct operations below 300 ft. RVR (100 meters).

d) unless a fail-operational rollout control system is used, operations are not appropriate on runway with the runway center line lights obscured by precipitation (i.e. snow or ice).

e) an instrument, an annunciator, or crew procedures, to reliably detect and alert the pilot to abnormal lateral or vertical deviations during an approach, a flare, or an extended flare beyond the touchdown zone, excessive lateral deviations during rollout.

2.3.4 DECELERATION SYSTEM (S) / PROCEDURES FOR CATEGORY III

A means to determine that a landing can be reliably completed within the available length of the runway is necessary to conduct CAT III operations (see Appendix G). At least one of the following means to assess stopping performance should be used:

a) a "runway-remaining" indicator display showing length of remaining runway after touchdown;

b) a deceleration display which can advise the pilot of the adequacy of aircraft deceleration to stop within the confines of the available runway;

c) a groundspeed indicating system (i.e. inertial);

d) an automatic braking system; and/or

e) a procedural means to assure a safe stop (not appropriate for minima less than 300 ft. RVR (100 meters).

2.4 EQUIPMENT PERFORMANCE REQUIREMENTS

2.4.1 This manual does not contain detailed technical specifications for the various types of required equipment where such equipment is already described in an appropriate Technical Standards Order (TSO). An applicant may, however, obtain acceptance of equipment on the basis of standards other than TSOs, provided such standards are acceptable to the CAA. The criteria which follow list performance data specifically applicable to CAT II/III certification.

TABLE 2-1

AIRBORNE EQUIPMENT REQUIREMENTS FOR CAT II/III CERTIFICATION

ITEM	REQUIREMENT
Single Flight Director with dual displays **and** single automatic approach coupler, **or** two independent Flight Director Systems	Required, except for 2 engine prop aircraft and rotorcraft, which require a single Flight Director, **or** a single automatic Approach Coupler.
Dual ILS localizer and Glide Slope Receivers	Required
Equipment to identify DH	Radio Altimeter Required
Avionics Failure Warning System	Required
Missed Approach Attitude Guidance	Required; may be: a) Attitude gyros with calibrated pitch marking; **or** b) Flight Director pitch command; **or** c) computed pitch command.
Auto-throttle System	Required for all turbo-jets if operations based on dual flight directors or if split axis coupler used. Not required for prop aircraft unless

	split axis couplers used.*
Ice and Rain Protection	Required. To include: a) a protection system for windshield; **and** b) a heat source for each airspeed system pilot tube installed.
Communication Equipment	Two independent VHF air-ground communication systems are required.
Duplicated Equipment a) two gyroscopic pitch and bank indicating systems; b) two gyroscopic direction indicating systems; c) two airspeed indicators; d) two sensitive altimeters adjustable for barometric pressure; and e) two vertical speed indicators.	Required

*If the applicant shows that an auto-throttle system does not significantly reduce the pilot's workload, the requirement may be waived even with split couplers.

2.4.2 FLIGHT DIRECTOR SYSTEMS

When CAT II and III operations are predicated on two independent flight directors, each installation shall consist of equipment which will provide for the following performance in the aircraft under consideration, and in the test condition stipulated:

a) Aircraft Speed - maximum and minimum approach speeds;

b) Wind Conditions (may be illustrated analytically) - surface cross-wind component of 10 KT, wind shear of 4 KT per 100 ft., along or across the runway, commencing at a height of 500 ft. above the runway;

c) Mode Selection and Indication - manual selection shall be positive, and the selection clearly identified;

d) Localizer Performance (for demonstration, the aircraft should be stabilized on the localizer beam before the outer marker is intercepted, inbound) - from the outer marker to an altitude of 300 ft. above the runway threshold, the flight director shall permit the aircraft to track within ±35 microamperes (95% probability) of the indicated localizer course, without any sustained oscillations. From 300ft. above the runway threshold to at least DH, the flight director shall permit the aircraft to track within ±25 microamperes (95% probability) of the desired course without any sustained oscillations;

e) Glide Slope Performance (for demonstration, the aircraft should be stabilized in the glide slope before an altitude of 700 ft. above the runway elevation is reached) - from 700 ft. to at least DH, the flight director shall permit the aircraft to tack the center of the indicated glide slope to within ±35 microamperes or ±12 ft., whichever is greater, without any sustained oscillations.

2.4.3 AUTOMATIC APPROACH COUPLER AND SINGLE FLIGHT DIRECTOR

When CAT II operations are predicted on use of a single flight director system and automatic approach coupler/autopilot, the flight director system shall conform to the requirements of para. 2.4.2, and drive two similar displays (one for each pilot). The autopilot system shall include a positive quick-release located on each pilot's control wheel/cyclic stick, and aural as well as visual warning of inadvertent autopilot disengagement.* The autopilot system for CAT III, which provides automatic landing capability as well, shall provide the following performance under the test conditions stated:

* The Commissioner may, on application, permit a waiver of the requirement for aural warning of inadvertent autopilot disengagement in the case of aircraft fitted with a conspicuous warning light in clear view of the pilot-in-command and second-in-command, and where written procedures require one of the pilots to monitor flight instruments until the runway is in view.

a) Aircraft Speed - maximum and minimum approach speeds;

b) Minimum Autopilot Altitude - not less than 80 ft. above runway threshold;

c) Wind Condition (may be illustrated analytically) - surface cross-wind component of 15 KT, surface downwind component of 10 KT, wind shear of 4 KT per 100 ft. along or across the runway, commencing at a height of 500 ft. above the runway threshold;

d) Localizer Performance (for demonstration, the aircraft should be stabilized on the localizer beam before the outer marker is intercepted, inbound) - from the outer marker to an altitude of 300 ft. above the runway threshold, the automatic pilot/coupler shall cause the aircraft to track automatically to within ±35 microamperes (95% probability) of the indicated localizer course without any sustained oscillations. From 300 ft. above the runway threshold to at least DH, the automatic pilot/coupler shall cause the aircraft to track automatically to within ±25 microamperes (95% probability) of the desired course without any sustained oscillations;

e) Glide Slope Performance (for demonstration, the aircraft should be stabilized in the glide slope before an altitude of 700 ft. above the runway elevation is reached) - from 700 ft. to at least DH, the autopilot/coupler shall cause the aircraft to track the center of the indicated glide slope to within ±35 microamperes or ±12 ft., whichever is greater, without any sustained oscillations.

2.4.4 LOCALIZER RECEIVER SYSTEM

The localizer system installation shall consist of two independent localizer receivers each driving at least one indicator or flight director display. A single antenna may be used for both receivers if adequate reliability is shown. The system shall perform within the following parameters:

a) each localizer receiver system shall be capable of independent, continuous operation during the approach and landing phases;

b) each system shall display positive visual warning indication to show degradation of localizer system performance at least under the following conditions;

i) the absence of carrier, or either or both modulation signals,

ii) the reduction of both modulation signals to one half the normal 20%,

iii) when a difference of depth of modulation equal to 0.093 ±0.002 produces an output of less than one half normal to this standard localizer deviation signal;

c) each localizer receiving system centering error must not exceed 5 microamperes (preferably 3 microamperes) on a 95 % probability basis under the following conditions, using a standard test signal:

i) variation of RF signal level from 50 to 1,000 microvolts,

ii) variation of DC power over the range of 24 to 28 volts, or AC power over the range 105 to 120 volts,

iii) variation of ambient temperatures over the range expected by the operator to be experienced by the equipment in CAT II/III operations.

2.4.5 GLIDE SLOPE RECEIVER SYSTEM

The glide slope system installation shall consist of two independent glide slope receivers each driving at least one indicator or flight director display. A single antenna may be used for both receivers if adequate reliability can be shown. The system shall perform within the following parameters:

a) each glide slope receiver system shall be capable of independent, continuous operation during the approach and landing phases;

b) each system shall display positive visual warning indication to show degradation of glide slope system performance at least under the following conditions:

i) the absence of either or both modulation signals,

ii) the reduction of both modulation signals to one half of their normal 40%

iii) when a difference of depth of modulation equal to 0.091 ±0.002 produces an output of less than one half normal response to this standard glide slope deviation signal;

c) each glide slope system centering error must not exceed those specified in Radio Technical Commission for Aeronautics (RTCA).

2.4.6 RADIO ALTIMETER

The radio altimeter equipment used to determine DH above the nominal touchdown point shall meet or exceed the following performance standards under the test conditions stated:

a) display to each pilot clearly and positively the altitude information in flight which indicates the aircraft main landing gear wheel height above terrain;

b) each indicator presentation shall display altitude to an accuracy of ±5 ft. or ±5% of altitude, whichever is greater, under the following conditions:

i) pitch angle, zero ±5° about the mean approach attitude.

ii) roll angle, zero to ±20°,

iii) forward velocity, from minimum approach speed up to 200 KT, or up to the maximum approach speed, whichever is greater,

iv) sink rated, from 0 to 15 ft. per second in the altitude range between 200 and 100 ft. above terrain;

c) over a level surface, the altimeter shall track the actual altitude of the aircraft without discernible lag or oscillation;

d) with the aircraft at a height above terrain of 200 ft. or less, any abrupt change in terrain representing no more than 10% of the aircraft altitude shall not cause the radio altimeter to unlock, and indicator response to such a change shall not exceed 0.1 second. If the system unlocks, it shall provide an accurate information display within 1.0 second of the unlock;

e) systems which contain a self-monitor system shall test the entire system (with or without the antenna) at least at all aircraft altitudes less than 500 ft. above terrain, and those with a push to test feature, at a simulated altitude of less than 500 ft.;

f) the system shall provide a positive failure warning display, visible to both pilots, any time there is a loss of power or absence of ground return signal within the operating range of the system;

g) the system shall include a settable DH marker to permit selection of the DH and the notification of the fact, by aural and/or visual means, that it has been reached, over an altitude range between 200 and 100 ft. Operation of this feature shall not interfere with the normal operation and display of the radio altimeter system.

2.4.7 AVIONICS FAILURE WARNING SYSTEM

The CAT II/III system must provide for detection against the consequences, of single failure of essential avionics systems. The warning system may be composed of individual system failure indications (flags), self monitoring systems, cross monitoring or automatic comparison of redundant systems, or combinations of the foregoing. Such a system shall ensure that a positive warning of failure of any essential part of an avionics system, including the indicators, is provided to the pilots and there shall be no ambiguity as to action required by the crew. The following additional criteria shall apply:

a) when cross monitoring is used, crew operating procedures must not be adversely affected by the need to monitoring all or any of the displays while carrying out other duties during the approach phase;

b) the warning system intended for use shall in itself cause no hazard to the individual instrument systems nor to the overall aircraft during any part of the intended flight operation;

c) if used as a part of the CAT II/III approach system, the following , as a minimum, shall be provided with a system to detect and warn of failure or malfunction:

i) attitude display system (vertical gyro),

ii) heading (compass and directional gyro systems),

iii) altitude (low range radio altimeter systems),

iv) ILS localizer and glide slope receiver systems,

v) flight director systems,

vi) automatic approach coupler/automatic pilot systems,

vii) automatic throttle control system.

2.4.8 MISSED APPROACH ATTITUDE GUIDANCE SYSTEM

A system for providing attitude guidance for missed approaches shall be provided. This system may comprise one of the following alternatives:

a) dual, independent attitude indicators, each visible to the appropriate pilot, with calibrated pitch markings in at least 10° increments over a range adequate to cater for missed approach by the aircraft;

b) an automatic computed pitch command signal as part of the automatic approach coupler/automatic pilot which provides the appropriate missed approach pitch attitude to the aircraft when the pilot initiates missed approach action;

c) an automatic computed pitch command indication displayed on the flight director(s) to provide indication of the appropriate pitch attitude for the missed approach phase.

2.4.9 AUTO-THROTTLE SYSTEM

An auto-throttle system, when installed as a part of a CAT II/III system, must provide safe operation under all operating conditions, including those occasioned by wind shear, gusts and sideslips. The system shall:

a) automatically adjust throttles to maintain aircraft speed to within ±5 KT of the stabilized program airspeed, but not less than computed threshold airspeed, under all intended flight conditions. Proper operating points such as reference speed or angle of attack may be set manually or automatically;

b) provide throttle application at a rate consistent with the recommendations of the appropriate engine and airframe manufacturer and as approved by the airworthiness authority;

c) maintain stable short period and long term longitudinal stability aircraft modes for all intended flight situations during manual and automatic flight control;

d) ensure that a malfunction of any part of the system will not restrict either pilot from maintaining safe control of the aeroplane or engines. Provision shall be made for at least the following:

i) disconnect switches readily accessible to both pilot and co-pilot,

ii) throttle drive mechanism which permits manual override without application of excessive throttle forces,

iii) automatic disconnect of auto-throttles on the application of go-around (overshoot) thrust or power by the manual throttles,

iv) positive limitation, by design, of the maximum attainable servo velocity to that required for adequate performance,

v) appropriate indication of system engagement and disengagement.

2.4.10 PRECIPITATION REMOVAL EQUIPMENT

A system shall be provided to protect against moisture in any form restricting visibility through the windshield throughout the approach, landing and ground roll phase. The anti-icing system must be capable of satisfactory operation in all icing conditions for which the aircraft itself is certified.

2.4.11 COMMUNICATION EQUIPMENT

The aircraft communications systems shall include the following as a minimum, within the performance standards specified:

a) each aircraft intended to perform CAT II/III operations shall be equipped with at least two independent VHF air-ground communications systems, each capable of operation with appropriate ATC facilities;

b) each VHF communications systems shall meet or exceed the minimum performance standards established in RTCA Document DO-139 (Minimum Operational Characteristics for Airborne VHF Communications Systems) or other standards acceptable to the CAA, and shall be listed in the appropriate part of the department of Communication' Radio Equipment List;

c) each VHF communications system shall permit simultaneous and independent operation by either pilot without mutual interference and without interference to any other aircraft system.

2.4.12 FLIGHT CONTROL SYSTEMS

In addition to the CAT III requirements of paras. 2.4.2 and 2.4.3, a flight system, conforming to the control system for operations conducted without a DH, also requires a fail-operational flight control system. For operations conducted with a 50 ft. DH, a fail-passive flight control system may be used. Both fail-passive and fail-operational systems should be shown to provide the capability to safely touchdown within the touchdown zone and not preclude a safe go-around from any point on the approach to touchdown. A safe touchdown should consider airplane structural limit loads, vertical and cross track velocity at touchdown, the airplane attitude and the airplane's track, with respect to the runway center line, which occurs immediately before and after touchdown.

2.4.13 MANUALLY FLOWN FLIGHT GUIDANCE SYSTEMS

A system which provides guidance signals to the flight crew for a manually flown approach and landing as one of the required redundant systems for CAT III approach and landing should provide touchdown performance, as well as conform to the requirements of paras. 2.4.2 and 2.4.3.

The flight guidance system should provide sufficient information so that a pilot of average skill can provide the same degree of repeatable touchdown performance (dispersions), without outside visual reference, as specified for automatic landing systems. The demonstration should include the ability to take control from the approach to touchdown.

2.4.14 FLARE COMPUTER OR FLARE COMPUTATION

Flare for CAT III should provide the following performance in conjunction with other components of the flight control system:

a) signals to the flight control system to achieve landing touchdown dispersions within criteria; and

b) a display to the flight crew with a clear indication that the flare has (or alternatively, has not) been initiated at the minimum normal flare engage height.

2.5 MAINTENANCE

2.5.1 Normal maintenance practices which must be followed for existing avionics equipment, or modifications thereto, will be similarly applicable to CAT II/III instrumentation.

2.5.2 Applicants for CAT II/III certification who do not currently have a maintenance facility integral to their organization will be required to establish and follow a program acceptable to the CAA.

2.5.3 RELIABILITY REPORTING

For a period of two years after receipt of approval for CAT II/III operations, an operator shall provide to the CAA, a monthly summary (in duplicate) of the following information:

a) the total number of approaches where an airborne CAT II/III system was utilized to make successful actual or simulated approaches to CAT II/III minima, broken down by aircraft type (see para. 3.4.1 for definition of a successful approach);

b) the total number of unsatisfactory CAT II/III approaches, actual or simulated, broken down by aircraft identification and airport. The reason for unsatisfactory operation shall be designated, either by indicating faulty airborne equipment, an apparent fault in the ground system, or cancellation of an approach because of ATC restrictions.

2.5.4 The above report may be combined with that described in para. 3.4.3 of this manual.

CHAPTER 3 OPERATION OF THE AIRCRAFT

3.1 CERTIFICATION

3.1.1 A operations specification for CAT II/III operations will not be included in an operating certificate until the applicant has:

a) demonstrated that his flight crew have carried out an approved program training;

b) laid down detailed procedures and instructions for crew in the operations manual; and

c) demonstrated that his equipment, maintenance program, operating procedures and instructions result in a standard of safety acceptable to the Commissioner.

NOTE: All fixed wing operator CAT II or lower approaches will be coupled approaches.

3.1.2 When the above requirements have been met, pilots of the applying operator who have successfully undergone an evaluation, as described below, will be initially authorized for interim CAT II minima. Approval of lower minima will not be given until the Commissioner is satisfied that the operational experience with interim CAT II minima has been adequately proven. This interim period will, in all cases involving approval at South African airports, as a first officer certified to act as second-in-command during CAT II/III operations on a similarly certified aircraft, or a combination of these.

3.1.3 The interim CAT II minimum may be waived for rotorcraft air operators when it can be shown that the operator has completed at least one full season in areas of inclement weather pertaining to lower limits operating to authorized IFR descent limits below 200 ft.

3.2 PILOT QUALIFICATIONS

3.2.1 The minima prescribed above are authorized only for those pilots-in-command who have completed an approved CAT II/III training program and have been certified by a Designated Flight Examiner as being qualified for CAT II/III operations. No pilot-in-command shall be authorized to conduct CAT II/III operations in turbo-jet aircraft unless he has had at least 300 hours as pilot-in-command in turbo-jet aircraft. The pilot-in-command must also have completed 100 hours of line flying on the aircraft type, in command unless otherwise authorized in an operating certificate or operations manual. No pilot-in-command shall be authorized to conduct CAT II/III operations in turbo-prop aircraft or rotorcraft unless he has had 100 hours as pilot-in-command on the type of turbo-prop aircraft or rotorcraft for which he is approved. Further, the second-in-command must have completed the required CAT II/III training program and have been certified by the operator to act as second-in-command during CAT II/III operations.

3.2.2 When requirements of para. 3.1.1 have been met, pilots of the applying operator who have successfully undergone an evaluation as described below will be authorized for CAT II/III. CAT III operations automatically certifies for CAT II operation.

3.3 CREW TRAINING

3.3.1 The applicant's training program shall provide ground training for pilots-in-command, seconds-in-command, and where applicable, in-flight relief pilots in the following subjects:

a) the operational characteristics, capabilities and limitations of the CAT II/III ILS and visual aids (e.g. approach lights, in-running lights, transmissometers, runway markings);

b) The operational characteristics, capabilities and limitations of the CAT II/III airborne system to be used by the applicant, including the following, as appropriate:

i) the flight director system,

ii) the automatic approach coupler (including split axis),

iii) the system used to identify the DH,

iv) the instrumentation and display systems,

v) automatic throttle systems,

vi) other systems and devices peculiar to the applicant's installation such as computed go-around guidance, failure warning systems, etc.;

c) resolution of the DH:

i) normal height loss during overshoot,

ii) extra height loss due to abnormal conditions,

iii) time to correct an azimuth error before flare;

d) missed approach technique using fixed or computed attitude guidance display, as appropriate;

e) RVR observing system, its use and limitations;

f) the use of visual cues associated with the runway environment during CAT II/III weather conditions with different glide angles, cockpit cut-off angles and the altitude at which these visual cues are normally discernible;

g) problems associated with the transition from non-visual flight during RVRs 1600 and 1200, emphasis should be placed on the need for continuing to monitor flight instruments (or of staying coupled) until pitch attitude and vertical descent path have been visually assessed;

h) the effect of wind shear and turbulence;

i) review of the CAT II/III operations specifications;

j) crew duties;

k) significant factors in the calculation of DH/alert height.

l) recognition of and proper reaction to significant failure encountered prior to and after reaching the alert height or DH as applicable.

3.3.2 In addition to the required training covering the CAT II ground school items, an annual refresher course for all flight crew approved for CAT II shall be incorporated in the training program.

3.4 CREW CERTIFICATION

3.4.1 For the purpose of airborne evaluation, a successful approach is defined as one in which, at the DH:

a) the aircraft is in trim for continuation of a normal approach and landing;

b) the indicated airspeed, heading and threshold height, are satisfactory for a normal flare and landing. The speed must be within plus or minus 5 KT of the computed airspeed and in no circumstances less than the threshold speed, and for rotorcraft the indicated airspeed, heading and threshold height are satisfactory for a normal transition to an in-ground effect hover without abnormally large flare such as would cause a gain in altitude and/or a loss or required visual reference;

c) the aircraft is positioned so that the flight deck is within, and tracking to remain within, the lateral confines of the runway extended;

d) deviation from the glide path does not exceed ±75 microamperes (equivalent to one dot)* as displayed on the ILS indicator; no unusual roughness or excessive attitude changes have occurred after leaving the middle marker.

* This relationship may not be true for older instruments. In such cases, the allowable indicators deflection is that which is equivalent to ±75 microamperes.

3.4.2 When preparatory requirements have been met, arrangements will be made between the applicant and the CAA for crew evaluation. Details of the evaluation procedure will be determined by Testing Standards specialists, but the following general criteria will apply;

a) an evaluation of flight crews and operating procedures for certification for CAT II/III will be demonstrated using applicable type simulators certified for CAT II/III. Non-visual simulators may be used to demonstrate crew coordination and proficiency in the handling of emergency procedures during an approach and overshoot; all other checks, whether initial or recurrent, must be done in a visual type simulator. Rotorcraft evaluation of flight crew and operating procedures may be conducted in the aircraft provided the carrier can provide a suitable IMC simulator system satisfactory to the Commissioner which will simulate the required weather;

b) the crew will consist of a pilot-in-command, a second-in-command, and a third crewman as appropriate to type. The company DFE will not form part of the flight crew;

c) the Captain's initial proficiency check will be comprised of a minimum of one CAT II/III ILS approach, during which a practical emergency (e.g. engine fire) is introduced, aimed at assessing crew co-ordination, plus a second CAT II/III ILS approach to a landing in CAT II/III weather minima. Recurrent proficiency checks for Captains will be comprised of at least one CAT II/III ILS approach to a landing;

d) the period of certification will be for six months; renewal tests may be combined with semi-annual pilot proficiency checks or during an approved LOFT program;

e) the recording of a successful evaluation will be made on the pilot's permanent training records.

f) the Captain's initial/recurrent proficiency check will comprise of:

i) two ILS approaches using the automatic landing system or other approved manual system,

ii) an automatic landing from one of the approaches or manual for an approved manual system,

iii) a missed approach starting from a very low altitude which may result in touchdown during the go-around maneuvers,

iv) for those CAT II/III operations predicated on the use of a fail-passive rollout control system, a manual rollout using visual reference or a combination of visual and instrument references. Other flight crew members will be checked concurrently in the performance of their assigned duties in support of the above initial/recurrent proficiency check items.

3.4.3 Following certification to interim CAT II/III minima, the operator should use the airborne system to approved minima as frequently as feasible to ensure continued performance and reliability of the system and to build up pilot experience in approaches to authorized limits. Each CAT II/III approach, real or simulated, is to be recorded on a form developed by the operator, including the following information as a minimum:

a) date, type of aircraft, name of pilot-in-command, airport and runway of landing, and reported ceiling and visibility;

b) whether approach was auto-coupled or flown manually;

c) if auto-coupled, indicate, when applicable:

i) if flight director agreed with autopilot,

ii) the height at which coupler was disengaged,

iii) if autolanding was successful;

d) whether the approach was successful, as defined in para. 3.4.1, or unsuccessful;

e) If the approach was unsuccessful, specify the unsatisfactory element of the CAT II/III system (e.g. airborne equipment, ground installation, crew performance, traffic condition);

f) the difference, if any, between computed airspeed and actual airspeed at the DH;

g) an assessment of the overall quality of the CAT II/III system as Good, Acceptable, Poor or unacceptable.

3.4.4 A consolidated report containing the above information is to be forwarded to the Commissioner monthly. These reports will be used as one basis for determining when a carrier may be considered for upgrading to operational CAT II/III minima. (See para. 2.5.4).

3.5 OPERATING LIMITATIONS

3.5.1 An operator applying for CAT II/III certification will be required to have a section in their operations manual assigned specifically to this subject. This portion is to stipulate, among other things, conditions that must be met before an approach to CAT II/III minima may be commenced:

a) the airborne equipment required in Table 2-1 and para. 2.3.1, applicable to the contemplated approach, is operating satisfactorily;

b) the following essential elements of a CAT II/III runway system are operating satisfactorily to CAT II/III standards and tolerances (satisfactory operation may be assumed unless reported otherwise):

i) ILS localizer, glide path and middle marker,

ii) high intensity approach lights,

iii) runway center line and touchdown zone lights,

iv) runway edge, threshold and end lights,

v) RVR reporting systems at touchdown and mid-point areas, and for CAT III rollout area, RVR as well,

vi) alternate no break power source available;

c) the cross-wind component on the landing runway is 10 KT or less. For rotorcraft the carrier shall establish in their operations manual acceptable cross-wind component for each type certified for CAT II/III;

d) except for rotorcraft, 15% additional runway over the authorized normal field length tables in the Aircraft Flight Manual;

e) the tailwind component does not exceed 10 KT, or such lesser amount determined by equipment and runway limitations. For rotorcraft the carrier shall establish in their operations manual acceptable tailwind component.

f) unless otherwise authorized in an operations specification or in the company operations manual, CAT III approaches in aeroplanes are to be conducted in an autopilot-coupled mode.

3.5.2 The operations manual shall also specify that, in CAT II/III weather conditions, a missed approach* should be initiated when:

a) the pilot-in-command, upon reaching the authorize DH, has not established required visual reference;

b) the pilot-in-command determines that a safe landing cannot be accomplished within the touchdown zone and the aircraft stopped within confines of computed runway stopping distance;

c) any of the required airborne equipment specified in Table 2-1 becomes inoperative and is still required to complete a CAT II/III approach; or

d) any of the elements of the airport system specified in subpara. 3.5.1 (b) of this section becomes inoperative during a CAT II/III approach, except that, if the RVR reporting system or the standby power system should fail after the aircraft is established on the glide path, and is inside the final approach fix, the approach may be continued at the pilot's discretion provided the RVR readings from the commencement of the approach have not been less than those authorized.

3.5.3 The operations manual must also specify actions to be taken in the event of engine failure. These instructions will, under such circumstances, forbid the commencement or continuation of an approach to CAT II/III limits, unless an operator demonstrates to a CAA Inspector that exceptions to this general rule are

justified for specific situations and aircraft types. If exceptions are approved, the operations manual will clearly describe the agreed situations under which a CAT II/III approach may be conducted with one engine inoperative.

* When a failed element is one required only for CAT II/III approaches, the pilot may elect to continue to a CAT II/III DH (200/100 ft.) prior to deciding whether to continue or abandon the approach.

CHAPTER 4

THE AIRPORT

4.1 CERTIFICATION

4.1.1 Approval of an airport for CAT II/III operations will be the responsibility of the Commissioner, following a suitable recommendation by the General Manager Aviation Safety Infrastructure recording of such approval will be by suitable annotation of the Airport Certificate. This annotation will stipulate that CAT II/III approaches may be accepted at that airport when the following elements have met or exceeded the specifications described in this chapter:

a) Obstacle Clearance Limits;

b) Instrument Landing System;

c) Visual Aids;

d) Meteorological Services;

e) Air Traffic Control Services;

f) Standby Power;

g) Pre-threshold Terrain.

4.1.2 When an airport has met the requirements for CAT II/III operations stipulated in manual, an appropriate NOTAM announcing this fact will be issued by the CAA.

4.2 OBSTACLE CLEARANCE REQUIREMENTS

4.2.1 Obstacle clearance requirements at South African airports will be those depicted in ICAO document, Procedures for **Air Navigation Services Aircraft Operations** (PANS-OPS), Volume II, Part III, Chapter 21, Amendment No.1.

4.2.2 In addition, South Africa will abide by the “Obstacle Limitation Surfaces” for CAT II/III runways as specified in ICAO **Annex 14**, Part IV. For convenience, the salient points of this section are reproduced in Appendix “A”.

4.2.3 The Commissioner will be responsible for determining the governing obstacle clearance limit which will determine the minimum CAT II/III DH.

4.3 ILS INSTALLATION

4.3.1 The ILS installation must conform with the specification for facility performance CAT II/III ILS contained in ICAO Annex 10, Volume I, Chapter 3.

4.3.2 The required components of a CAT II/III ILS are:

a) localizer (dual channel);

b) glide path (dual Channel);

c) middle marker (dual channel);

d) outer marker or compass locator beacon (if not applicable DME collocated with the glide path antenna may be used as an acceptable alternate to part or all of the ILS marker beacon system or the compass locator beacon).

4.3.3 Flight inspections and ground checks of the localizer and glide path setting of ILS zoning criteria, will be done in accordance with applicable Maintenance Manuals 4-3LOC-12/1, 4-3GP-12/1; and Flight Inspection Procedures 4-3LOC-9/1, 4-3GP-9/1. A brief description of these inspections is included in Appendix "B". Also included in this appendix are guidelines for maximum snow accumulations at the glide path antenna site, and the minimum area around the localizer and glide path antennas that must be protected from ground interference.

4.3.4 CAT II/III ILS installation will be downgraded to non-categorized status under the following conditions:

a) if the annual or routine flight inspection is delayed more than 30 days;

b) if there has been a significant change in ground conditions since the last flight inspection. (The definition of "significant change" must be left to individual airport electronic maintenance staffs. Where uncertainty exists, a flight inspection should be carried out).

c) where the standby localizer, glide path, or middle marker transmitter are not available.

4.3.5 Under all the conditions described in para. 4.3.4, an appropriate Class I NOTAM will be issued, according to the indications outlined in paras. 4.9.1 to 4.9.3.

4.4 VISUAL AIDS

4.4.1 Runway marking shall be in accordance with SA-CATS-AH. These are as outlined in Appendix "C".

4.4.2 The minimum lighting requirements are as follows:

a) approach, threshold, touchdown zone and center line lights to DOT standards and tolerances for CAT II/III (equivalent to the standard stipulated in ICAO **Annex 14**, Part V except that threshold lights are automatically set one intensity setting higher than the approach lights when the latter are on intensity setting 1, 2, 3 or 4);

b) runway edge and end lights to DOT standards for high intensity systems (equivalent to the standard stipulated in ICAO **Annex 14**, Part V).

4.4.3 Appendix "D" describes the standard configuration for approach, runway, and runway exit lights in use for south African CAT II/III airports.

4.4.4 The following operational standards have been established for CAT II/III ILS lighting systems:

a) **Approach Lights:** Outage of 5% will be permitted but shall not include consecutive outages on center line barrettes or the 1,000 foot bar.

b) **Runway Center Line Touchdown Zone Lights:** Outage of 5% will be permitted outside the touchdown zone. Within the touchdown zone area (the first 3,000 ft.), outages shall be

confined to one light per touchdown zone bar, and any outages in the center line shall not be consecutive.

c) **Runway Edge, Threshold and End Lights:** Outage of 5% will be permitted, but no more than two consecutive edge lights may be out at one time, no more than one threshold/end light.

d) When corrective action cannot be taken, with reference to paras. (a), (b) and (c), then the CAT II/III operations will be downgraded to non-categorized status.

4.5 METEOROLOGICAL SERVICES

4.5.1 In addition to the normal meteorological information in routine hourly and special reports, RVR values must be known at the touchdown and mid-point prior to commencement of a CAT II/III approach. Accordingly, two transmissometers are required for each CAT II/III runway, one at the touchdown point, designated the "A" system, and one at the mid-point, normally half-way down the runway, designated the "B" system. Readouts from both systems are to be continuously available in the Airport Controller position. For CAT III operations an additional rollout RVR is required.

4.5.2 Information on turbulence, wind shear and slant visual range could be invaluable during CAT II/III approaches. Pilots who have just completed approaches are the only reliable source of such information, and therefore should be encouraged to report any significant values in these areas so that the information can be passed to succeeding aircraft.

4.6 AIR TRAFFIC SERVICES

4.6.1 The Airport Controller is the focal point on the airport insofar as CAT II/III operations are concerned. The Airport Controller must, therefore, be immediately aware if any essential airport element, as listed below, becomes unserviceable or is not operating to prescribes standards and tolerances (see para. 4.9 for NOTAM Procedures):

a) approach, threshold, touchdown zone, center line, edge and end lights;

b) ILS localizer, glide path, or middle marker;

c) RVR reporting system;

d) commercial (electrical) and standby (diesel) power.

4.6.2 The status of those items listed in para. 4.6.1 (b), (c) and (d) will be available continuously by status indicators in the control tower. The lighting elements listed in para. 4.6.1 (a) will be checked daily, and unless advised to the contrary, the Airport Controller will assume all lighting is within acceptable limits.

4.6.3 When any lighting element is found to be unserviceable, or below acceptable tolerances, the Airport Controller will be so advised; he must also know when the element is restored to an acceptable status. Accordingly, the airport management will arrange a reliable communication link between airport maintenance and ATC units to ensure this information is passed.

4.6.4 The Airport Controller will, when CAT II/III weather exists or is forecast, advise the Terminal Control Unit whenever an essential airport element is unserviceable. In this event, the Automatic Terminal Information Service (ATIS) broadcast will include the fact that CAT II/III approaches are not authorized. Where ATIS is not available, incoming aircraft will be given this information as early as feasible. (See also para. 3.5.2 for conditions under which an approach should be abandoned/discontinued).

4.6.5 When the ceiling is 200 ft. and/or the visibility is 800m, or when worse conditions exist or are considered imminent (within a time span of less than one hour), and providing inbound aircraft are scheduled, the Airport Controller will switch airfield systems to standby power (see paras. 4.7.1 to 4.7.4).

4.6.6 Standby power to remote communication transceiver sites is not provided at some locations. At such locations a serviceable DC-powered transceiver shall be immediately available in the control tower.

4.6.7 When CAT II/III approaches are made, special care is to be taken in the control of taxing aircraft. Holding position marking have been established at all major airports on the basis of potential interference with ILS signals. Should these prove to be inadequate for CAT II/III operations, Air Navigation Regional Directors should initiate a requirement for more restrictive holding positions. In no case will taxiing aircraft or ground vehicles be allowed to enter ILS critical areas, depicted in Appendix “B”, when CAT II/III approaches are in progress.

4.6.8 Terminal Controllers shall assume that pilots using CAT II/III facilities prefer an automatic coupled approach. Accordingly, terminal controllers shall vector the aircraft to intercept and be stabilized inbound on the localizer at least five miles prior to crossing the outer marker (or a similar distance prior to interception of the glide path where no outer marker is installed). The aircraft shall be at minimum vectoring altitude before interception of the glide path.

4.6.9 An aircraft overflying the localizer at close range may cause interference which could jeopardize a CAT II/III approach by a following aircraft. To minimize this risk, departing aircraft should have started their takeoff run before the approaching aircraft is within 4 NM of the threshold. In the case of consecutive approached, enough separation should be allowed to ensure the preceding aircraft cannot adversely affect the localizer signal for the following aircraft; the minimum separation in such cases is 5 NM.

4.6.10 To enable approaching pilots to comply with para. 3.5.2, Airport Controllers will advise them immediately of the failure of any element listed in sub-para. 3.5.1 (b). (See para. 4.9.2 for subsequent pilot action).

4.7 STANDBY POWER

4.7.1 When a runway is placed on CAT II/III status, the standby on-site diesel power system becomes the primary source, and commercial power will revert to the standby source. In this way the backup power source, commercial electric, is available without interruption if the diesel generator system should fail.

4.7.2 At airports with CAT II/III runways, a switching arrangement is installed in the control tower enabling the controller to select diesel or commercial power, at will. One of the controller’s actions when placing a runway on CAT II/III status is selection of diesel power as the primary source.

4.7.3 The Airport Controller must be aware of the limitations of this system, particularly with regard to the number of starts that can be made over a given time period, the length of continuous running time of diesel generators, and minimum loading of the system.

4.7.4 If a failure occurs in the standby power system (commercial electric), The runway shall be declared unavailable for CAT II/III approaches. However, if an aircraft is on final approach when the failure occurs, the pilot may complete the approach, and the ban then applied to subsequent approaches until standby power is restored.

4.8 PRE-THRESHOLD TERRAIN

4.8.1 While terrain under the approach path should be relatively level, vis-à-vis the runway surface, there will usually be irregular contours ahead of the threshold. Since DH/alert height for CAT II/III approaches will be determined by radio altimeters, two requirements emerge with regard to terrain.

4.8.2 Firstly, the terrain must be level enough to ensure the instrument will not "unlock" during a critical phase of descent, a distance taken to be at least 3,000 ft. ahead of threshold, to a width 100 ft. either side of the extended runway center line. As a guide acceptable irregularities in this area, tentatively agreed to in ICAO, are as follows:

"Gentle changes of ground height up to ±5 ft. may be acceptable, as are isolated abrupt changes such as objects of 10 ft. or depressions of 10 ft. Repetitive abrupt changes should be restricted to less than 3 ft., and preferably should be avoided. Single buildings of heights up to 10 ft. can be tolerated if their length is less than 50 ft. measured parallel to the center line".

4.8.3 In the case of airports which fail to meet this requirements, any restrictions on the use of radio altimeters, and the resultant effect on DH and automatic landings, will be determined by the CAA (Airports). Any such restriction will be reflected in the approach procedure for the runway concerned.

4.8.4 The second requirement is for height information above the ground at the point DH is reached. The DH will be approved minimum above the highest elevation of the first 3,000 ft. of the runway, but the radio altimeter will, at that point on the glide path, be measuring the height distance immediately below the aircraft. To determine the require radio altimeter reading when DH is reached, profile charts are required which provide elevation information for the first 3,000 ft. of the runway, and a similar distance ahead of the runway. Then, knowing the glide path angle and the glide path intercept point, the required reading on the radio altimeter at DH can be calculated.

4.8.5 Responsibility for production of these profile charts will be with CAA (Pans Ops). Such charts will require Commissioner approval before they can be put into operational use.

4.9 NOTAM PROCEDURES

4.9.1 Control tower personnel are responsible for originating a NOTAM which upgrades or downgrades a CAT II/III runway. Examples of suggested wording are: "CAT II/III approaches on Runway 29 not authorized TIL or TIL APRX (8-Figure Group)" It should be noted that use of the term "runway" in this context involves the entire CAT II/III system: ILS, visual aids, RVR system and standby power.

4.9.2 To help explain to incoming pilots the status of a downgraded runway, the NOTAM will state what the unserviceability is. Since the loss of the CAT II/III element* can result in a wide variation of landing limits, depending on remaining aids available and individual company operations specifications, the pilot-in-command will determine his appropriate action, either to divert to his alternate airport or continue the approach down to CAT I limits.

4.9.3 The type of NOTAM normally employed should be "Voice Advisory" (and/or ATIS, where applicable). Series "A" NOTAM should be used when it is known the problem will be of long duration.

* a) CAT II/III approach and runway lighting;

b) RVR system;

c) standby power;

d) ILS outside CAT II/III tolerances.

APPENDIX "A"

OBSTACLE LIMITATION SURFACES

1. In addition to the obstacle clearance surfaces specified for precision approach runways, the following obstacle limitation surfaces shall be established for a precision approach runway CAT II/III:

   a) Inner Approach Surfaces;

   b) Inner Transitional Surfaces;

   c) Balked Landing Surface.

2. These surfaces are designed to protect an aircraft with a wing span up to 200 ft., below a DH of 100 ft., aligned within the runway width, visual at that height, to climb at a gradient of 1 in 30 and diverge from the runway center line at a splay no greater than 10 %. The origin of the balked landing surface, 6,000 ft. past the threshold, is based on the assumption that the latest point for initiating the missed approach is the end of the touchdown zone lighting and change in aircraft configuration to obtain a positive climb gradient will normally require a further distance of 3,000 ft., equivalent to a maximum time of 15 seconds. The slopes of 1 in 3 for inner transitional surface are the resultant surfaces using a 1 in 30 climb gradient with a splay of 10%.

3. The location of these surfaces and their relationship with contiguous Obstacle Clearance Surfaces is shown pictorially on pages A-3 and A-4.

4. The Inner Approach Surface lies within and is aligned with the Approach Surface, and is constructed as follows:

   a) Width: 400 ft.;

   b) Distance from threshold: 200 ft.;

   c) Length: 3000 ft.;

   d) Slope: 2%.

5. The Inner Transitional Surfaces lie within and are aligned with the Transitional Surfaces, and are constructed as follows:

   a) Length: from 200ft. before the runway threshold to the beginning of the inner edge of the balked landing surface;

   b) Distance from threshold: 6,000 ft.;

   c) Origin of sides: 200 ft. either side of the runway center line;

   d) Slope: 33.3%.

6. The Balked Landing Surface lies within and is aligned with the Takeoff Climb Surface, and is constructed as follows:

   a) Length of Inner Edge: 400 ft.;

   b) Distance from threshold: 6,000 ft.;

   c) Divergence (each side): 10%;

   d) Slope: 3.33%.

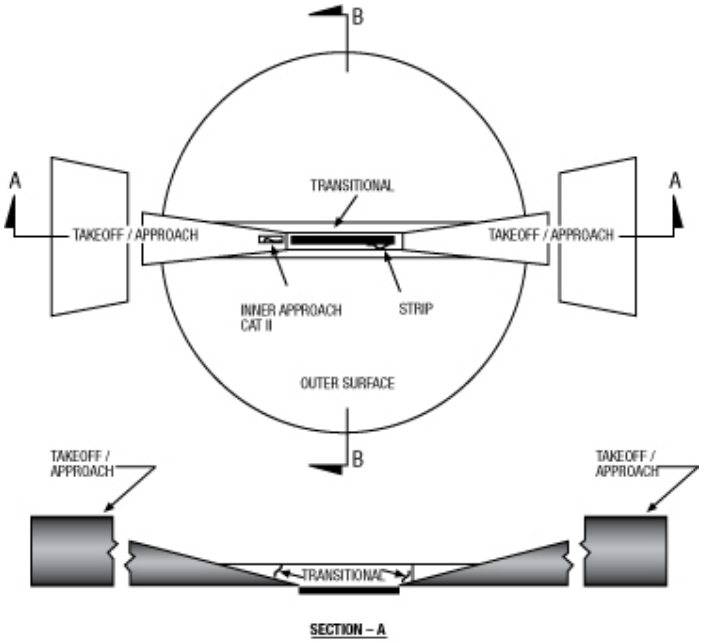
7. Objects shall not be permitted above the Inner Approach Surface, the Inner Transitional Surfaces of the Balked Landing Surface except for:

a) frangibly mounted objects which because of their function must be located on the strip;

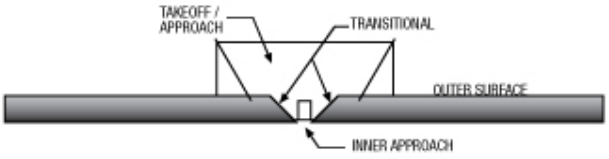
b) in the case of Inner Transitional Surfaces and Balked Landing Surface, snow banks.

FIGURE 1A

OBSTACLE LIMITATION SURFACES
CAT II/III



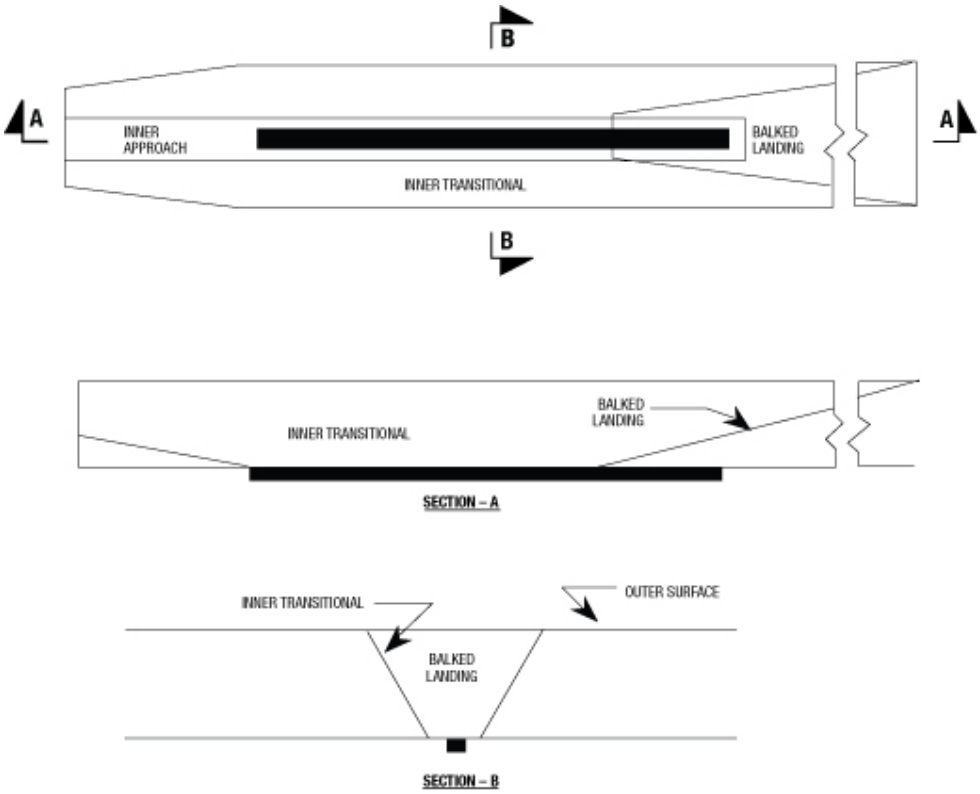
SECTION – A



SECTION – B

FIGURE 1B

INNER TRANSITIONAL AND BALKED OBSTACLE LIMITATION SURFACES
CAT II



APPENDIX "B"

CATEGORY II ILS CRITERIA

1. GENERAL

The performance criteria for CAT II/III ILS in South Africa, and the periodic checks of these systems, will at least match the Standards and Recommended Practices outlined in ICAO **Annex 10**, and the guidelines suggested in ICAO Document 8071.

2. FLIGHT INSPECTIONS

The flight inspection is the ultimate criterion of an ILS.

3. COMMISIONING INSPECTION

This inspection is performed before the facility is certified for use. It is normally performed once only unless major changes have been made to a previously commissioned system, which then requires a recommissioning. The nature of these changes is detailed in the appropriate manuals for the maintenance and operation of equipment.

4. ANNUAL INSPECTION

This inspection is performed once a year on commissioned systems and provides a verification of facility capabilities.

5. ROUTINE INSPECTION

This is an inspection conducted at four monthly intervals to confirm the facility performance continues to meet its technical requirements and to satisfy its operational requirements.

6. SPECIAL INSPECTION

This inspection is made of circumstances require system verification (i.e. major system repairs, suspected malfunctions or modifications).

7. ILS CRITICAL SENSITIVE AREAS

When CAT II/III operations are in progress, unauthorized vehicles and/or aircraft will not be permitted within the critical or sensitive areas as outlined in Figure 1B and 2B. Critical areas are defined as those where the presence of a vehicle or taxiing aircraft may possibly affect ILS signals. The depicted areas are theoretical, and will probably vary with individual sites. Actual critical areas can be defined only by experimentation and experience. When any portion of a designated sensitive area becomes suspect as a likely source of interference, that portion must be included as part of the critical area. "CAT II/III Hold" signs are posted on taxiways and must be observed by aircraft and vehicles when CAT II/III approaches are being made..

8. A telecommunications vehicle may be authorized to proceed to the ILS equipment buildings provided that an aircraft on a CAT II/III approach has not passed the outer marker*. If already at the building, however, such a vehicle must remain parked there until authorized to move by ATC.

9. No vehicles or aircraft will be permitted to cross or remain on an active CAT II/III runway, or on any other runway or taxiway where their presence could affect ILS signals, when an aircraft on a approach has passed the outer marker*.

10. If there is a roadway in the glide path sensitive areas, as depicted in Figure 2B, no vehicle will be permitted to stop or park on that roadway. Signs shall be erected to indicate these restrictions.

* Where there is no outer marker, a point 4 NM from the runway threshold will be used as datum.

11. The critical area is shown in Figure 3B. Areas A, B and C are all considered to be critical in terms of ground conditions, vehicles intrusion, etc., with Area A being the most sensitive zone.

The critical area shall be prominently marked with signs to restrict the unauthorized entry of vehicles.

FIGURE 1B

LOCALIZER

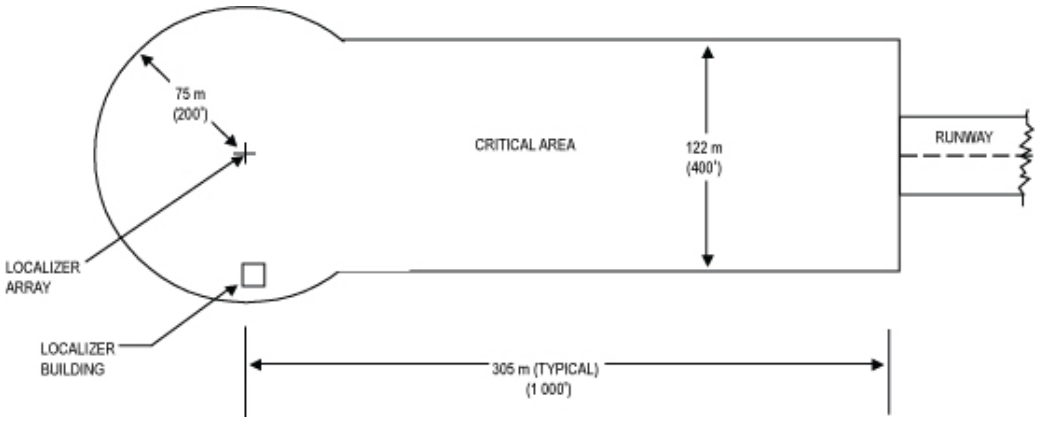


FIGURE 2B

GLIDEPATH

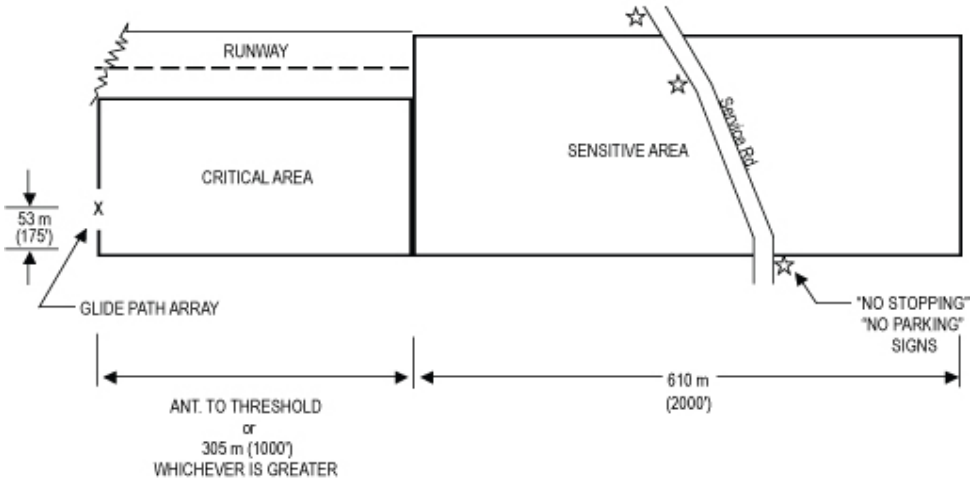
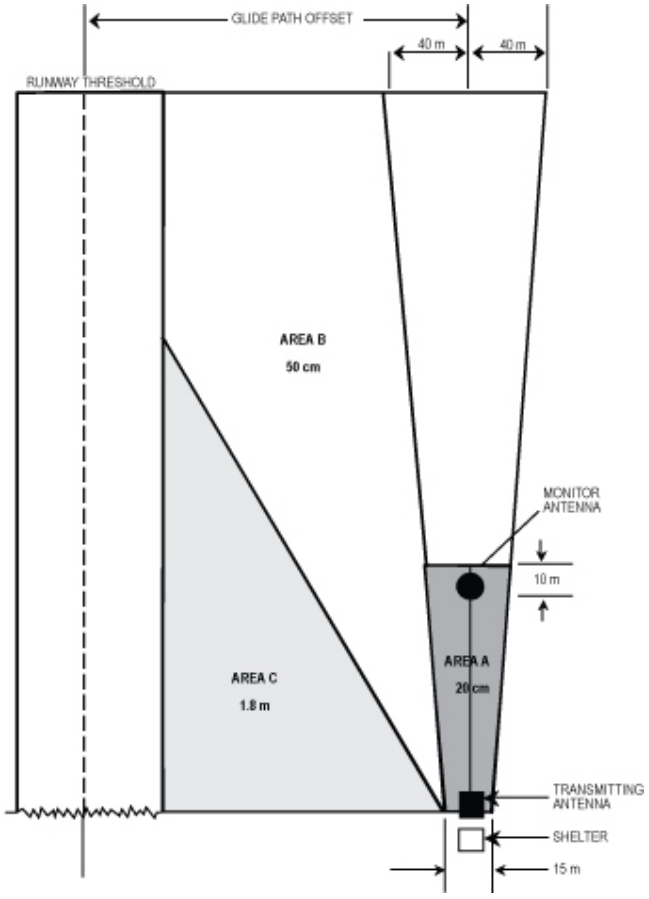


FIGURE 3B

GLIDE PATH CRITICAL AREA

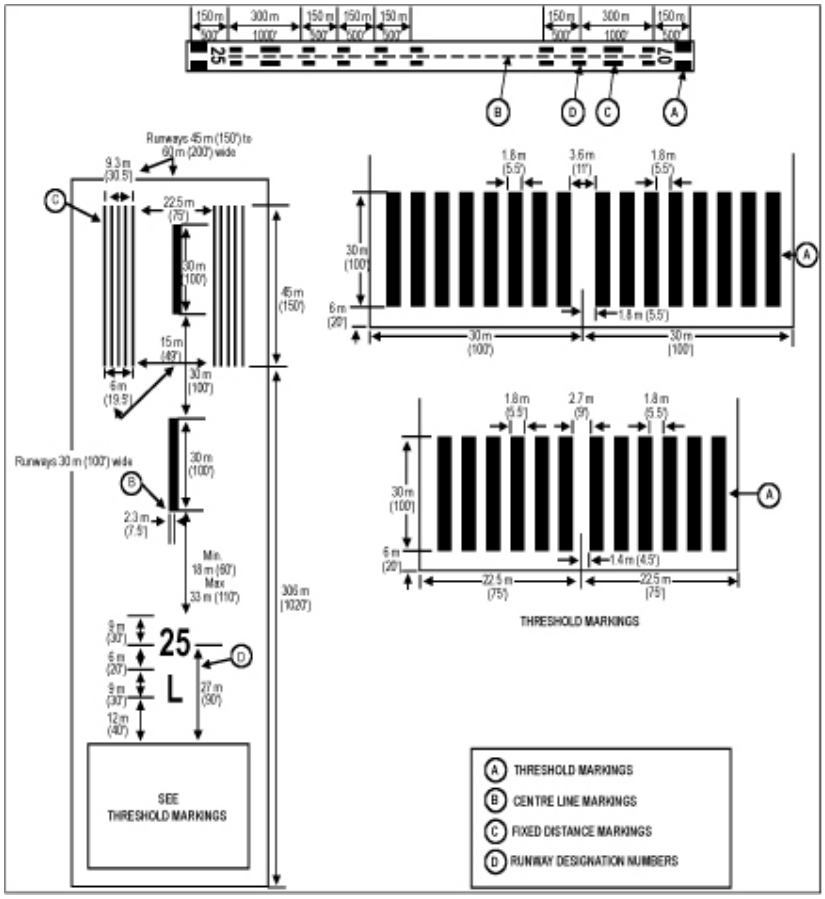
GLIDE PATH SITES



APPENDIX “C”

FIGURE 1C

RUNWAY MARKINGS NON-PRECISION AND PRECISION APPRAOCH RUNWAYS



APPENDIX “D”

FIGURE ID

APPROACH LIGHTING CAT II/III HIGH INTENSITY APPROACH SYSTEM LAYOUTS 60 M (200') TYPICAL

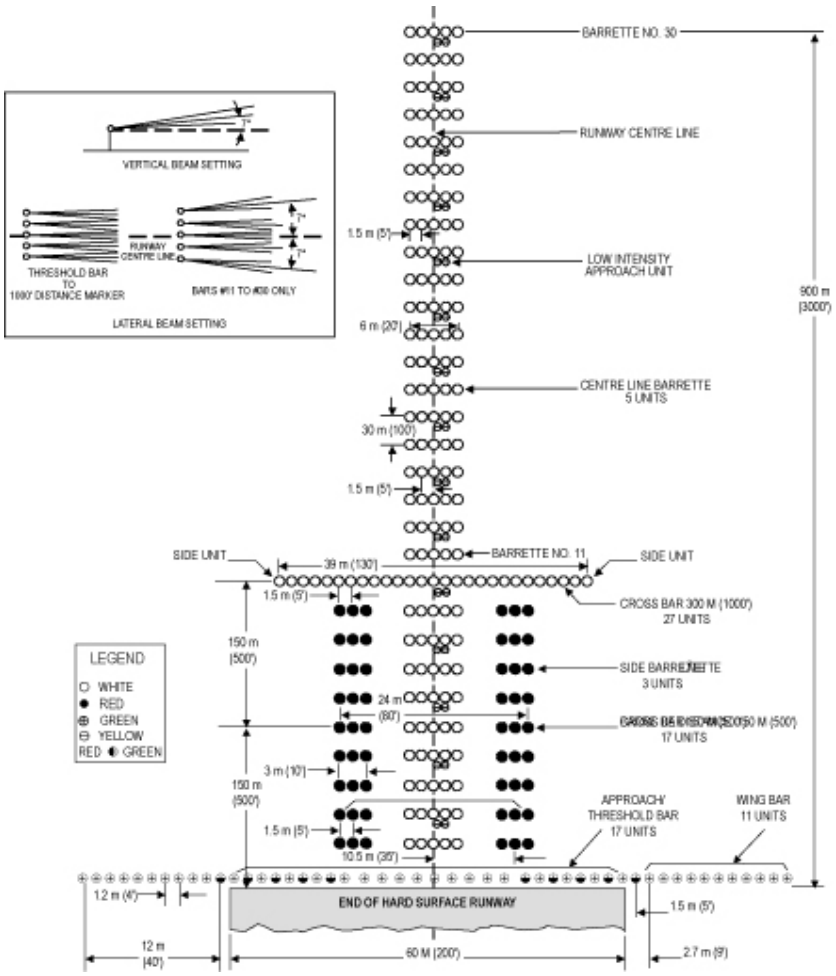
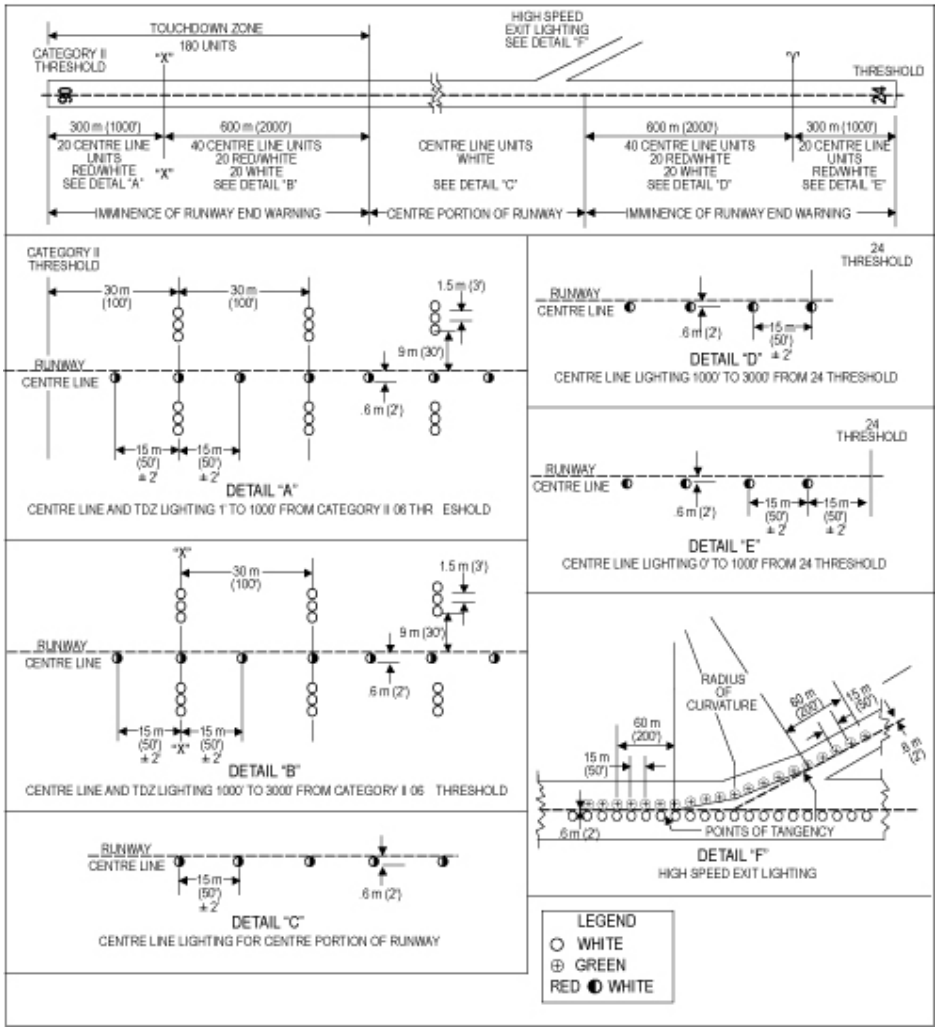


FIGURE 2D

TYPICAL RUNWAY CENTER LINE AND TOUCHDOWN ZONE LIGHTING



APPENDIX "E"

CATEGORY III FAIL – PASSIVE ROLLOUT CONTROL SYSTEMS

1. PURPOSE

Appendix E contains general criteria for the approval of aircraft equipment comprised of fail-passive rollout control systems in operations and the installation thereof.

2. GENERAL CRITERIA

The guidelines and procedures contained herein are considered acceptable methods of determining transport category airplane airworthiness for use of fail-passive rollout control systems in CAT III operations. After touchdown and until the point where safe manual control of the aircraft by the crew using visual references is assured, aircraft system failures (when considered separately or with other system failures that are not shown to be extremely improbable) cannot preclude the joint pilot/rollout and control system from controlling the aircraft and maintaining the aircraft within the runway length available.

3. EQUIPEMENT APPROVAL CRITERIA

Same as Chapter 2.

4. SYSTEM PERFORMANCE CRITERIA AFTER TOUCHDOWN FOR LATERAL STEERING CONTROL

The performance of the rollout control system should be consistent with the performance of the flight guidance and control system required for CAT III approach and landing. In addition, it should be shown be a combination of demonstration and analysis, for wet and dry runway surface conditions, that the performance of the rollout control system is satisfactory. Demonstrations in simulated or actual reduced visibility, representative of expected conditions in which the system is to be used, should also be conducted.

a) the following environmental conditions are to be considered in meeting the criteria of this appendix:

   i) The full range of environmental conditions and airplane configurations used in meeting the airworthiness requirements for a CAT III system should be considered, including headwinds of at least 25 KT, tailwind of at least 10 KT and crosswinds of at least 15 KT. These environmental conditions and airplane configurations should be compatible with the conditions and configurations demonstrated during airworthiness approval of the CAT III airborne systems as specified in Chapter 2.

   ii) The range of certificated runway conditions (dry and wet) should be considered.

b) It should be demonstrated that, considering the conditions prescribed in subpara. (a), the rollout control system meets the following accuracy criteria:

i) The maximum distance from the aircraft center line, at the main landing gear, to the runway center line should not exceed 27 ft. during the rollout when evaluated on a two-sigma basis. Compliance with this requirement should be shown by flight test or a combination of analysis and flight test. The maximum lateral deviations, observed during demonstrations to meet this requirement, should be used when computing the two-sigma deviation. Methods equivalent to the two-sigma basis may be used for non-standard distributions.

ii) A suitable analysis should show that, with normal operation of the aircraft and the rollout control system, no more than 1 landing in one million will result in the outboard landing gear being closer than 5 ft. to the lateral limits of a 150-foot wide runway during rollout.

c) It should be shown by analysis and confirmed by tests, under both dry and wet runway conditions, that the rollout control system provides sufficient damping to prevent unacceptable overshoot of, or excessive oscillation about the localizer center line during normal system operations.

d) Probable flight crew member actions should not significantly affect the normal tracking performance of the rollout control system.

5. PROTECTION FROM DISENGAGEMENT AND INDICATION OF SYSTEM STATUS

a) The rollout control system should be protected from inadvertent disengagement when operating in the ground rollout mode and the indication of any system malfunction should be conspicuous and unmistakable.

b) There should be a positive indication to the flight crew that:

i) the rollout control system is available, or alternatively, is not available, before the airplane descends to the alert height; and

ii) the ground rollout has, or alternatively, has not, been initiated at touchdown.

6. SYSTEM FAILURE PROTECTION CRITERIA

It should be demonstrated that the rollout control system meets the performance criteria of para. 4 of this appendix under normal conditions and meets the following additional criteria when failure occur in these systems. Additionally, the most adverse runway and visibility conditions expected in service with fail-passive rollout control system should be considered. In making these determinations, normal flight crew member actions, associated with the visual cues that are available, should be included in the consideration of the failure condition.

a) Single failures of the rollout control system and its associated components should not:

i) cause any significant displacement of the aircraft from its normal rollout path,

ii) upon system disconnection, involve any out-of-trim condition not easily controlled by the pilot, or

iii) cause any action of the flight control system that is not readily apparent to the pilot, either by control movement or advisory display.

b) An aural and visual warning should be provided for rollout control systems failure conditions not shown to be extremely improbable, which would result in the aircraft wheels leaving the lateral confines of a 45m wide runway.

c) Aircraft system failure should not preclude to joint pilot/rollout control systems from controlling the aircraft, maintaining the aircraft on the runway, and stopping within the runway available under the most adverse runway and visibility conditions expected in service.

APPENDIX "F"

CATEGORY III FAIL – OPERATIONAL ROLLOUT CONTROL SYSTEMS

1. PURPOSE

This appendix contains criteria for the approval of fail-operational rollout control airborne equipment and installation.

2. GENERAL CRITERIA

The guidelines and procedures contained herein are considered acceptable methods of determining transport category airplane airworthiness for use of fail-operational rollout control systems in CAT III operations. After touchdown and until the point where safe manual control of the aircraft by the crew using visual references is assured, aircraft system failures (when considered separately or in conjunction with other system failures that are not shown to be extremely improbable) cannot preclude the joint pilot/rollout and control system from controlling the aircraft and maintaining the aircraft within the runway length available. Additionally, these failure conditions cannot present cockpit cues or indications to the pilot which could cause an attempt at a manual rollout using visual reference. These capabilities should be demonstrated under the most critical conditions expected in service.

3. EQUIPEMENT APPROVAL CRITERIA

Same as Chapter 2.

4. SYSTEM PERFORMANCE CRITERIA AFTER TOUCHDOWN FOR LATERAL STEERING CONTROL

The performance of the rollout control system should be consistent with the performance of the flight guidance and control system required for CAT III approach and landing. In addition, it should be shown be a combination of demonstration and analysis, for wet and dry runway surface conditions, that the performance of the rollout control system is satisfactory. Demonstrations in simulated or actual reduced visibility, representative of expected conditions in which the system is to be used, should also be conducted is system operation is dependent on crew actions or manual control.

a) the following environmental conditions are to be considered in meeting the criteria of this appendix:

   i) The full range of environmental conditions and airplane configurations used in meeting the airworthiness requirements for a CAT III system should be considered, including headwinds of at least 25 KT, tailwind of at least 10 KT and crosswinds of at least 15 KT. These environmental conditions and airplane configurations should be compatible with the conditions and configurations demonstrated during airworthiness approval of the CAT III airborne systems as specified in Chapter 2.

   ii) The range of certificated runway conditions (dry and wet) should be considered.

b) It should be demonstrated that, considering the conditions prescribed in subpara. (a), the rollout control system meets the following accuracy criteria:

i) The maximum distance from the aircraft center line, at the main landing gear, to the runway center line should not exceed 27 ft. during the rollout when evaluated on a two-sigma basis. Compliance with this requirement should be shown by flight test or a combination of analysis and flight test. The maximum lateral deviations, observed during demonstrations to meet this requirement, should be used when computing the two-sigma deviation. Methods equivalent to the two-sigma basis may be used for non-standard distributions.

ii) A suitable analysis should show that, with normal operation of the aircraft and the rollout control system, no more than 1 landing in one million will result in the outboard landing gear being closer than 5 ft. to the lateral limits of a 45m wide runway during rollout.

c) It should be shown by analysis and confirmed by tests, under both dry and wet runway conditions, that the rollout control system provides sufficient damping to prevent unacceptable overshoot of, or excessive oscillation about the localizer center line during normal system operations.

d) Probable flight crew member actions should not significantly affect the normal tracking performance of the rollout control system.

5. PROTECTION FROM DISENGAGEMENT AND INDICATION OF SYSTEM STATUS

a) The rollout control system should be protected from inadvertent disengagement when operating in the ground rollout mode and the indication of any system malfunction should be conspicuous and unmistakable.

b) There should be a positive indication to the flight crew that:

i) the rollout control system is available, or alternatively, is not available, before the airplane descends to the alert height; and

ii) the ground rollout has, or alternatively, has not, been initiated at touchdown.

c) Under normal conditions, the cockpit displays should provide sufficient lateral guidance for manual control, after a flight crew initiates the disconnection of the rollout control system, to prevent the outboard landing gear from exceeding the lateral limits of a 45m wide runway. This capability should be demonstrated by flight tests, which use the cockpit displays for lateral control after disconnection of the rollout control system, at several points in the landing after the main wheels touchdown. The flight test should include conditions where the airplane is offset from the localizer center line by at least 27 ft. when the rollout control system is disconnected.

6. SYSTEM REDUNDANCY AND FAILURE PROTECTION CRITERIA

It should be demonstrated by flight tests, or a combination of analysis and flight tests, that the rollout control system has the redundancy and failure protection, necessary to meet the performance criteria of para. 4 of this appendix, under normal conditions, and meets the following additional criteria if failures, which are not shown to be

extremely improbable, can occur in the system. Additionally, the most adverse runway and visibility conditions expected in service should be considered. In making these determinations, normal flight crew member actions, associated with the visual cues that are available, should be included in the consideration of the failure condition.

a) Probable failures of the rollout control system and its associated components, considered separately and in relation to other systems, should not cause any significant displacement of the aircraft from its normal rollout path.

b) It should be confirmed by demonstration, or a combination of demonstrations and analysis, that the outboard landing gear will not exceed the lateral limits of a 45m wide runway considering:

   i) any probable incorrect flight crew member action, including the application of asymmetrical braking or reverse thrust, and

   ii) any failure or failure combinations not shown to be extremely improbable in the rollout control system, its associated components, and other systems.

APPENDIX "G" DECLERATION SYSTEMS FOR CATEGORY III

1. PURPOSE

This Appendix contains criteria for the approval of airborne equipment and installation of deceleration systems used in CAT III operations.

2. CRITERIA FOR AUTOMATIC BRAKING, DECELERATION DISPLAY, OR RUNWAY REMAINING SYSTEMS

If automatic braking, deceleration displays, ground speed displays, or runway remaining indicators are used for credit, a means will be demonstrated for the flight crew to determine that deceleration of the airplane is proceeding satisfactorily or that the airplane will reach a complete stop prior to reaching the end of the runway.

a) If used, an automatic braking system should allow antiskid protection and have manual reversion capability. An automatic braking system should provide smooth and continuous deceleration from touchdown until the airplane comes to a complete stop on the runway, and provide the following:

   i) Disconnect must not create unacceptable additional crew workload or crew distraction from normal rollout braking.

   ii) Normal operation of the automatic braking system should not interfere with a rollout control system. Manual override of the automatic braking system must be possible without excessive brake pedal forces or interference with the rollout control system. The system should not be susceptible to inadvertent disconnect.

   iii) A positive indication of system disengagement and a conspicuous indication of system failure should be provided.

   iv) No malfunction of the automatic braking system should interfere with either pilots' use of the manual braking system.

b) If an automatic braking system is installed for rollout deceleration credit, demonstrated wet ant dry runway landing distances, based upon the use of the automatic landing system with automatic throttle, for each mode of the automatic braking system, should be determined and presented in the airplane flight manual as performance information. Procedures should be established to permit pilots, prior to landing, to determine the automatic brake setting needed to obtain a safe stop on the runway being used for landing.