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Administration

# Advisory Circular

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AC 120-28D

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## CRITERIA FOR APPROVAL OF CATEGORY III WEATHER MINIMA FOR TAKEOFF, LANDING, AND ROLLOUT



**1. Purpose.** This advisory circular (AC) provides an acceptable means, but not the only means, for obtaining and maintaining approval of operations in Category III Landing Weather Minima and low visibility takeoff including the installation and approval of associated aircraft systems. It includes additional Category III criteria or revised Category III criteria for use in conjunction with Head-up Displays, satellite navigation systems, low visibility takeoff guidance systems, Wide-body Fail Passive operations and use of Category III during certain engine inoperative operations. This revision also updates and incorporates provisions of the former AC 20-57 into AC 120-28.

This revision incorporates changes resulting from the first steps toward international all weather operations (AWO) criteria harmonization taken by the Federal Aviation Administration (FAA), European Joint Aviation Authorities (JAA), and several other regulatory authorities. Subsequent revisions of this AC are planned as additional all weather operations harmonization items (AHI) are agreed and completed by FAA JAA, and other regulatory authorities.

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**1. PURPOSE.** This advisory circular (AC) provides an acceptable means, but not the only means, for obtaining and maintaining approval of operations in Category III Landing Weather Minima and low visibility takeoff including the installation and approval of associated airborne systems. This AC is applicable to Title 14 of the Code of Federal Regulations (14 CFR) part 121, 135 and 125 operators. Certain aspects of this AC are applicable to 14 CFR part 129 operators. Many of the principles, concepts and procedures described also may apply to 14 CFR part 91 operations and are recommended for use by those operators when applicable. Mandatory terms used in this AC such as "shall" or "must" are used only in the sense of ensuring applicability of these particular methods of compliance when the acceptable means of compliance described herein is used. This AC does not change, add or delete regulatory requirements or authorize deviations from regulatory requirements.

**CANCELLATION.** AC 120-28C, dated March 9, 1984, and AC 20-57A dated January 12, 1971, are canceled.

## **2. RELATED REFERENCES AND DEFINITIONS.**

**2.1. Related References.** Title 14 of the Code of Federal Regulations (14 CFR) part 23, section 23.1309; part 25, sections 25.1309, 25.1322, 25.1581, and 25.1583; part 91, sections 91.175 and 91.189; part 121, sections 121.579, and 121.651; part 125, sections 125.379, and 125.381; part 129, section 129.11; and part 135, section 135.225.

Unless a specific reference is made to a particular version of a rule or AC, current editions of the following AC's should be used:

AC 23.1309-1, Equipment, Systems, and Installation in Part 23 Airplanes

AC 25-7A, Flight Test Guide for Certification of Transport Category Airplanes

AC 25.1309-1, System Design Analysis

AC 120-29, Criteria for Approving Category I and Category II Landing Minima for 14 CFR Part 121 Operators

Standard Operations Specifications Parts A and C,

FAA Order 8400.8, Procedures for Approval of Facilities for FAR Part 121 and Part 135 Category III Operations

FAA Order 8400.10, Air Transportation Operations Inspector's Handbook

**2.2. Definitions.** A comprehensive set of definitions pertinent to Category III approach and landing and low visibility takeoff is included in Appendix 1.

Within this AC, Runway Visual Range (RVR) values are specified in units of feet (ft.) unless otherwise noted (e.g., meters (m)).

Where visibility minima are stated in both feet and meters (e.g., RVR300 (75m)) using values other than those identified as "equivalent" in standard operations specifications, it is intended that the RVR value in feet apply to minima specified in feet, and the value in meters apply in states specifying their minima in meters.

Minima typically used for low visibility operations including a minima conversion table where applicable are provided in the operations specifications shown in Appendix 7.

In this AC, where the term "RNP Level" is used, it may be considered to be equivalent to the term "RNP Type" typically used in some current ICAO and other authority references. The term "RNP Level" is used in the U.S. to match various RNP approval documents (e.g., AFM's) already in widespread use, and to reserve use of the term "RNP Type" for future anticipated RNP applications.

### **3. BACKGROUND.**

**3.1. Major Changes Addressed in this Revision.** This AC includes additional Category III criteria or revised Category III criteria for use in conjunction with Head-up Displays, satellite navigation systems, low visibility takeoff guidance systems, Wide-body Fail Passive operations and use of Category III during certain engine inoperative operations.

This revision also updates and incorporates provisions of the former AC 20-57 into AC 120-28, since provisions of the former AC 20-57 are directly related to and dependent on criteria provided in this AC.

This revision incorporates changes resulting from the first steps toward international all weather operations (AWO) criteria harmonization taken by the Federal Aviation Administration (FAA), the European Joint Aviation Authorities (JAA), and several other regulatory authorities. Subsequent revisions of this AC are planned as additional all weather operations harmonization items (AHI) are agreed and completed by FAA and JAA, or internationally.

**3.2. Relationship of Operational Authorizations for Category III and Airborne System Demonstrations.** Takeoff and landing weather minima are approved through applicable operating rules, use of approved instrument procedures and issuance of operations specifications. Airworthiness demonstration of airborne equipment and systems is usually accomplished in support of operational authorizations on a one time basis at the time of Type Certification (TC) or Supplemental Type Certification (STC). Since operating rules continuously apply over time and may change after airworthiness demonstrations are conducted, or may be updated consistent with safety experience, additional Category III credit or constraints may apply to operators or aircraft as necessary for safe operations. Airworthiness demonstrations are based on the particular operational and airworthiness criteria in effect at the time a type design certification basis is established for a particular TC or STC.

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Subsequent operational authorizations may constrain capabilities originally demonstrated based on current operational regulatory policy and experience. The main body of this AC contains criteria related to operational approval and Appendix 2 and Appendix 3 are the primary source of airworthiness criteria. Nothing in this AC is intended to preclude an operator from proposing and demonstrating to the FAA the ability to operate to Category III minima with a different equipment configuration; or alternatively to an RVR minima lower than that presently described in this document.

**3.3. Applicable Criteria.** AC 120-28C, dated March 9, 1984, and AC 20-57A dated January 12, 1971 are canceled. Except as described below, new airworthiness demonstrations or operational authorizations should use criteria of AC 120-28D. Airworthiness demonstrations may use equivalent JAA criteria where agreed by FAA through the FAA/JAA criteria harmonization process.

In general, the provisions of the main body of this AC outline concepts, objectives, and provisions necessary for operators. The appendices contain definitions, abbreviations, airworthiness demonstration provisions typically applied in conjunction with type certification, technical information necessary for airworthiness or operational assessments (e.g., atmospheric/wind models, obstacle clearance criteria) and examples of operational authorizations (e.g., sample Operations-Specifications (OpSpecs)). Certain criteria related to airworthiness assessment are included in the main body of the AC primarily to address the status and eligibility of previously certificated in-service aircraft for current authorizations (e.g., status of service bulletin compliance for continued or new authorizations, demonstration provisions applicable to "in-service" aircraft).

Operators electing to comply with this AC's revised criteria may receive the applicable additional credit(s). Aircraft manufacturers, operators or modifiers may elect to demonstrate that their aircraft meet the revised criteria to seek additional credit for any particular operation (e.g., HUD installation) or for all operations addressed by this AC (e.g., incorporation of a general compliance statement related to AC 120-28D, instead of reference to the former canceled criteria of AC 120-28C). However, aircraft demonstrated to earlier criteria may continue to be approved for Category III operations in accordance with that earlier criteria, and applicants may continue to make reference to the fact that an earlier demonstration was based on that previous criteria

(e.g., in the AFM). Aircraft manufacturers, modifiers or operators seeking authorization provided for only in this AC must, however, use applicable criteria of this AC (e.g., for RNP based missed approach obstacle criteria, meet pertinent provisions of Appendix 9). To get a particular authorization cited by this AC, the operator need only meet the provision or provisions applicable (e.g., RVR600 fail passive landing minima may be authorized per 4.3.8 for presently authorized airborne systems meeting previous criteria without regard to Appendix 3 criteria).

## **4. OPERATIONAL CONCEPTS.**

**4.1. Classification and Applicability of Minima.** Landing minima are generally classified by Category I, Category II and Category III (e.g., see ICAO Annex 6 references, and the associated

ICAO Manual of All Weather Operations DOC 9360/AN910, 2nd Edition, 1991). AC 120-29 (as amended) addresses Category I and II. This AC addresses Category III.

Takeoff minima are usually classified by RVR or meteorological visibility, and other factors (e.g., aircraft characteristics).

Although a wide variety of normal and non-normal situations are considered in the design and approval of systems used for Category III, Category III minima are primarily intended to apply to normal operations.

For non-normal operations, flightcrews are expected to take the safest course of action appropriate for the situation, including consideration of normal landing weather minima. When aircraft systems have been demonstrated to account for certain non-normal configurations (e.g., an approach with an engine inoperative) flightcrew may take into account this information in assessing the safest course of action.

**4.2. Takeoff.** Takeoff minimums are included in standard operations specifications. This AC addresses criteria for takeoff in low visibility conditions where additional aircraft equipment is provided to assist the pilot in a low visibility takeoff, or is required to assure safe operations when using minima below values acceptable for exclusive use of visual reference.

Standard OpSpecs list minima acceptable to FAA for manual control based exclusively on visual reference.

Authorization of takeoff minima below the level supported by use of visual reference alone requires use of a guidance system which has been demonstrated to provide an acceptable level of performance and satisfactory workload for the minima approved, with or without use of visual reference. The performance and workload assessment of such a system must have considered any compensation that may be introduced by the pilot for particular guidance system characteristics (e.g., coping with a slight localizer signal offset during initial runway alignment) or concurrent pilot use of the guidance system with limited or patchy visual references.

Systems intended to be used at or above the minima authorized for visual reference alone (e.g., as a supplement to manual control) may be used if demonstrated to be:

- 1) Safe in normal use, and
- 2) If there is no unacceptable increase in pilot workload or significant adverse effect on crew coordination, and
- 3) If the system is unlikely to introduce a significant hazard if a failure or degradation of the system itself occurs, and

4) If the system is unlikely to introduce a significant additional hazard if other potential failures in the aircraft occur (e.g., engine failure, electrical component failure), and

5) A failure or anomaly in a NAVAID(s) used does not introduce a significant hazard.

Authorized minima for such systems may be no lower than that specified for manual control using visual reference alone.

If low visibility takeoff operations are predicated on the use of RNP, then the provisions applicable to RNP apply only following liftoff, after passing 35 ft. above the published elevation of the runway.

A proof of concept demonstration is necessary for initial authorization of takeoff minima less than RVR300 ft./75m.

Criteria for demonstration of systems eligible for takeoff minima below the level supported by use of visual reference alone are found in section 5.1.3 for operational authorization or Appendix 2 for systems proposed for airworthiness demonstration.

#### **4.3. Landing.**

**4.3.1. Concepts and Objectives.** Category III landing minima are classified as Category IIIa, Category IIIb or Category IIIc. Definitions of these categories are provided in Appendix 1. Visual conditions encountered in Category III operations range from visual references being adequate for manual control during rollout (e.g., Category IIIa) to visual references being inadequate even for taxi operations without special visual reference enhancements or suitable synthetic references. For any Category III operation, the airplane and external system requirements established (e.g., position fixing) should be compatible with any visual reference requirements that are specified.

Category III operations may be conducted manually using Flight Guidance Displays, or automatically using approved autoland system or with Hybrid Systems which employ both automatic and flight guidance elements. If the particular Flight Guidance Display depicts flight director or other command guidance it may be approved in accordance with this AC, or equivalent. Situational Flight Guidance Displays may be used if the Proof of Concept (PoC) is satisfactorily demonstrated. When an automatic system is to be the primary means of control the use of that system should not require pilot intervention. The means for crew intervention must be provided, however, in the unlikely event the pilot detects or strongly suspects inadequate system performance (e.g., the pilot determines that an automatic landing cannot be accomplished within the touchdown zone). If a Hybrid system is employed, then the primary mode of operation must be automatic to touchdown, with manual control used only as an alternate means to complete the operation.

To be approved for Category III operations, the airplane and its associated systems should be shown to be capable of safely completing an approach, touchdown, and rollout and permitting a safe go-around from any altitude to touchdown following any failure condition not shown to be extremely improbable.

Cockpit design, instrumentation, annunciations and warning systems, should be adequate in combination to assure that the pilot can verify that the aircraft should touch down within the touchdown zone and safely rollout if the controlling visibility is reported at or above applicable minima. Systems based on automatic control to touchdown, or touchdown and rollout and manually flown flight guidance system (e.g., HUD), have been approved by FAA. Other concepts may be acceptable if Proof of Concept [PoC] testing can demonstrate an equivalent or greater level of safety as presently specified for approval of automatic systems (e.g., hybrid systems or vision enhancement systems).

To be approved for Category III operations, the airplane and its associated systems should be shown to be able to perform to the necessary level of accuracy, integrity, and availability. This is typically shown initially during airworthiness demonstration, is confirmed during the operational authorization process, and is monitored by the operator on a continuing basis.

Category III operations are predicated on meeting requirements for Category II, or equivalent, for that portion of the approach prior to 100' HAT (see the current version of AC 120-29 for approval of Category II).

If Category III operations are predicated on the use of RNP, then the provisions of this AC or any subsequent current version of AC120-29A, or other suitable FAA criteria for application of RNP are considered to be acceptable to apply to definition of any instrument approach procedure segment down to 100 ft. HAT.

Below 100 ft. HAT, the provisions of this or any subsequent version of AC120-28 are considered to be the applicable criteria to assure the necessary performance for landing, flare and rollout.

For a go-around and missed approach from DA(H), Alert Height (AH), or the end of the touchdown zone for a rejected landing, RNP provisions may be applied from the point of initiation of a go-around to completion of the applicable missed approach procedure, in accordance with provisions of this version of AC 120-29, any subsequent current version, or any other RNP criteria found acceptable to the FAA.

**4.3.2. Fail Operational Category III Operations.** A Fail Operational System is a system which after failure of any single component, is capable of completing an approach, flare and touchdown, or approach, flare, touchdown and rollout by using the remaining operating elements of the Fail Operational system. The failure effects of single components of the system, airplane or equipment external to the airplane which could have an effect on touchdown or rollout performance must be considered when evaluating Fail Operational systems. Fail Operational systems may be used to touchdown for Category IIIa (e.g., without a rollout system) or Category IIIb through rollout to a full stop. Use of a fail-operational system to touchdown in conjunction with a rollout system that is not fail-operational is acceptable as long as a suitable minimum RVR is specified in the operations specifications, for rollout.

This AC contains criteria for approval of minima as low as RVR150 using a fail-operational system for landing and rollout. Approval of minima less than RVR150 would require a proof of concept [PoC] demonstration.

Note: A landing system is considered to include each of the elements in the aircraft which are necessary to perform the landing and rollout function (e.g., flight control, hydraulic system(s), electrical system(s), sensors).

The required redundancy may be provided by multiple automatic landing systems, by multiple automatic landing and rollout systems, by redundant manual flight guidance systems, or by suitably redundant hybrid systems.

The reliability and performance of the required operational systems should be such that continued safe operation to landing, or landing and rollout, can be achieved following any failure condition occurring below the Alert Height that is not shown to be extremely improbable. Systems identified below and in 4.3.3 through sections 4.3.8, or equivalent, are considered to meet the intent of this provision.

Failure conditions which result in the loss or disconnect of all the redundant landing, or landing and rollout systems, occurring below the Alert Height, are permissible if the occurrence of these failure conditions is extremely remote and the loss or disconnect is accompanied by acceptable warning indications for the pilots. Airplanes which are demonstrated to meet the airworthiness assessments of Appendix 3 for fail operational systems are considered to meet these reliability and performance criteria.

The following are typical arrangements which may be acceptable for Fail Operational Systems:

1. Two or more monitored fail passive autopilots or integrated autopilot flight director systems each with dual channels making up an automatic fail operational system designed so that at least one autoflight system remains operative after the failure of one system, and the failed system is not used or cannot cause unacceptable autoflight system performance.

Note: Following a failure with this configuration, it is not intended that a landing be continued with flight director alone, unless a successful Proof of Concept demonstration has been completed.

2. Three autopilots or integrated autopilot flight director systems designed so that at least two remain operative after failure to permit comparison and provide necessary monitoring and protection while continuing to a landing.
3. A monitored fail passive automatic flight control system with automatic landing capability to touchdown and rollout, if applicable, plus an independent and adequately failure protected manual flight guidance system, suitable for landing and rollout with guidance provided for the flying pilot and monitoring displays for the non-flying pilot. A proof of concept demonstration would be necessary for this arrangement.

4. Two independent and adequately monitored manual flight guidance systems with independent displays for the pilot flying and the pilot not flying, each capable of supporting a landing and rollout. A proof of concept demonstration would be necessary for this arrangement.

Aircraft meeting fail-operational requirements of Appendix 3 of this AC, or equivalent, for landing and rollout may be authorized for fail-operational Category III to the lowest currently applicable minima specified in Operations-Specifications for this type of system. As of the publication of this AC, the lowest authorized minima for U.S. operators are Touchdown, Mid, and Rollout RVR of 300ft within the U.S., or 75m internationally.

Aircraft previously demonstrated to meet acceptable fail-operational criteria of earlier AC's or alternate criteria (e.g., suitable JAR criteria) may receive additional credit beyond those already authorized, as specified in provisions of this AC, through appropriate showing of compliance with applicable operational provisions of this AC, and subsequent amendment of applicable operations specifications. An example of aircraft in this category are those B767 or B757 aircraft having statements in the FAA approved AFM indicating they met all fail-op rollout provisions of AC 120-28B or AC 120-28C, except for certain rollout disconnect provisions. Since criteria of AC 120-28D are now revised to alternately address this condition, these aircraft are considered eligible to fully meet Appendix 3 provisions for fail-operational rollout and may be operationally authorized for landing minima accordingly (also see 4.3.8).

Aircraft with a fail operational landing system but without a rollout system, that were originally approved in accordance with AC 120-28, AC 120-28A, AC 120-28B or AC 120-28C, may typically be approved for minima not less than Touchdown Zone, Mid and Rollout RVR600. Eligibility for RVR600 requires compliance with appropriate current service bulletins in accordance with the manufacturer's recommendations, and a determination by FAA that "in-service" operational performance of the system is acceptable.

Aircraft with a fail operational landing system and a rollout system, or a fail operational landing system and a fail passive rollout system originally approved in accordance with FAA "Special Conditions" for a rollout system, or criteria of AC120-28, AC120-28A, or AC120-28B are now considered to have rollout capability equivalent to fail operational and may typically be approved for minima not less than Touchdown Zone, Mid, and Rollout RVR300. Current models in this group found acceptable include the L1011, A300, DC10-30, certain DC10-10s or DC10-40s with suitably upgraded avionics equipment equivalent to currently FAA approved DC10-10s or -30s, and late model B747-200 or -300 aircraft with appropriate versions of the triple channel SPZ-1 autopilot and a rollout system. For these aircraft, appropriate current service bulletin compliance should be reviewed and completed, and line operational performance of the system must be shown to be acceptable. However it is important to note that, as with other aircraft types, Category III authorization for some of these aircraft may be restricted to certain runway facilities since landing or rollout performance may not necessarily be

acceptable due to site specific irregular underlying approach terrain, touchdown zone slope, or ILS beam characteristics.

**4.3.3. Alert Height.** Fail-operational Category III is based on use of an Alert Height (see Appendix I). An Alert Height is the height above a runway based on characteristics of the airplane and its Fail Operational System, above which a Category III approach must be discontinued and a missed approach initiated if a failure occurred in one of the redundant parts of the flight control or related aircraft systems, or if a failure occurred in any one of the relevant ground systems. Use of an Alert Height is consistent with the design philosophy which requires that an aircraft be capable of safely completing a touchdown and rollout (if applicable) following a failure occurring after passing the point at which the Alert Height is specified.

Operational Alert Heights must always be equal to or lower than that specified in the airworthiness demonstration, and may be specified at or below 200 ft. HAT. The Alert Height is specified by an operator of an aircraft and approved by the FAA. The operational Alert Height used must be consistent with the aircraft design, training, ground facilities, and other factors pertinent to the air carriers operation. Typically a minimum usable operational alert height is 50' HAT. However lower Alert Heights may be approved if there is an appropriate reason to do so (e.g., for certain types of hybrid systems).

Airworthiness demonstration of an Alert Height is as specified in Appendix 3. In order to assure the necessary reliability of aircraft systems, airworthiness demonstrations of Alert Height should be from an altitude of at least 200 ft. above the touchdown zone elevation.

**4.3.4. Fail Passive Category III Operations.** A Fail Passive System is a system which in the event of a failure, causes no significant deviation of aircraft flight path or attitude. The capability to continue the operation may be lost and an alternate course of action (e.g., a missed approach) may be required. A fail-passive system is the minimum capability system acceptable for Category III operation with a Decision Height not less than 50 ft. HAT.

Fail Passive Approach Operations are conducted with a decision height not lower than 50 ft., and are limited to RVR values which provide suitable visual reference to address normal operations as well as failure contingencies. Since a Fail Passive Category 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 remote, a DH is specified. A DH is established to assure that prior to passing that point the pilot is able to determine that adequate visual reference exists to allow verification that the aircraft should touchdown in the touchdown zone. If this visual reference is not established prior to passing DH, a missed approach must be initiated. After passing DH, a missed approach will also be initiated if visual cues are lost, or a reduction in visual cues occurs which prevents the pilot from continuing to verify the aircraft is in a position which will permit a landing in the touchdown zone. In the event of a failure of the airborne system at any point in the approach to touchdown, a

missed approach is required. However, this provision does not preclude a pilot's authority to continue an approach if continuation of an approach is considered by the pilot to be a safer course of action.

Such a failure however, does not preclude continuation to a Category I or Category II minima if the necessary remaining elements of the aircraft system are operational and if the crew qualification addresses necessary action to continue such an approach are met. Any adjustments to approach minima or procedures made on final approach should be completed at a safe altitude (e.g., above 500 ft. HAT).

The need to initiate a go-around below 100 ft. AGL due to an airplane failure condition should be infrequent. In addition, an aircraft using a Fail Passive system for Category III should be shown to provide the capability to touch down in the touchdown zone or to complete a safe manual or automatic go-around from any altitude to touchdown following any failure condition not shown to be extremely improbable.

Typical arrangements which may be used to meet the requirements for Category III fail passive operations using a 50 ft. Decision Height include the following:

1. A single monitored automatic flight control system with automatic landing capability.
2. A fail operational automatic flight control system with automatic landing which has reverted to a Fail Passive configuration or has been dispatched in a fail-passive configuration.
3. A monitored flight guidance system (e.g., HUD) designed for manual control by the pilot flying, and for monitoring by the pilot not flying. Aircraft intended for Fail Passive Category III operations should have aircraft systems which meet the criteria specified in Appendix 3. Aircraft previously demonstrated to meet earlier Fail Passive criteria may continue to operate using Category III minima in accordance with approved operation specifications.

**4.3.5. Decision Altitude (Height).** For Category II and certain Category III procedures (e.g., when using a Fail-Passive landing system) a Decision Height (or an equivalent IM position fix) is used as the controlling minima. The "Altitude" value specified is considered as advisory. The altitude value is available for cross reference. Use of a barometrically referenced DA for Category III is not currently authorized for part 121, 129 or 135 operations at U.S. facilities.

A Decision Height is applied to all Fail Passive operations and is specified at certain locations where fail operational minima is authorized. For Category III, a Decision Height is usually based on a specified radio altitude above terrain on the final approach or touchdown zone. The Decision Height is established to assure that prior to passing that point the pilot is able to determine that adequate visual reference exists to allow verification that the aircraft should touch down in the touchdown zone.

For Category I, a DA(H) is specified as the minimum altitude in an approach by which a missed approach must be initiated if the required visual reference to continue the approach has not been

established. The "Altitude" value is typically measured by a barometric altimeter or equivalent (e.g., Middle Marker) and is the determining factor for minima for Category I Instrument Approach Procedures. The "Height" value specified in parenthesis is typically a radio altitude equivalent height above the touchdown zone (HAT) used only for advisory reference and does not necessarily reflect actual height above underlying terrain. The DA element of a DA(H) is applicable to Category III only in the event that an approach is considered to revert to Category I or Category II minima following airborne equipment failure, ground facility status, or other similar condition permitting an approach to be conducted to pertinent Category I or II minima.

**4.3.6. Go-Around Safety.** An aircraft approved for Category III should be capable of safely executing a go-around from any point in an approach prior to touchdown with the aircraft in a normal configuration, or specified non-normal configuration (e.g., engine out if applicable). It is necessary to provide for go-around due to Air Traffic Services contingencies, rejected landings, loss of visual reference, or missed approaches due to other reasons. The evaluation of this capability is based on normal, or specified non-normal, Category III operations at the lowest controlling RVR authorized and should account for factors related to geometric limitations during the transition to go around, limited visual cues, auto-pilot mode switching and other pertinent factors. For aircraft in which a go-around from a very low altitude may result in an inadvertent touchdown, the safety of such a procedure should be established considering its effect on related systems, such as operation of auto spoilers, automatic braking systems, autopilot mode switching, autothrottle mode, reverse thrust initiation and other systems associated with, or affected by, a low altitude go-around.

Except for failure conditions shown to be extremely improbable, a safe go-around must be possible from any point on the approach to touchdown.

If an automatic go-around capability is provided, it should be demonstrated that a go-around can be safely initiated and completed from any altitude to touchdown. If the automatic go-around mode can be engaged at or after touchdown, it should be shown to be safe. The ability to initiate an automatic go-around at or after touchdown is not required.

**4.3.7. Category IIIa.** In accordance with ICAO definitions of Category III, Category IIIa operations may be conducted with either Fail Operational or Fail Passive systems. The lowest approvable landing minima for Category IIIa is RVR700 or a foreign equivalent of 200 meters.

Note: For certain Category III operations using fail passive systems that were formerly limited to RVR700, but now are eligible for authorization to RVR600, see paragraph 4.3.8 (Most Category III operations authorized for RVR700 prior to issuance of this AC are now eligible for authorization to RVR600, upon request of the operator for issuance of a revision to that operator's pertinent OpSpecs).

Category IIIa operations with fail passive systems are conducted using a 50 ft. Decision Height.

Category IIIa operations using a fail operational system with a rollout control system are generally conducted using an Alert Height, and not a Decision Height. Visual reference is not a specific requirement for continuation of the approach or touchdown.

Category IIIa operations using a fail operational system without a rollout control system installed require establishment of suitable visual reference with the touchdown zone prior to touchdown.

For any of the above systems there should be a sufficient combination of information from flight instruments, annunciations, and alerting systems to assure that the pilot can verify that the aircraft should touch down within the touchdown zone, and safely initiate rollout.

Unless otherwise specified by FAA, aircraft having operation specifications authorizing RVR700 as of the effective date of this AC, may continue to use those minima without additional demonstration.

Aircraft demonstrated to meet airworthiness provisions of AC 120-28B or AC 120-28C for Fail Passive systems remain eligible for any previously approved operational authorization under provisions of this AC and do not require additional airworthiness demonstration. Aircraft previously having completed an airworthiness demonstration in accordance with AC 120-28C remain eligible for any operational authorization that was permitted by AC 120-28C.

Aircraft demonstrated to meet airworthiness criteria prior to AC 120-28B, and not currently authorized in operations specifications for Category III may be approved for new Fail Passive Category III operations on a case-by-case basis depending on facilities to be used, service bulletin compliance status and other relevant safety factors.

Aircraft, including wide body aircraft such as the DC-10, L1011 and B 747, which are authorized for fail-operational Category III, but have not been demonstrated to meet the provisions for Fail Passive systems shown in Appendix 3, may be approved for Fail Passive operations with landing minima limited to RVR1000 provided the following criteria are met:

1. The aircraft must be shown to be in compliance with relevant service bulletins for the applicable flight control system and displays.
2. An auto throttle system must be installed and operational.
3. The system must be shown to provide reliable auto land performance in line operations.
4. A demonstration using a simulator or aircraft must be completed for that operator and aircraft type, showing that the system and procedures applicable to Fail Passive operations can be practically applied for that air carrier's operation.

Wide body aircraft types not previously authorized or currently authorized by FAA to use minima less than RVR1000 based on a fail passive system must meet the airworthiness requirements of Appendix 3 or equivalent for any new authorization of minima less than RVR1000.

New aircraft types or derivative aircraft with new flight control system designs should be demonstrated in accordance with Appendix 3 for Fail Passive systems, or equivalent requirements, if fail passive authorization is sought.

**4.3.8. Category IIIb.** Category IIIb operations are usually conducted with fail operational systems. Fail passive landing systems may be used, but are limited to Category IIIb minima not less than touchdown zone RVR600 (175 m). Airborne systems used for Category IIIb authorized for landing below touchdown zone RVR600 (175 m) must include either a manual flight guidance or automatic rollout or control system for lateral steering which provides the means to control the aircraft until the aircraft slows to a safe taxi speed. Category IIIb operations based on fail operational systems require the use of systems which after passing Alert Height, are capable of the safe completion of the approach, touchdown, and rollout, following any failure conditions not shown to be extremely remote. When fail operational systems are used, they do not necessarily require that operating procedures specify that the approach must necessarily be continued after a failure.

Category IIIb operations based on fail passive landing systems meeting provisions of Appendix 3 of this AC, or equivalent, must use a decision height not less than 50 ft. HAT.

For Category IIIb operations based on fail operational systems, the availability of visual reference is not a specific requirement for continuation of an approach to touchdown. The design of flight instrument systems, annunciations, and alerting systems should be adequate to assure that the pilot can verify the aircraft should touch down within the touchdown zone, and rollout.

Category IIIb operations may be conducted to a touchdown zone RVR and relevant mid or rollout RVR not less than 600 ft. with a fail operational or fail passive landing system without a rollout control system.

Category IIIb operations may be conducted to a touchdown zone RVR of not less than 600 ft. and an relevant mid or rollout RVR not less than RVR400 with a fail operational or fail passive landing system and with any FAA approved rollout control system.

Category IIIb operations may be conducted to a touchdown zone, and relevant mid, and rollout RVR minima not lower than RVR400 (125 m) when using a fail operational landing system and a rollout control system shown to meet Fail Passive criteria of Appendix 3 (or earlier FAA criteria applicable to a rollout system).

Category IIIb operations may be conducted to a touchdown zone RVR, and relevant mid, and rollout RVR minima not less than RVR150 (50 meters) with a fail operational landing system and a rollout control systems shown to meet the Fail Operational criteria of Appendix 3, or earlier equivalent criteria.

See **NOTE** below for criteria, and **Section 4.3.2** above for examples of various aircraft types, systems, and minima which may be authorized.

**NOTE:** Since amended criteria is specified for fail operational rollout control systems in Appendix 3 of this circular, certain systems previously certificated using earlier criteria of AC120-28C or AC120-28B that at the time of certification were not considered fail operational due to certain conditions that were noted in the AFM as exceptions, but now are considered to meet fail operational criteria, may now be considered as fail operational for the purpose of authorizations under this paragraph.

Accordingly, systems considered to be eligible for this credit are those systems which otherwise previously met all provisions for a fail operational rollout control system as described in Appendix 3 of AC120-28C (or earlier AC 120-28A or B equivalent) except for provisions related to inadvertent control wheel autopilot disconnect and level of redundancy required for nosewheel steering function. Each of these provisions are now revised in Appendix 3.

Operators seeking additional allowable credit for these newly re-classified fail-operational rollout control systems may apply for corresponding minima adjustment through amended operations specifications. "Relevant" or "applicable" mid or rollout RVR is considered to be any transmissiometer report (or equivalent instrumentally derived RVR measurement) considered to be covering a portion of the runway where the aircraft is operating at a speed above a safe taxi speed.

A summary of the minima that may now be authorized based on the above criteria are shown below in table 4.3.8-1.

Landing System Type	Rollout System Type	TDZ RVR (ft)**	Mid RVR (ft)**	Rollout RVR (ft)**
Fail Op or Fail Passive*	No Rollout system	600	600	600
Fail Op or Fail Passive*	Any FAA Approved Rollout System	600	400	400
Fail Op*	Fail Passive*	400	400	400
Fail Op*	Fail Op*	150	150	150

**Lowest Minima Authorized for Fail Operational or Fail Passive Landing Systems, or  
Landing and Rollout Systems**  
**Table 4.3.8 -1**

Table 4.3.8-1 Notes:

\* Note: Fail Op denotes a Fail Operational Flight Guidance System  
Fail Passive denotes Fail Passive Flight Guidance System

\*\* Note: RVR values are shown in U.S. facility units of feet and as Touchdown zone, Mid, and Rollout RVR values, but corresponding metric values or other designated RVR reporting locations may be applied internationally, if acceptable to the State of the Aerodrome.

Equivalent minima may be specified for systems demonstrated to meet earlier airworthiness criteria of AC 120-28B or AC 120-28C. Credit for systems demonstrated prior to AC 120-28B will be as designated in approved operations specifications or as designated by AFS-400 for new Category III applications using such aircraft.

#### **4.3.9. Runway Field-Length.**

a. The Runway Field-Length for Category III is as specified by section 121.195 for a wet runway, if each of the following conditions are met:

1. Anti-skid systems are operative (if installed for the aircraft type).
2. The runway surface braking action is expected to be at least "fair" or better (or equivalent Runway Condition Reading, James Brake Devise, or Tapley reading).

In the event that either of the above conditions are not met, the factor to be applied to the section 121.195b distance is 1.3, unless otherwise demonstrated to the FAA that a factor less than 1.3 is acceptable (e.g., due to other factors, such as the required use of an auto brake system).

b. Once airborne, additional consideration of Category III landing field length by the flightcrew is not required for normal operations. In the event of un-forecast adverse weather or if failures occur, the crew and aircraft dispatcher should consider any adverse consequences that may result from a decision to make a Category III landing (e.g., braking action reports). Category III operations should not normally be conducted with braking action less than "fair".

c. When auto brake systems are used for Category III, information must be available to the flightcrew to assist in making the proper selection of a suitable auto brake setting consistent with the field length available for landing and the runway condition, including braking action.

**4.3.10. Landing System Sensors (NAVAID's) and Aircraft Position Determination.** Various landing system sensors (NAVAID's) or combinations of sensors may be used to provide the necessary position fixing capability to support authorization of Category III landing weather minima. While certain navigation sensors (NAVAID's) are installed and classified primarily based on landing operations, the sensors described in this section may also be used for takeoff, missed approach, or other operations (e.g., RNAV position determination). Regardless of the sensors, NAVAID's, or combination of

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NAVAID's used, the NAVAID's and sensors must provide coverage for the intended flight path and for anticipated displacements from that flight path for normal operations, rare normal operations (e.g., winds and wind gradients), and for specified non-normal operations where applicable (e.g., "engine-out go-around" flight path). In addition, Category III authorizations should be consistent with the provisions or characteristics for specific sensors listed below in 4.3.10.1 through 4.3.10.3 unless otherwise accepted or approved by FAA.

**4.3.10.1. Instrument Landing System (ILS).** The ILS provides a reference signal aligned with the runway centerline and deviation signals when the airplane is displaced left or right of the extended runway centerline. The linear coverage area for this signal is approximately 3 degrees either side of the extended runway centerline from a point emanating at the far end of the runway. The ILS also provides a vertical flight path (nominally 3 degree descent angle) to a point in the landing zone of the runway. The vertical coverage is approximately 0.7 degrees on either side of the vertical reference path. ILS characteristics should be considered as defined in ICAO Annex 10, unless otherwise specified by FAA. U.S. ILS systems are classified by Type, as defined in FAA Order 6750.24 as amended (e.g., II/D/2).

**4.3.10.2. Microwave Landing System (MLS).** The MLS provides a reference signal aligned with the runway centerline and deviation signals when the airplane is left or right of the extended centerline. The linear coverage area is approximately 40 degrees either side of the extended runway centerline emanating from a point at the far end of the runway. The MLS provides a vertical flight path to the runway similar to ILS. MLS characteristics should be considered as defined in ICAO Annex 10, unless otherwise specified by FAA. U.S. MLS systems are classified by Type, similar to ILS.

**4.3.10.3. GPS/GNSS Landing System (GLS).** GLS is a landing systems based upon the Global Navigation Satellite System (GNSS). For Category III operations the landing system typically includes a local area differential augmentation system in the vicinity of the runway for which a Category III procedure is specified. The local area system may serve one or more runways, or nearby airports, depending on its classification for each particular runway. The classification of a GLS service may be different for different runway ends (e.g., III/E/3 for Runways 14L and 14R, but I/D/1 for RW 22L). Desired path, centerline, and deviation signals as applicable, are computed by airborne avionics. The coverage area for GLS is typically at least within a 25 mile radius of a primary airport, but extended service volumes are permitted. GLS provides for both vertical and lateral flight path specification to the touchdown zone of the runway(s) served, and a lateral path for rollout or takeoff guidance. GLS characteristics should be considered as defined in ICAO Annex 10, unless otherwise specified by FAA (e.g., FAA accepted references to RTCA SC-159 MASPS).

U.S. GLS systems should be operationally classified by "Type" for each runway end served, similar to ILS (e.g., GLS II/D/2). The operational classification is intended to address at least the service provided in terms of "Type of service or performance level", "area of service" relative to each specific runway served, and level of availability or continuity. As with ILS, the classification schema should not be specified in terms of specific minima Categories (e.g., Category III), since onboard aircraft equipment capability or other factors may determine actual minima to be authorized.

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GLS systems are intended to provide equivalent or better service to that provided by a U.S. Type I ILS, including: 1) Adequate guidance over the runway for takeoff or landing rollout (e.g., autoland), and 2) Vertical guidance on approach down to at least 100' HAT. GBAS local area augmentation systems (e.g., LAAS) are usually considered to support this objective. Wide area augmentation systems (e.g., WAAS, EGNOS) are typically considered to be RNAV systems, and are not alone considered to be GLS.

Authorization for use of GLS is for each specific air carrier, aircraft, and GLS system type until pertinent GLS international standards accepted by FAA are promulgated.

**4.4. RNAV/Flight Management Systems (FMS).** RNAV/Flight Management Systems (FMS) are typically used in conjunction with Category III Instrument Approach Procedures only for initial or intermediate approach segments, or for missed approach.

For departure, RNAV/Flight Management Systems (FMS) may be used for non-visual takeoff guidance after passing the height at which LNAV or VNAV may respectively be engaged or made active, or above 35' AGL, whichever is higher. Other applicable FAA criteria (e.g., section 121.189) must be addressed for takeoff. For development or authorization of departure procedures which follow completion of a low visibility takeoff, FAA Orders 8260.40A, 7100.1, or other applicable RNAV/RNP criteria should be consulted.

Procedures based on 3D or 2D RNAV may or may not include use of RNP. For RNP operations, see section 4.5 below.

**4.5. Required Navigation Performance (RNP).** A definition for Required Navigation Performance (RNP) is specified in Appendix 1. Standard Levels of RNP typically used for various initial, intermediate approach and missed approach segments for Category III procedures may be based on specific landing systems (e.g., ILS, MLS, or GLS), on multisensor RNAV (e.g., FMS with IRS, VOR, DME inputs), or on other aircraft navigation systems having FMS like capabilities (e.g., GPS Navigation Systems).

RNP applications used for a final approach segment supporting a Category III procedure are typically be based on use of a specific landing system sensor (e.g., ILS, MLS, or GLS), or on multisensor RNAV systems having suitable flight critical performance.

Aircraft/systems RNP capability is typically determined by assessing RNP total system error components, Path Definition Error (PDE), Position Estimation Error (PEE) and Flight Technical Error (FTE). In addition to total system error (TSE) components, associated assurance limits are considered to determine what levels of navigation performance may actually be achieved with integrity. Assessment may specify that certain RNP levels may only be achieved with flight director or autopilot coupled operation, or that for particular applications availability must be based on use of dual independent navigation systems (e.g., as with the/E equipment classification).

**4.5.1. Standard RNP Types.** Standard values of RNP supporting initial, intermediate, or final approach segments, or missed approach segments applicable to Category III procedures are as specified in Table 4.5.1-1 below.

**Table 4.5.1-1**  
**STANDARD RNP TYPES APPLICABLE TO Category III**

RNP Type	Applicability/Operation (Approach segment)	Normal Performance (95%)	Containment Value
RNP 1	Initial/Intermediate/ Missed approach	+/- 1 nm	+/- 2 nm
RNP 0.5	Initial/Intermediate/ Missed approach	+/- 0.5 nm	+/- 1 nm
RNP 0.3	Initial/Intermediate/ Missed approach	+/- 0.3 nm	+/- 0.6 nm
RNP levels as specified for lowest Category I	Final approach/ initial missed approach (but not below 200' HAT)	(See AC 120-29, as amended)	(See AC 120-29, as amended)
RNP levels as specified for Category II	Final approach/ initial missed approach (but not below 100' HAT)	(See AC 120-29, as amended)	(See AC 120-29, as amended)
RNP 0.003/15	Final approach/ initial missed approach (any altitude)	+/- 0.003 nm +/- 15 ft. (*)	+/- 0.006 nm +/- 30 ft. (*)

(\*) Note: vertical accuracy does not apply below 100 ft. HAT - below 100 ft. HAT vertical performance is determined by applicable standards for touchdown performance.

RNP is a required navigation performance level described by the specification of a numeric value indicating the required navigation accuracy for a specific operation, typically specified laterally in nautical miles - e.g., RNP 1 is a Required Navigation Performance of  $\pm 1$  nautical mile (95% Probability).

RNP containment is specified as RNP(X) times two (i.e., RNP(X) x 2).

Standard RNP Levels are defined for lateral performance, or lateral and vertical performance, if applicable.

Regarding containment, the probability of exceeding the containment value without annunciation should be assessed by some acceptable method. If assessed during an airworthiness demonstration program during type design or STC, this probability should be considered to be at least remote (e.g., a major failure

condition). If based on “fleet qualification” (e.g., use of criteria such as contained in RTCA DO-236 Appendix D for RNP) alternative methods, procedures or buffers may be used to assure protection of containment.

Operationally, containment is typically used in procedures or separation standards in conjunction with other operational verification procedures, other systems (e.g., TCAS, EGPWS), or operational buffers to satisfactorily address assurance of safe operations and contingencies. This is to provide for safety in the unlikely event operation within the containment region cannot be maintained.

In the event that operational procedures or other technical methods are not available to assure safety in the event of loss of containment, then potential for loss of containment situations may need to be addressed in a hazard assessment specifically keyed to an example of the intended application or operation. More demanding uses of containment may require a higher level of assurance or a more complex or comprehensive backup or contingency mechanism (e.g., use of an RNP Level for specification of a lateral path for Category III flare and rollout).

**4.5.2. Non-Standard RNP Types.** Non-Standard RNP Types are those RNP values other than as specified in paragraph 4.5.1. Non-Standard RNP Types are authorized by FAA on a case by case basis where an applicant has a demonstrated need for such use.

**4.6. Flight Path Definition.** The following parameters, path points, or definitions may be used as a technical basis for a variety of other references or terms eventually necessary to prepare or implement procedures or development criteria. This section is intended to provide a technical basis for preparation of operational concepts for use with RNAV and RNP based systems (e.g., to serve as a technical basis for preparation of procedures criteria, operations concepts, operational manuals, or operational authorizations). Actual procedural information, manuals, training materials and other documents used by operators, pilots, procedure developers or others who may need to apply this information may use simplified or summarized forms of this information, as necessary, to satisfy their particular operational requirements.

Note: The path points and segments addressed below are those considered necessary to support definition and operational use of systems intended for Category III. For commonality, their definition and use are intended to be consistent with Category I and Category II. It should be noted, however, that various GNSS or other RNAV applications or criteria currently use or propose use of other similar points or waypoints, use different terminology, or use different definitions for points (e.g., Landing Threshold Waypoint). Accordingly, since U.S. and international terminology and definitions for such points are evolving, it is important to confirm and assure suitability of each point used, for consistency of terminology, suitable definition, and suitable application.

**Landing and Rollout Flight Path** - The following criteria specifies certain reference points and other criteria necessary to effectively implement landing and rollout operations using a landing system where the required flight path is not inherent in the signal structure of the navigation aid (e.g., satellite systems). The location of points used to describe the landing and rollout flight path are shown in Figure 4.6-1.

**Runway Datum Point (RDP)** - The RDP is used in conjunction with the FPAP and a vector normal to the WGS-84 ellipsoid at the RDP to define the geodesic plane of a final approach flight path to the runway for touchdown and rollout. It is a point at the designated lateral center of the landing runway defined by latitude, longitude, and ellipsoidal height. The RDP is typically a surveyed reference point used to connect the approach flight path with the runway. The RDP may or may not necessarily be coincident with the designated runway threshold.

**Flight Path Alignment Point (FPAP)** - The FPAP is used in conjunction with the RDP and a vector normal to the WGS-84 ellipsoid at the RDP to define the geodesic plane of a final approach and landing flight path. The FPAP may be the RDP for the reciprocal runway.

**Flight Path Control Point (FPCP)** - The FPCP is a calculated point located above the RDP in a direction normal to the WGS-84 ellipsoid. The FPCP is used to relate the vertical descent of the final approach flight path to the landing runway.

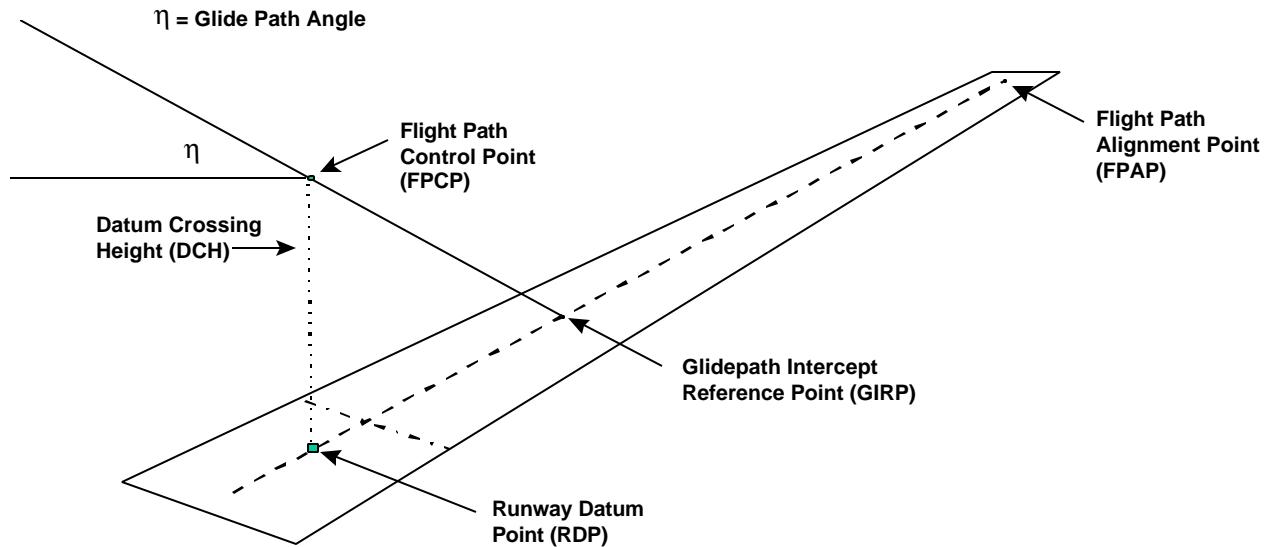
**Datum Crossing Height [DCH]** - The height (feet) of the FPCP above the RDP.

**Glide Path Angle [GPA]** - The glide path angle is an angle, defined at the FPCP, that establishes the descent gradient for the final approach flight path of an approach procedure. It is measured in the geodesic plane of the approach (defined by the RDP, FPAP, and WGS-84 ellipsoid's center). The vertical and horizontal references for the GPA are a vector normal to the WGS-84 ellipsoid at the RDP and a plane perpendicular to that vector at the FPCP, respectively.

**Glidepath Intercept Reference Point [GIRP]** - The GIRP is the point at which the extension of the final approach path intercepts the runway.

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**Figure 4.6-1**



The locations established for, and the values assigned to, the **RDP**, **FPCP**, **DCH** and **GPA** should be selected based upon the operational need to establish the **GIRP**. Operational considerations include:

1. Path of wheels over threshold,
2. Need for coincidence with other aids and systems - visual and non-visual, or markings
3. Runway characteristics (e.g., local slope in the touchdown zone, general runway upslope or downslope, runway lateral crown),
4. Actual displaced thresholds or multiple runway thresholds,
5. Actual clearways or stopways
6. Construction temporary requirements

**Takeoff Flight Path.** The flight path for low visibility takeoff (while on the runway) should be defined by the RDP and FPAP.

**4.7. Engine Inoperative Category III.** The basic concept addressing expected flightcrew response to non-normal situations, such as typically represented by an engine failure, is described in Section 6.1.8.

Engine Inoperative Category III is specifically addressed because for some modern aircraft and systems it is possible to retain and address Category III operating capability, as an alternate configuration. This is to aid operators and pilots in planning for and selecting more desirable and fully considered landing airports that may be closer in distance or time, have less adverse weather in terms of icy or short runways with adverse winds, are better equipped to handle a diversion or emergency, or provide a timely return to land at a takeoff airport or a closer takeoff alternate airport, in the unlikely event of engine failure or other serious problem related to the engine failure.

With pre-planned engine inoperative Category III capability, airports and minima that otherwise may not be considered acceptable for use could be selected by the pilot or operator without having to subsequently justify its use based on emergency authority. This capability also has the advantage of allowing for full pre-assessment of the aircraft capability, and engine inoperative aircraft configurations (e.g., flap settings, electrical system capability, hydraulic system capability), approach procedure characteristics, missed approach performance and other factors that may be difficult to assess in real time if not previously assessed.

This capability also can permit an operator some additional flexibility in selecting alternate airports.

Accordingly Section 5.17 describes aircraft and airborne system criteria for credit for engine inoperative Category III capability. Sections 7.1.3 item 10, and 7.2.6 address crew qualification. Section 10.8 addresses operational authorization and selection and use of alternates.

## **5. AIRBORNE SYSTEMS.**

### **5.1. General.**

**5.1.1. Airborne Systems.** Airworthiness criteria for airborne systems intended to meet criteria in this AC are specified in paragraph 5.1.3 through 5.19 below for operational authorizations, or Appendix 2 for takeoff, or Appendix 3 for landing and rollout for airworthiness demonstration of new or modified aircraft types or systems.

Aircraft shown to meet provisions of Appendix 2 or 3 respectively, are considered to meet provisions of this section.

For aircraft approved using earlier versions of this AC, airworthiness criteria for airborne systems intended for Category III operations are as specified in criteria referenced by the approved AFM.

Airborne equipment listed in this section needs to be operative for Category III, in accordance with provisions of applicable standard Operations Specifications (OpSpecs) and Operations Specifications for that operator. Airframe manufacturers and individual operators may also include other optional equipment as part of the Category III configuration, however, that equipment does not need to be operative to conduct a Category III approach unless required by that operator's OpSpecs.

Airborne systems making use of RNP capability for approach segments or missed approach segments should be approved in accordance with or consistent with any one or more of the following criteria or processes:

- 1) FANS I or FANS A systems approved through a certification program acceptable to FAA, or
- 2) Through reference to an acceptable standard such as RTCA DO-236 for RNP, or
- 3) Through reference to RTCA DO-236 Appendix D for "fleet qualification" of existing aircraft, or
- 4) Through other FAA or FAA accepted equivalent criteria for intended for application or approval of RNP (e.g., TERPS or PANS-OPS RNP provisions as adopted).

**5.1.2. Non-Airborne Systems.** Unless otherwise specified in the Appendices to this AC, NAVAID/landing system characteristics, including facility classification, should be considered as specified in Section 4.3.10 above and AC 120-29 for ILS, MLS or GLS (e.g., U.S. use of ICAO Annex 10 Criteria, FAA Order 6750.24 as amended, and the applicable NAVAID facility classification for Category III). NAVAID facility use is predicated on applicable ILS, MLS, or GLS Type classifications (e.g., ILS III/E/2, GLSII/D/2) or equivalent classification at non-U.S. facilities. Specific Navigation Services are addressed in Section 5.12.

**5.1.3. Takeoff Guidance Systems.** When takeoff minima are predicated on use of a takeoff guidance system, the takeoff guidance system should be demonstrated to meet provisions of this paragraph or provisions specified in Appendix 2 by an airworthiness demonstration. Takeoff guidance systems which have been shown to meet Appendix 2 by airworthiness demonstration and have a corresponding AFM reference are typically considered to meet requirements of this paragraph.

A takeoff guidance systems shall be demonstrated to show that the airplane will not deviate significantly from the runway centerline during takeoff while the system is being used within the limitations established for it. Compliance may be demonstrated by flight test, or by a combination of flight test and simulation. Flight testing must demonstrate repeatable performance, and cover those factors affecting the behavior of this airplane (e.g., wind conditions, ILS characteristics, weight, center of gravity). Compliance with the performance envelope should be demonstrated with pilots appropriately qualified to use the airborne system, and should not require extraordinary skill, training or proficiency.

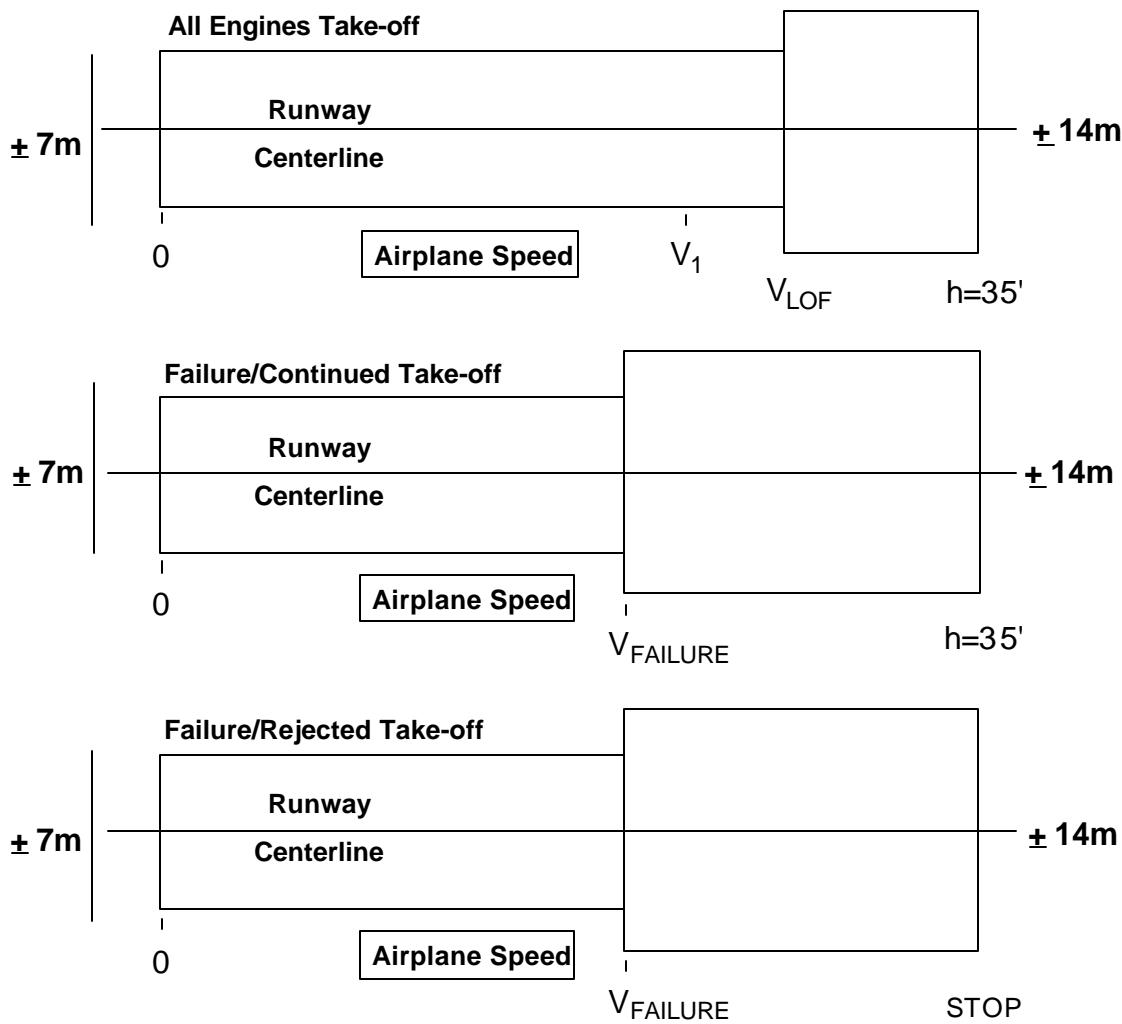
Demonstrated winds should be 150% of the winds for which credit is sought, but not less than 15 knots of headwind or crosswind.

In the event that the airplane is displaced from the runway centerline at any point during the takeoff or rejected takeoff, the system must provide sufficient guidance to enable the "pilot flying", or the pilot in command who may assume control and become the "pilot flying", to control the airplane smoothly back to the runway centerline without significant overshoot or any sustained nuisance oscillation.

Figure 5.1.3-1 provides the performance envelope for evaluating takeoff command guidance systems for the following scenarios:

- a. Takeoff with all engines operating
- b. Engine Failure at  $V_{ef}$  - continued takeoff
- c. Engine Failure just prior to  $V_1$  - rejected takeoff
- d. Engine Failure at a critical speed prior to  $V_{mcg}$  rejected takeoff: ( $V_{ef} < V_{mcg}$ )

Note: For that portion of the flight path following liftoff, the demonstrated lateral path may be adjusted for any effect of wind drift when showing compliance with the performance envelope below.



**FIGURE 5.1.3-1.**

**5.2. Airborne Systems for Category III Minima Not Less than RVR600.** The following equipment in addition to the instrument and navigation equipment required by 14 CFR part 91 for IFR flight is the minimum aircraft equipment considered necessary for Category III:

1. A redundant flight control or guidance system, demonstrated in accordance with Appendix 3, or for aircraft types previously demonstrated acceptable earlier criteria described in previous versions of AC 120-28 as amended, or acceptable international criteria, such as the JAR AWO.

Acceptable flight guidance or control systems include the following:

- a. A Fail Operational or Fail Passive automatic landing system at least to touchdown, or
- b. A Fail Operational or Fail Passive manual flight guidance system providing suitable head-up or head-down command guidance, and suitable monitoring capability at least to touchdown, or
- c. A hybrid system, using automatic landing capability as the primary means of landing at least to touchdown.
- d. Other system which can provide an equivalent level of performance and safety.

NOTE: For system concepts not currently approved by FAA or system concepts not addressed by Appendix 3, a proof of concept demonstration is required prior to either airworthiness or operational consideration for approval.

2. An automatic throttle or automatic thrust control system which meets Appendix 3, or appropriate earlier criteria as specified in an FAA-approved AFM. However, for operations with a 50 foot Decision Height, or other operations that have specifically been evaluated such as for engine inoperative landing capability, automatic throttles may not be required if it has been demonstrated that operations can safely be conducted, with an acceptable work load, without their use.
3. At least two independent navigation receivers/sensors providing lateral and vertical position or displacement information, typically with the first pilot's station receiving information from one and the second pilot's station receiving information from the other. The navigation receivers/sensors must meet the criteria specified in Appendix 3 or equivalent, or must meet an earlier acceptable criteria as specified in an FAA AFM (e.g., 2 ILS localizer and glide slope receivers meeting performance requirements of AC 120-28C; Appendix 1, paragraph 7a & b).
4. At least two approved radio altimeter systems which meet the performance requirements outlined in Appendix 3, or acceptable earlier criteria, as specified in an FAA AFM, typically with the first pilot's station receiving information from one and the second pilot's station receiving information from the other.
5. Failure detection, annunciation, and warning capability, as described in Appendix 3, or as determined acceptable by earlier criteria, such as 120-28C; Appendix 1, paragraph 7c & 7g, and specified in an FAA AFM.
6. Missed approach guidance provided by one or more of the following means:

- a. Attitude displays which include suitable pitch attitude markings, or a pre-established computed pitch command display.
  - b. An approved flight path angle display, or
  - c. An automatic or flight guidance go-around capability.
7. Suitable forward and side flight deck visibility for each pilot, as specified in 5.13.1.
  8. Suitable windshield rain removal, ice protection, or defog capability as specified in 5.13.2.

### **5.3. Airborne Systems for Category III Minima Less Than RVR600.**

**5.3.1. Airborne Systems for Category III Minima Not Less than RVR400.** The following equipment in addition to the instrument and navigation equipment required by part 91 for IFR flight is the minimum aircraft equipment considered necessary for Category III operations to minima less than RVR600 but not less than RVR400:

1. A redundant flight control or guidance system, demonstrated in accordance with Appendix 3, or for aircraft types previously demonstrated acceptable earlier criteria described in previous versions of AC 120-28 as amended, or acceptable international criteria, such as the JAR AWO.

Acceptable flight guidance or control systems include the following:

- a. A Fail Operational landing system with a Fail Operational or Fail Passive automatic rollout system, or
- b. A Fail Passive landing system (limited to touchdown zone RVR not less than RVR600) with Fail Passive rollout provided automatically or by a flight guidance system providing suitable head-up or head-down guidance, and suitable monitoring capability, or
- c. A Fail Operational hybrid automatic landing and rollout system with compatible manual flight guidance system, using automatic landing capability as the primary means of landing.
- d. Other system which can provide an equivalent level of performance and safety.

NOTE: For system concepts not currently approved by FAA or system concepts not addressed by Appendix 3, a proof of concept demonstration is required prior to either airworthiness or operational consideration for approval.

2. An automatic throttle or automatic thrust control system which meets Appendix 3, or appropriate earlier criteria as specified in an FAA-approved AFM. However, for operations with a 50

foot Decision Height, automatic throttles may not be required if it has been demonstrated that operations can safely be conducted, with an acceptable work load, without their use.

3. At least two independent navigation receivers/sensors providing lateral and vertical position or displacement information, typically with the first pilot's station receiving information from one and the second pilot's station receiving information from the other. The navigation receivers/sensors must meet the criteria specified in Appendix 3 or equivalent, or must meet an earlier acceptable criteria as specified in an FAA AFM (e.g., 2 ILS localizer and glide slope receivers meeting performance contained in AC 120-28C; Appendix 1, paragraph 7a & b).

4. At least two approved radio altimeter systems which meet the performance criteria outlined in Appendix 3, or acceptable earlier criteria, as specified in an FAA AFM, typically with the first pilot's station receiving information from one and the second pilot's station receiving information from the other.

5. Failure detection, annunciation, and warning capability, as described in Appendix 3, or as determined acceptable by earlier criteria, such as 120-28C; Appendix 1, paragraph 7c & 7g, and specified in an FAA AFM.

6. Missed approach guidance provided by one or more of the following means:

- a. Attitude displays which include calibrated pitch attitude markings, or a pre-established computed pitch command display,
- b. An approved flight path angle display, or
- c. An automatic or flight guidance go-around capability.

7. Suitable forward and side flight deck visibility for each pilot, as specified in 5.13.1.

8. Suitable windshield rain removal, ice protection, or defog capability as specified in 5.13.2.

**5.3.2. Airborne Systems for Category III Minima Not Less than RVR300 (75 m).** Visibility minima of RVR300 is applicable to those facilities reporting RVR in feet and which have appropriate reporting increments in feet. Visibility minima of 75m is applicable to those facilities reporting RVR in meters and which have appropriate reporting increments in meters.

In addition to the aircraft equipment specified in 5.3.1 above, the following equipment is required for Category III minima not less than RVR300 (75m):

1. A Fail Operational Automatic Flight Control System, or manual flight guidance system designed to meet fail operational system criteria, or a hybrid system in which both the fail-passive automatic system and the monitored manual flight guidance components provide approach and flare guidance to touchdown, and in combination provide full fail operational capability, and

2. A fail operational rollout guidance or control system that can assure safe rollout to taxi speed consisting of either:

a. A fail operational automatic rollout control system or fail operational manual flight guidance rollout system, or

b. A hybrid system consisting of at least a fail passive automatic rollout system and a compatible Fail Passive manual flight guidance rollout control system demonstrated in accordance with Appendix 3; (may be approved for operations not less than RVR300), or

3. Suitable flight instruments, annunciations, or crew procedures which can reliably detect and alert the flightcrew to abnormal lateral or vertical flight path performance during an approach to touchdown, or abnormal lateral performance during rollout.

**5.3.3. Airborne Systems for Category III Minima Less than RVR300 (75 m).** In addition to the aircraft equipment specified in 5.3.2 above, the following equipment is required for Category III minima less than RVR300 (75m):

1. A Fail Operational Automatic Flight Control System, or manual flight guidance system designed to meet fail operational system criteria, or a hybrid system in which both the fail-passive automatic system and the monitored manual flight guidance components provide approach and flare guidance to touchdown, and in combination provide full fail operational capability, and
2. A fail operational automatic, manual, or hybrid rollout control system.

**5.4. Automatic Flight Control Systems and Automatic Landing Systems.** Automatic Flight Control Systems or Autoland Systems considered acceptable for Category III, include:

- 1) Those systems meeting pertinent criteria of Appendix 3,
- 2) Those systems meeting acceptable earlier FAA criteria which have already been and currently are approved for use through operations specifications (whether or not specifically referenced in AFM provisions), or
- 3) Those systems meeting other equivalent criteria (e.g., JAR AWO), found acceptable to the FAA.

**5.5. Flight Director Systems.** Characteristics of Flight Director Systems (head down or head up) used for aircraft authorized for Category III should be compatible with any characteristics of the autopilot or autoland system used. Flight control systems which provide both autopilot control and flight director information may or may not display flight director commands as appropriate for the system design and operator requirements. Regardless of whether Flight Director commands are provided,

situational information displays of navigation displacement must also be provided to both flightcrew members. To assure that unacceptable deviations and failures can be detected, the displays must be appropriately scaled and readily understandable in the modes or configurations applicable.

"Flight director systems" may be considered as "fail passive" if after a failure, the flight path of the aircraft does not experience a significant immediate deviation due to the pilot following the failed guidance before the pilot detects the failure and discontinues using the guidance.

**5.6. Head-up Display Systems.** Head-up Display systems used as the basis for a suitable Category III authorization must provide guidance for one or both pilots as appropriate for the system design. If information is provided to only the flying pilot, then appropriate monitoring capability must be established for the non flying pilot. Monitoring tasks must be identified, and the non flying pilot must be able to assume control of the aircraft in the event of system failure or incapacitation of the pilot using the Head-up Display (e.g., for a safe go-around or completion of rollout). Head-up Display Systems acceptable for Category III must meet provisions of Appendix 3, or acceptable earlier criteria specified by the FAA and referenced in an AFM.

"Head-up Display systems" may be considered as "fail passive" if:

1. After a failure, the pilot using the system or pilot monitoring the system is made aware of the failure in a timely manner, and
2. The flight path of the aircraft does not experience a significant immediate deviation from the intended path due to the pilot following the failed guidance before the pilot flying or pilot monitoring detects the failure, and the pilot flying discontinues using the guidance.

**5.7. Enhanced/Synthetic Vision Systems.** Enhanced/Synthetic Vision Systems based on millimeter wave radar or other such sensors may be used to assure the integrity of other flight guidance or control systems in use during Category III operations. They must be demonstrated to be acceptable to FAA in a proof of concept evaluation and they must otherwise be in accordance with Appendix 3. Use of Enhanced/Synthetic Vision Systems for purposes other than establishing the accuracy or integrity of flight guidance system performance must be demonstrated to be acceptable through proof of concept testing prior to identification of specific airworthiness and operation criteria.

**5.8. Hybrid Systems.** Hybrid systems (e.g., a fail passive autoland system used in combination with a monitored HUD flight guidance system) may be acceptable for Category III if each element of the system alone is shown to meet its respective suitability for Category III, and if taken together, the components provide the equivalent performance and safety to a non-hybrid system as specified for the minima sought (e.g., fail operational Category IIIb).

Hybrid systems with automatic landing capability should be based on the concept of use of the automatic landing system as the primary means of control, with the manual flight guidance system serving as a backup mode or reversionary mode.

Manual rollout flight guidance capability must be provided for hybrid systems which do not have automatic rollout capability. Such manual rollout capability must have been shown to have performance and reliability at least equivalent to that of a fail passive automatic rollout system.

Any transition between hybrid system elements (e.g., control transition from autoland use to manual control HUD use, or for response to failures) must be acceptable for use by properly qualified flightcrews (e.g., qualified in accordance with part 121, SFAR 58, or equivalent JAA criteria, as applicable, and standard industry practices). Transitions should not require extraordinary skill, training, or proficiency.

For any system which requires a pilot to initiate manual control near or shortly after touchdown, the transition from automatic control prior to touchdown to manual control using the remaining element of the hybrid system (e.g., HUD) after touchdown must be shown to be safe and reliable.

For hybrid systems, operational procedures following failure of the automatic system or flight guidance system prior to touchdown may require that the pilot initiate a go-around, even though the aircraft using a hybrid system must have been demonstrated as being capable of safely completing a landing and rollout following a failure of one of the hybrid system elements below alert height.

A hybrid system may be approved for Category III if it is shown to meet the criteria specified in Appendix 3 when approved through an airworthiness demonstration process. Alternately, a hybrid system may be acceptable for Category III if it is determined to meet applicable airworthiness criteria for each element of the system separately (e.g., separately meets Category III criteria for autoland and HUD), and in addition, a successful operational suitability demonstration is completed using the individual system elements together as a hybrid system. If acceptability is determined through an operational demonstration process, the individual elements of the hybrid system must be shown to be compatible for both normal and non-normal operations, and the combined system must be shown to have the necessary performance, integrity, and availability appropriate for the operations intended.

An operator may receive approval to use an automatic landing system and a manual flight guidance system as a Hybrid System provided, (a) each system individually meets appropriate airworthiness assessments, and (b), that operator conducts a successful operational demonstration showing the hybrid system's capability to meet applicable provisions of this section.

For hybrid systems used for Category III an Alert Height of 50' or higher should be used unless otherwise approved by the FAA AFS-400.

**5.9. Instruments and Displays.** Flight instrument and display presentations related to Category III, including attitude indicators, EADI's, primary flight displays, EHSI's, HIS's, or other such navigation displays must provide pertinent, reliable and readily understandable information for both normal and non-normal conditions related to Category III landing and missed approach.

Alert Height and/or Decision Height indications must be readily understandable, appropriately highlighted, and not be compromised by effects such as typical underlying terrain on the final approach path, and other annunciations or automatic audio call-outs. In addition, instruments and displays should provide appropriate indications considering terrain characteristics identified in Appendix 3 Section 6.3.4. Controls for altitude or height alerts used for minima determination or alert heights should use standard indications such as RH for radio height (or RA for radio altitude) and BARO for barometric altitude, rather than operational designations such as DH or MDA. Use of the designation RH or RA for height referenced values, or BARO for barometric altitude referenced values for controls or displays do not preclude related use of display symbology color changes or use of flashing alphanumeric symbology as the aircraft descends below a specifically referenced height or altitude value.

Situation information displays of navigation displacement must be available to both flightcrew members, and must be appropriately scaled and readily understandable in presentations or mode of display used. Instrument and panel layouts must follow accepted principles of flight deck design.

**5.10. Annunciations.** Annunciations must be clear, unambiguous, and appropriately related to the flight control mode in use. The mode annunciation labels should not be identified by landing minima classification. For example, LAND 2, LAND 3, Single Land, Dual Land, etc., are acceptable mode annunciation labels, whereas, Category II, Category III, etc., should not be used. Aircraft previously demonstrated for Category III which do not meet this criteria may require additional operational constraints to assure the correct use of minima suited to the aircraft configuration. In addition, mode annunciation labels must be consistent with other annunciations in the cockpit, and with the airplane documentation.

**5.11. Automatic Aural Alerts.** Automatic Aural Alerts (e.g., automatic call-outs, voice callouts) of radio altitude, or call-outs approaching landing minimums, or call-outs denoting landing minimums must be consistent with the design philosophy of the aircraft in question. However, any automatic call-outs used should not be of a volume or frequency that interferes with necessary flightcrew communications or normal crew coordination procedures. Recommended automatic call-outs include a suitable alert or tone as follows:

1. At 500 ft. (radio altitude), approaching minimums and at minimums, and
2. Altitude call-outs during flare, such as at "50" ft., "30" ft. and "10" ft., or altitudes appropriate to aircraft flare characteristics. Low altitude radio altitude call-outs, if used, should appropriately address the situation of higher than normal sink rate during flare, or an extended flare which may be progressing beyond the touchdown zone.

**5.12. Navigation Sensors.** Various navigation sensors may be acceptable to support Category III operations as specified in Section 4.3.10. ILS localizer and glideslope signals are the primary means currently used for the determination of deviation from the desired path for Category III operations. Criteria for acceptable ILS and MLS localizer and glide-slope receivers are included in Appendix 3 or in earlier acceptable criteria used by FAA for previous demonstrations of systems for Category III. Other

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navigation sensors, such as GNSS, or DGNSS, may be used individually or in combination to satisfy the necessary accuracy, integrity and availability for Category III if proof of concept demonstrations are successfully completed and operational experience at Category I and Category II minimums is acceptable. Navigation sensors other than ILS must meet equivalent ILS performance or appropriate RTCA or EUROCAE criteria, unless otherwise authorized.

Appropriate marker beacon information, or equivalent, must be displayed to each pilot for the outer, middle and inner markers. Appropriate substitutes for marker beacons may be authorized by the FAA for Category III based upon the use of suitable GNSS/DGNSS capabilities, or DME.

### **5.13. Supporting Systems and Capabilities.**

**5.13.1. Flight Deck Visibility.** Suitable forward and side flight deck visibility for each pilot should be provided as follows:

- a. The aircraft should have a suitable visual reference cockpit cutoff angle over the nose for the intended operations, at the intended approach speeds, and for the intended aircraft configurations, as applicable (e.g., flap settings),
- b. The aircraft's flight deck forward and side windows should provide suitable visibility for taxi and ground operations in low visibility, and
- c. Placement of any devices or structure in the pilots visual field which could significantly affect the pilot's view for low visibility operations must be acceptable (e.g., HUD drive electronics, sunvisor function or mountings).

**5.13.2. Rain and Ice Removal.** Suitable windshield rain removal, ice protection, or defog capability should be provided as specified below:

- a. Installation of rain removal capability is required (e.g., windshield wipers, windshield bleed air).
- b. Installation and use of windshield hydrophobic coatings, or use of equivalent rain repellent systems which meet pertinent environmental standards are recommended.
- c. Installation of windshield anti-ice or de-ice capability is required for aircraft intended to operate in known icing conditions during approach and landing.
- d. Installation of at least forward windshield defog capability is recommended for aircraft subject to obscuration of the pilot's view during humid conditions.

Aircraft subject to obscuration of the windshield due to rain, ice, or fogging of the pilot's view which do not have protection, or which do not have adequate protection may require operational limitations on the conditions in which low visibility operations are conducted.

**5.13.3. Miscellaneous Systems.** Other supporting systems should meet appropriate criteria compatible with Category III Operational Objectives. Applicable criteria may include criteria as specified in Appendix 3, criteria as specified in basic airworthiness requirements applicable to U.S. certificated aircraft, or equivalent, or operational criteria for IFR flight. Regarding supporting systems, "In-service aircraft" or "new production" aircraft may meet or continue to meet criteria previously found acceptable for Category III operation for supporting systems for those aircraft. Supporting systems for Category III are considered to include, as applicable: Instruments, radar altimeters, air data computers, inertial reference units, attitude and heading gyros, instrument switching, flight deck night lighting, landing lights and taxi lights, position lights, turnoff lights, recognition lights, GPWS or EGPWS, flight data recorders or other low visibility related aircraft systems pertinent to a particular type.

Any GPWS or EGPWS systems interfaces (e.g., glide slope deviation warning) should be compatible with and should not interfere with the Category III Operations to be conducted (e.g., for engine inoperative Category III Configurations). For multimode capable systems for Category III (e.g., MMR), interfaces with GPWS or EGPWS for each MMR mode (e.g., ILS, MLS or GLS) should be consistent.

For Flight Data Recorders (FDR's) or Quick Access Recorders (QAR's), it is recommended that operators consider appropriate flight data recorder requirements for incident or event analysis when addressing provisions for Category III. It is recommended that any data recorders installed provide sufficient capability for recording of parameters applicable to flight guidance system performance for use with Category III operations. Typical parameters of interest and appropriate sample rates are those found in Appendix 8 applicable to Irregular Terrain Assessment.

**5.14. Go-Around Capability.** Regardless of the flight guidance system used an appropriate go-around mode/capability should be provided. A go-around mode/capability must be able to be selected at any time during the approach to touchdown. The go-around mode/capability should provide information for a safe discontinuance of the approach at any point to touchdown, if activated prior to touchdown. If activated at a low altitude where the aircraft inadvertently touches the ground, the go-around mode should provide adequate information to accomplish a safe go around and not exhibit unsafe characteristics as a result of an inadvertent touchdown. Inadvertent selection of go-around after touchdown should have no adverse effect on the ability of the aircraft to safely rollout and stop.

**5.15. Excessive Deviation Alerting.** An acceptable method should be provided to detect excessive deviation of the aircraft laterally and vertically during approach, and laterally during rollout, as applicable. The method used should not require excessive workload or undue attention. This provision does not require a specified deviation warning method or annunciation, but may be addressed by parameters displayed on the ADI, EADI, or PFD. When a dedicated deviation warning is provided, its use must not cause excessive nuisance alerts.

## **5.16. Rollout Deceleration Systems or Procedures for Category III.**

**5.16.1. Stopping Means.** A means to determine that an aircraft can be reliably stopped within the available length of the runway is necessary to conduct Category III operations. At least one of the following means to assess stopping performance should be used:

1. An automatic braking system which includes information for the flightcrew about appropriate auto brake settings to be used for landing or which provides landing distance information suitable for use by the flightcrew to determine which auto brake setting may or may not be appropriate.
2. A ground speed indicating system based on inertial information or other equivalent source such as GNSS, together with acceptable procedures for its use.
3. A deceleration display or other indication which can advise the pilot of the adequacy of aircraft deceleration to stop within the available runway length.
4. A runway remaining indicator display reliably showing the length of remaining runway after touchdown.
5. A procedural means to assure a safe stop acceptable to FAA. However, a procedural means to ensure a safe stop is not appropriate for minima less than RVR300 (75 m).

**5.16.2. Antiskid Systems.** Unless otherwise determined to be acceptable to the FAA, aircraft authorized for Category III should have an operable anti-skid system installed and operative per the applicable FAA MMEL and MEL.

The authorization for aircraft to operate using Category III minima without anti-skid is determined by the POI for each aircraft type, considering the following factors:

1. Extra field length margin of runways to be authorized, compared with field lengths necessary for the aircraft type, and
2. The braking system characteristics of the aircraft regarding susceptibility to tire failure during heavy braking, and susceptibility to tire failure during operations with reduced or patchy runway surface friction.

**5.17. Engine Inoperative Category III Capability.** The following criteria are applicable to aircraft systems intended to qualify for "engine inoperative Category III" authorizations. Aircraft demonstrated to meet "engine inoperative" provisions of Appendix 3 that have an appropriate reference to engine inoperative Category III capability in the FAA approved AFM are typically considered to meet the provisions listed below.

The AFM or equivalent reference must suitably describe demonstrated approach and missed approach performance for the engine inoperative configuration, and the aircraft must meet pertinent criteria otherwise required for all-engine Category III or equivalent criteria. This performance data should also be available in the automated flight planning, performance and weight and balance systems normally used by the air carrier so as to be readily available to the pilot and, if applicable, the aircraft dispatcher.

Exceptions to all-engine Category III, or equivalent criteria, may be authorized for engine inoperative Category III as follows:

- a. The effects of a second engine failure when conducting Category III operations with an engine inoperative need not be considered, except for a demonstration that the airplane remain controllable when the second engine fails,
  - b. Crew intervention to re-trim the aircraft to address thrust asymmetry following engine loss may be permitted,
  - c. Alternate electrical and hydraulic system redundancy provisions may be acceptable, as suited to the type design (e.g., bus isolation and electrical generator remaining capability must be suitable for the engine out configuration),
  - d. Requirements to show acceptable landing performance may be limited to demonstration of acceptable performance during engine out flight demonstrations (e.g., a safe landing on the runway), and
  - e. Landing system "status" should accurately reflect the aircraft configuration and capability.
2. Suitable information must be available to the flightcrew at any time in flight, and particularly at the time of a "continuation to destination" or "diversion to alternate" decision. This is to determine that the aircraft can have an appropriate Category III approach capability when the approach is initiated (e.g., Non-normal checklist specification of expected configuration during approach, autoland status annunciation of expected capability).
  3. Performance should be demonstrated in appropriate weather conditions considering winds and any other relevant factors.

**5.18. Airborne System Assessment for Irregular Pre-Threshold Terrain.** Notwithstanding that airworthiness demonstrations may consider irregular terrain in the pre-threshold area, special operational evaluations are nonetheless required for certain airports having difficult pre-threshold terrain conditions (see Section 6.2.5). Criteria for the operational evaluation of irregular pre-threshold terrain airports is contained in Appendix 8. This criteria may be used both for operational authorizations and in conjunction with airworthiness demonstrations for type certification (TC) or supplemental type certification (STC).

**5.19. Airworthiness Demonstrations of Airborne System Capability for Category III.**

Airworthiness demonstrations of airborne systems not previously approved for Category III should be in accordance with the provisions of Appendices 2 through 6. Aircraft which have previously completed airworthiness demonstrations in accordance with earlier criteria may continue to reference the demonstrations against earlier criteria in their AFM and may elect to continue to use earlier criteria for continued production or demonstration of new production derivative aircraft. The criteria of this AC must be used when seeking credit not provided by the earlier criteria, for new aircraft types, or for significantly modified systems proposed to FAA for derivative aircraft after the date of the issuance of this revised AC. Category III aircraft systems may be evaluated in accordance with the applicable criteria contained in the Appendices of this AC during airworthiness demonstrations, or they may be evaluated in conjunction with an FAA approved program with an operator, for aircraft that are "in service" using the equivalent criteria and evaluation methods, to those specified in the Appendices to this AC. Operational demonstrations will not be conducted based on criteria prior to this AC.

## **6. PROCEDURES.**

**6.1. Operational Procedures.** Appropriate operational procedures based on the approved operator program should be addressed. Operational procedures should consider the pilot qualification and training program, airplane flight manual, crew coordination, monitoring, appropriate takeoff and landing minima including specification of either a Decision Height or an Alert Height (as applicable) for landing, crew call-outs, and assurance of appropriate aircraft configurations. Suitable operational procedures must be used by the operator and be used by flightcrews prior to conducting low visibility takeoff or Category III landing operations.

**6.1.1. Application of AFM Provisions.** The operator's procedures for low visibility takeoff or Category III landing should be consistent with any AFM provisions specified in the normal or non-normal procedures sections (e.g., Section 3 of the AFM) during airworthiness demonstrations. Adjustments of procedures consistent with operator requirements are permitted when approved by the POI. Operators should assure that no adjustments to procedures are made which invalidate the applicability of the original airworthiness demonstration.

Where navigation performance for a specific RNP can only be achieved by specific system modes (e.g., coupled flight director or autopilot), the specific modes and associated RNP levels should be applied consistent with the AFM.

Where operations are based on RNP, suitable flight manual provisions for RNP capability and use should be provided. If not available in the AFM or Flight Crew Operating Manual (FCOM), RNP operations may be approved on a case by case basis, consistent with "fleet qualification" for RNP criteria such as found in RTCA DO-236 Appendix D, or equivalent FAA criteria.

**6.1.2. Crew Coordination.** Appropriate procedures for crew coordination should be established so that each flightcrew member can carry out their assigned responsibilities. Briefings prior to the

applicable takeoff or approach should be specified to assure appropriate and necessary crew communications. Responsibilities and assignment of tasks should be clearly understood by crewmembers.

**6.1.3. Monitoring.** Operators should establish appropriate monitoring procedures for each low visibility takeoff, approach, landing, and missed approach. Procedures should assure that adequate crew attention can be devoted to control of aircraft flight path, displacements from intended path, mode annunciations, failure annunciations and warnings, and adherence to minima associated with DH and AH. Where a "monitored approach" is used, (e.g., where the First Officer is responsible for control of the aircraft flight path by monitoring of the automatic flight system) appropriate procedures should be established for transfer of control to the captain who will be making the decision for continuation of the landing at or prior to Decision Height or Alert Height. Monitoring procedures should not require a transfer of responsibility or transfer of control at a time that could interfere with safe landing of the aircraft. Procedures for calling out failure conditions should be pre-established, and responsibility for alerting other crewmembers to a failure condition should be clearly identified.

**6.1.4. Use of the Decision Height or Alert Height.** Decision heights are normally used for Fail Passive Category III operations and Alert Heights are used for Fail Operational Category III operations. Certain exceptions are noted elsewhere in this AC (e.g., use of a Decision Height (DH) due to specific fail operational aircraft characteristic at a runway with irregular pre-threshold terrain). When Decision Heights are specified, procedures for setting various reference bugs in the cockpit should be clearly identified, responsibilities for Decision Height call-outs should be clearly defined, and visual reference requirements necessary at Decision Height should be clearly specified so that flightcrews are aware of the necessary visual references that must be established by, and maintained after passing Decision Height.

When Alert Heights are specified, the operator may elect to use an Alert Height at or below 200 ft. HAT as suitable for procedure or procedures identified for use by that operator.

Procedures should be specified for call-out of the Alert Height and if applicable for conversion of the Alert Height to a Decision Height in the event that the aircraft reverts from Fail Operational to Fail Passive flight control.

The operator should assure that at each runway intended for Category III operations, the radar altimeter systems used to define Alert Height or Decision Height provides consistent, reliable, and appropriate readings for determination of Decision Height or Alert Height in the event of irregular terrain underlying the approach path, or an alternate method should be used. Alert Height or DH may be based on other means (e.g., inner marker) only when specifically approved by FAA. Any adjustments to approach minima or procedures made on final approach should be completed at a safe altitude (e.g., above 500 ft. HAT).

**6.1.5. Call-outs.** Altitude/Height call-outs should be used for Category III. Callouts may be accomplished by the flightcrew or may be automatic (e.g., using synthetic voice call-outs or a tone system). Typical call-outs acceptable for Category III include a combination of the following:

- "1000 ft." above the touchdown zone,
- "500 ft." above the touchdown zone,
- "approaching minimums,"
- "minimums,"
- altitudes during flare, (e.g., 50, 30, 10) or AFGS mode transitions (e.g., flare, rollout), and
- as appropriate, auto spoiler, reverse thrust deployment and autobrake disconnect.

Calls made by the flightcrew should not conflict with the automatic systems or auto call-outs of the aircraft, and conversely the configuration selected for the aircraft should not conflict with expected call-outs to be made by the flightcrew. Compatibility between the automatic call-outs and the crew call-outs must be assured. The number of call-outs made, either automatically, by crew, or in combination, should not be so frequent as to interfere with necessary crew communication for abnormal events.

Also, call-outs should be specified to address any non-normal configurations, mode switches, failed modes, or other failures that could affect safe flight, continuation of the landing, or the accomplishment of a safe missed approach. Any use of crew initiated call-outs at altitudes below 100 ft. should assure that the callouts do not require undue concentration of the non-flying pilot on reading of the radar altimeter rather than monitoring the overall configuration of the aircraft, mode switching, and annunciations that might be related to a successful Category III landing. Automatic altitude call-outs or tones are recommended for altitude awareness, at least at and after passing Decision Height or Alert Height.

Operators may make provision for use of crew verbal callouts as a backup, or in lieu of automatic callouts in certain circumstances. It is recommended that operators have a policy addressing procedures to be used when an automatic callout system fails or is inoperative regarding making some or all key callouts manually. Examples of when use of verbal crew callouts may be appropriate instead of or to augment automatic callouts include:

- 1) When an automatic callout system has failed,
- 2) When automatic callouts are inoperative through an MEL provision, or
- 3) When a particular automatic callout is not issued or is masked by another cockpit advisory or crew conversation, or is not heard for some other reason.

**6.1.6. Aircraft Configurations.** Operational procedures should accommodate any authorized aircraft configurations that might be required for low visibility takeoff or Category III approaches or missed approaches. Examples of configurations that operational procedures may need to accommodate include:

1. Alternate flap settings approved for Category III,
2. Use of alternate AFGS modes or configurations (e.g., Single Land, LAND2),
3. Inoperative equipment provisions related to the minimum equipment list, such as a non-availability of certain electrical system components, inoperative radar altimeter, air data computers, hydraulic systems or instrument switching system components, and
4. Availability and use of alternate electrical power sources (e.g., APU) if required as a standby source.

Procedures required to accommodate various aircraft configurations should be readily available to the flightcrew and the aircraft dispatcher to preclude the inadvertent use of an incorrect procedure or configuration. Acceptable configurations for that operator and aircraft type should be clearly identified so that the pilots can easily determine whether the aircraft is or is not in a configuration to initiate a low visibility takeoff or Category III approach. Configuration provisions must be consistent with, but are not limited to, those provided in the operations specifications for that operator.

**6.1.7. Compatibility with Category I and Category II Procedures.** The operator should assure that to the greatest extent possible, procedures for Category III are consistent with the procedures for that operator for Category II and Category I to minimize confusion about which procedure should be used or to preclude procedural errors due to pilots reverting to familiar procedures accomplished more frequently such as for Category I. The operator should to the extent practical, minimize the number of procedures that the crew needs to be familiar with for low visibility operations so that, regardless of the landing category necessary for an approach, the correct procedures can be used consistently and reliably.

**6.1.8. Flightcrew Response to Non-Normal Events.** Takeoff and landing weather minimums are intended for normal operations. When non-normal events occur, flightcrews and aircraft dispatchers are expected to take the safest course of action to assure safe completion of the flight. Using emergency authority, pilots can deviate from rules or policies, to the extent necessary, to minimize the risk of continued flight to a safe landing. In some instances, guidelines are established for particular failure situations, such as failure of required aircraft systems prior to reaching Alert Height.

When procedures or configurations have not been specified, pilots and aircraft dispatchers are expected to use good judgment in making the determination of appropriate configurations or situations to conduct safe Category III operations. The decision to continue an approach or to discontinue an approach must

be made considering all relevant factors of the status of the aircraft, fuel on board, seriousness of the emergency, distance away of other available airports, and the likelihood of changing weather conditions, among other factors. It is not the intent of this AC to attempt to define guidelines for circumstances such as in-flight fire, minimum fuel reserves, or other situations requiring complex judgments of skilled crewmembers.

However, in the case of certain well-defined situations that can be addressed before departure, such as contingency planning in the event of an engine failure, guidelines are provided to assist pilots in making safe and consistent judgments about available alternative courses of action. Specific guidelines for initiation for a Category III approach with an inoperative engine are provided in section 5.17.

Guidelines for other configuration situations may be provided by the normal or non-normal procedure section of the aircraft flight manual or by the operator. Pilots and aircraft dispatchers are expected to be familiar with these guidelines and apply them to the extent practical but may deviate as necessary from those guidelines, to the extent that they consider necessary to assure safe flight and landing. If doubt exists as to the advisability of continuation of an approach or diversion, it is the flightcrews responsibility to exercise their emergency authority to the extent necessary to assure a safe flight.

## **6.2. Category III Instrument Approach Procedures and Low Visibility Takeoff.**

**6.2.1. Takeoff Guidance System Procedures.** When takeoff minima are predicated on use of a takeoff guidance system meeting the criteria of Section 5.1.3 or Appendix 2, procedures for use of the takeoff guidance system should be identified consistent with the approved AFM, or applicable operational authorization. Procedures should address at least the following items or factors:

- Setup, test, and initialization of the guidance system and NAVAID's, as applicable
- Roles and responsibilities of the PF and PNF
- Suitable alignment with and tracking of the runway centerline
- Suitable transfer of control between pilots for failures or incapacitation, as applicable
- Suitable response to failures (e.g., engine failure before and after  $V_1$ , electrical failure, guidance system alerts, warnings, and failures as applicable)

**6.2.2. Acceptable Procedures for Category III Approach.** Instrument Approach Procedures for Category III may be conducted in accordance with:

1. published 14 CFR part 97 procedures, or
2. approved operations specifications for special procedures, or

3. published foreign or military procedures approved by the FAA, or
4. foreign or military procedures accepted by FAA for specific foreign airports and runways.

**6.2.3. Standard Obstacle clearance for approach and missed approach.** Advisory Circular 120-29 as amended provides the standard Category II and III approach and missed approach criteria not otherwise specified in FAA Order 8260.3 (TERP's). The criteria in AC 120-29 should be applied except where acceptable TERP's criteria is provided for Category II and III operations using ILS, MLS, GLS or RNP facilities and equipment. Standard obstacle clearance criteria are typically incorporated with published part 97 procedures. Standard criteria used by several foreign authorities based on ICAO PANS OPS may be used where found to be acceptable to the FAA (e.g., JAA approved procedures). Category II and III procedures developed using criteria other than TERPS or PANS OPS are normally issued through operations specifications as special procedures. (See paragraph 6.2.4.)

**6.2.4. Special Obstacle Criteria.** In certain instances standard obstacle criteria as specified by TERPS may not be appropriate for particular Category III procedures. In such instances alternate criteria acceptable to the FAA may be used as specified in OpSpecs (e.g., RNP criteria).

**6.2.5. Irregular Terrain Airports.** Irregular terrain airports identified by a part 97 procedure, or by FAA order 8400.8, as amended, must be evaluated in accordance with FAA approved procedures prior to incorporation in operations specifications for use by air carriers operating to Category III minima.

Irregular terrain airport special evaluations should consider each particular aircraft type, the particular flight control system, and may include consideration of particular system elements such as the type of radar altimeters installed or other equipment.

Procedures for evaluation of these airports are provided in Appendix 8.

**6.2.6. Airport Surface Depiction for Category III Operations.** A suitable airport surface depiction (e.g., airport diagrams) should be available to flightcrews to assure appropriate identification of visual landmarks or lighting to safely accomplish taxiing in Category III conditions from the gate to the runway and from the runway to the gate. The Airport depiction should use an appropriate scale with suitable detailed information on gate locations, parking locations, holding locations, critical areas, obstacle free zones, taxi way identifications, runway identifications, and any applicable taxi way markings for designated holding spots or holding areas. Standard depictions provided by commercial charting services are typically acceptable if they provide sufficient detail to identify suitable routes of taxi to and from the runway and gate positions for departure or arrival.

**6.2.7. Continuing Category III Approaches in Deteriorating Weather Conditions.** The following procedures are considered acceptable in the event that weather conditions are reported to drop below the applicable Category III minima after an aircraft has passed the final approach point or final approach fix, as applicable. (Reference section 121.651.)

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- Operations based on a DA(H) may continue to the DA(H) and then land, if the specified visual reference is subsequently established by the pilot no later than the DA(H).
- Operations based on an Alert Height (AH) may continue to the AH and then land, if weather is reported to be at or above minima before passing the AH, or if suitable visual reference has been established by the pilot.
- Operations based on an AH may continue to land regardless of reported weather conditions if equipped with a fail operational rollout system which did not indicate a malfunction prior to passing alert height, and the pilot considers continuation a safe course of action.

Operators requesting amended operations specifications reflecting the procedures described above may have their current operations specifications amended by making application in accordance with paragraph 10.16. New Category III operators should have operations specifications issued reflecting these provisions in accordance with revised standard operations specifications (see samples provided in Appendix 7).

When wind constraints apply to Category III procedures (e.g., an Operation-Specification 15 knot crosswind component limit) the limit is considered to apply to the point of touchdown. If a report of a crosswind component value greater than the limit is received while on approach, an aircraft may continue an approach, but a subsequent wind report indicating winds are within limits or a pilot determination that actual winds are within limits must be made prior to touchdown. Acceptable methods for such a determination may include ATS reports, reports of other aircraft with reliable means of wind determination (e.g., IRS), pilot use of on board IRS or FMS wind readout capability, data link of recent winds, or pilot confirmation of an acceptable visual indication of winds on the surface by a wind sock, wind indicator or equivalent wind indicating device.

When an Airplane Flight Manual or other manufacturer's reference (e.g., FCOM) references "Maximum wind component speeds when landing weather minima are predicated on autoland operations", or an equivalent statement, an operator or flightcrew may consider those wind values to apply to "steady state" wind components. Any gust values which exceed the steady state wind limit need not be addressed if the flightcrew determines the gust exceedance can be considered insignificant in magnitude, variable in direction, occasional, or otherwise not applicable (e.g., obviously outdated gust report, winds and gusts reported at a location considered far from the runway or touchdown zone and not applicable, or gusts considered not pertinent during the period of touchdown or rollout).

**6.2.8. Low Visibility Taxi Procedures.** Low visibility taxi procedures should be adopted for each airport having such procedures. The procedures should be available to pilots in chart form, if applicable, and used. In addition to published Surface Movement Guidance and Control System (SMSGS) airport diagrams and information, the operator should provide:

- Any necessary specific gate identification information to find gates, ramp areas, or lead in vehicles,
- Any necessary information about identification of critical area protection zones or areas,
- Any necessary emergency response information for takeoff, landing, or other emergencies that are different for low visibility operations (e.g., markings or other ways to easily find and identify explosive holding areas in low visibility),
- Information on any known characteristics of the airport where aircraft ground vehicle traffic conflicts, taxi speed, or aircraft wing tip clearance pose unusual difficulty,
- Any other information necessary to facilitate safe operations in very low visibility (e.g., visual references that may be used for operations when standard markings may not be visible due to construction, snow cover).

Provision should be made for both day and night operation, unless operations are only conducted during either night or daylight hours.

Low visibility taxi and ground operations and related training and qualification are addressed in Sections 7.1.1 item 3 and 7.1.3 item 5 for ground training, Section 7.2 for flight training, and Section 8.5 for SMGCS Plans.

#### **6.2.9. Navigation Reference Datum Compatibility (e.g., WGS-84/Other Datum).**

Outside the U.S., it is important for operators using FMS, GPS and RNAV to be aware of, and where necessary, take precautions to address potential differences in the Navigation Data Base (NDB) "reference datum" used by their aircraft's navigation system, and the datum used en route and at destination or alternate airports. Some States specify aeronautical data (e.g., NAVAID locations, runway locations, waypoint locations), including data for instrument procedures, using a reference datum other than the standard WGS-84 datum, or equivalent.

Addressing this difference can be important to preclude significant navigation errors. If not appropriately addressed, aircraft actual position may significantly differ from indicated position when flying in these areas. Aircraft may experience navigation difficulty including:

- Incorrect FMS position updating,
- Incorrect navigation to a waypoint, NAVAID, runway, or other geographic location,
- Violation of airspace or obstacle clearance during approach or missed approach,
- Displacement from the desired flight path, or runway misalignment following completion of an instrument approach, or

- Significant map shift, if FMS position is based on updates from NAVAID(s) referenced to a local datum inconsistent with that of the aircraft's navigation data base.

Also, this issue can be important when flying with FMS using a WGS-84 referenced navigation data base with "GPS updating capability" installed, but not operative (e.g., as for an FMS MEL dispatch, with GPS inoperative, GPS updating inoperative; or GPS updating inhibited).

For Category III procedures, the issue of use of an appropriate Navigation "Reference Datum" principally applies to flying RNAV initial or intermediate approach segments, or missed approach segments. Final approach segments of ILS or MLS procedures typically are not adversely affected by a difference in reference datum because of direct use of the localizer course. GLS or RNP procedures, while depending on specification of an appropriate reference datum for final approach, are otherwise protected from this datum difference through other criteria which assures consistent datum use for procedure development.

Information about the navigation reference datum used in particular locations outside of the United States is typically available on the Internet. An example of a commercial web site containing this information may be found at: <http://www.jeppesen.com/wgs84.html>

Accordingly, when operating outside United States airspace and when WGS-84 is not used locally as the reference datum for NAVAID's or procedures, or a reference datum equivalent to WGS-84 is not used, operators should take suitable precautions, as described below. These precautions apply to any RNAV segments flown as part of any instrument approach procedure or missed approach procedure (including Category III procedures, if applicable) for:

- FMS equipped aircraft capable of GPS updating, or
- GPS "stand alone" equipped aircraft, or
- FMS equipped aircraft.

**a. Aircraft Equipped With FMS Having GPS Updating Capability, or Equipped With "GPS Stand Alone" Navigation Systems.**

For operations outside the United States, where the local datum is not WGS-84, or WGS-84 equivalent, or where the operator is uncertain as to whether the local datum is significantly different than WGS-84, the operator should take one or more of the following precautions, as necessary:

- 1) Verify that the datum is WGS-84, or equivalent,
- 2) Conduct an assessment of the difference in the datum used, to determine that any difference is not significant for the procedures to be flown,
- 3) Develop and use special RNAV procedure segments or aeronautical data referenced to WGS-84 or equivalent, as necessary,

- 4) Manually inhibit GPS updating of the FMS while flying the approach, or segments of the approach affected by the difference in reference datum,
- 5) Only use FMS or GPS Stand Alone systems to fly pertinent RNAV segments of the approach where it is possible to use other NAVAID raw data to confirm correct aircraft position along the flight path,
- 6) Conduct simulation verification, or in-flight verification or confirmation of suitable navigation performance,
- 7) Preclude FMS or GPS use on segments of the approach affected by the difference in reference datum, or
- 8) Use any other method proposed by the operator, and found acceptable to FAA, to assure that a difference in the NDB Reference Datum from the local datum does not cause loss of navigation integrity.

For GLS or RNP procedures or procedure segments, since the reference datum is consistent with WGS-84 by procedure design, operators of aircraft using GPS updating of FMS, or "GPS Stand Alone" systems for RNAV need not apply the special precautions listed above, unless otherwise advised (e.g., by NOTAM, or equivalent).

**b. FMS Equipped Aircraft That Do Not Have GPS Updating Capability.**

While possible, FMS equipped aircraft that do not have GPS updating capability may be less likely to experience this particular datum reference difference issue. This is because navigation data bases, local NAVAID's, and local instrument procedures typically address and resolve datum issues consistently on a local basis, and in a consistent manner within the locally used coordinate frame of reference. However, even though the datum difference issue may be less likely, it nonetheless may occur. Precautions should be applied by operators, as necessary, if there is significant doubt as to Navigation Data Base datum differences.

The precautions listed above in item a. should not be interpreted to discourage GPS installation and use. GPS updating of FMS can significantly increase both navigation accuracy and integrity, and reduce the risk of other types of navigation errors, including map shifts, yielding a significant safety increase.

**7. TRAINING AND CREW QUALIFICATION.** Training and crew qualification programs pertinent to Category III should include provisions for appropriate ground training, flight training, initial qualification, recurrent qualification, recency of experience, and re-qualification. The operators program should provide appropriate training and qualification for each pilot in command, second in command and any

other crewmember expected to have knowledge of or perform duties related to Category III landing or low visibility takeoff operations (e.g., Flight engineer).

Pilots in command are expected to have a comprehensive level of knowledge with respect to each of the ground training subjects and have performed each of the specified maneuvers and demonstrated skill in accomplishing each of the tasks specified for flight training. Second in command pilots should have a comprehensive knowledge of the subjects specified in the ground training program, and are expected to perform those relevant procedures or maneuvers applicable to the second in command is assigned duties during Category III landing operations or for low visibility takeoff. Other crewmembers are expected to have the knowledge required and the demonstrated skills to perform their assigned duties.

## **7.1. Ground Training.**

**7.1.1. Ground System and NAVAIDs for Category III.** Ground systems and NAVAID's are considered to include characteristics of the airport, electronic navigation aids, lighting, marking and other systems (e.g., RVR) and any other relevant information necessary for safe Category III landing or low visibility takeoff operations.

The training and qualification program should appropriately address the operational characteristics, capabilities and limitations of at least each of the following:

1. NAVAID's. The navigation systems to be used, such as the instrument landing system with its associated critical area protection criteria, marker beacons, distance measuring equipment, compass locators or other relevant systems should be addressed to the extent necessary for safe operations. As applicable, operationally relevant characteristics of NAVAID types to be used should be addressed. For example for ILS or MLS, any characteristics of beam bends, overflight disturbances, beam switchover to secondary transmitters or power sources, flare of the glide slope signal at low altitudes may need to be explained or addressed depending on the characteristics of the particular flight guidance system used. If non ground based systems (e.g., GNSS) are used, any characteristics or constraints regarding that method of navigation, must be addressed (e.g., proper procedure waypoint selection and use, integrity assurance, coping with space vehicle (SV) loss of availability or failure, SV terrain masking).
2. Visual aids. Visual aids include approach lighting system, touchdown zone, centerline lighting, runway edge lighting, taxiway lighting, standby power for lighting and any other lighting systems that might be relevant to a Category III environment, such as the coding of the center line lighting for distance remaining, and lighting for displaced thresholds, stop ways, or other relevant configurations should be addressed.
3. Runway and Taxiways and SMGCS Plans. The runway and taxiway characteristics concerning width, safety areas, obstacle free zones, markings, hold lines, signs, holding spots, or taxi way position markings, runway distance remaining markings and runway distance remaining signs should be addressed. The SMGCS plan use should be addressed as applicable. This should include any

necessary briefings to be conducted and crew coordination, particularly for crash and rescue, evacuation, or other non-normal events, if different for low visibility situations.

4. Weather Reporting. Weather reporting and transmissometer systems, including RVR locations, readout increments, sensitivity to lighting levels set for the runway edge lights, variation in the significance of reported values during international operations, controlling and advisory status of readouts, and requirements when transmissometers become inoperative should be addressed.

5. Facility Status. Facility status, proper interpretation of outage reports for lighting components, standby power, or other factors and proper application of NOTAM's regarding the initiation of Category III approaches or initiation of a low visibility takeoff should be addressed.

**7.1.2. The Airborne System.** The training and qualification program should address the characteristics, capabilities, limitations, and proper use of each appropriate airborne system element applicable to Category III landing or low visibility takeoff including the following:

1. Flight Guidance. The flight control system, flight guidance system, instruments and displays and annunciation systems including any associated flight director, landing system and roll out system, or takeoff systems, if applicable. For automatic or manual systems which require crew input for parameters such as inbound course or automatic or manually tuned navigation frequencies, the crew should be aware of the importance of checking that proper selections have been made to assure appropriate system performance.

2. Speed Management. The automatic throttle, FMC or other speed management system, if applicable.

3. Instruments. Situation information displays, as applicable.

4. Supporting Systems. Other associated instrumentation and displays, as applicable, including any monitoring displays, status displays, mode annunciation displays, failure or warning annunciations and associated system status displays that may be relevant.

5. Aircraft Characteristics. Any aircraft characteristics that may be relevant to Category III, such as cockpit visibility cutoff angles and the effect on cockpit visibility of proper eye height, seat position or instrument lighting intensities related to transition through areas of varying brightness visual conditions change. Pilots should be aware of the effects on flight visibility related to use of different flap settings, approach speeds, use of various landing or taxi lights and proper procedures for use of windshield wipers and rain repellent. If windshield defog, anti-ice, or de-icing systems affect forward visibility, pilots should be aware of those effects and be familiar with proper settings for use of that equipment related to low visibility landing.

### **7.1.3. Flight Procedures and Associated Information.**

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1. Operations Specification. Pilots and aircraft dispatchers should be familiar with, and properly able to apply, operations specifications applicable to Category III landing or low visibility takeoff.
2. Normal and Non-normal Procedures. Pilots should be familiar with appropriate normal and non-normal procedures including crew duties, monitoring assignments, transfer of control during normal operations using a "monitored approach," appropriate automatic or crew initiated call-outs to be used, proper use of standard instrument approach procedures, special instrument approach procedures, applicable minima for normal configurations or for alternate or failure configurations and reversion to higher minima in the event of failures.
3. Weather and RVR. Pilots and aircraft dispatchers should be familiar with weather associated with Category III and proper application of runway visual range, including its use and limitations, the determination of controlling RVR and advisory RVR, required RVR equipment, appropriate light settings for correct RVR readouts and proper determination of RVR values reported at foreign facilities.
4. Use of DA(H) or Alert Height. Pilots should be familiar with the proper application of Decision Height or Alert Height, as applicable, including proper use and setting of radar altimeter bugs, use of the inner marker where authorized or required due to irregular underlying terrain and appropriate altimeter setting procedures for the barometric altimeter consistent with the operators practice of using either QNH or QFE.

5. Use of Visual Reference. Pilots should be familiar with the availability and limitations of visual reference encountered for taxi, takeoff, and approach.

Approach visual reference limitation information should at least address aircraft geometry limitations on visual reference, actions to take with loss or partial loss of visual reference, risks of inappropriate use of visual reference, and necessary visual references for continuation after Decision Height, if a Decision Height is applicable. Issues listed in section 6.2.7 above for continuation or discontinuation of an approach in deteriorating weather conditions should be comprehensively addressed.

Pilots should be familiar with procedures for an unexpected deterioration of conditions to less than the minimum visibility specified for the procedure during an approach, flare or roll out including the proper response to a loss of visual reference or a reduction of visual reference below the specified values when using a Decision Height and prior to the time that the aircraft touches down. The operator should provide some means of demonstrating the expected minimum visual references that occur on approach when the weather is at acceptable minimum conditions, and the expected sequence of visual queues during an approach in which the visibility is at or above the specified landing minimums. This may be done using simulation, video presentation of simulated landings or actual landings, slides or pictures showing expected visual references, computer based reproductions of expected visual references, or other means acceptable to the FAA.

When an alert height is used, pilots should be familiar with the expected visual references sequence likely to be encountered during an approach, even though a specific regulatory visual reference is not established when using an alert height.

When a synthetic reference system such as "synthetic vision" or enhanced vision systems or independent landing monitors are used, pilots should be familiar and current with the interpretation of the displays to assure proper identification of the runway and proper positioning of the aircraft relative to continuation of the approach to a landing. Pilots should be briefed on the limitations of these systems for use in various weather conditions and specific information may need to be provided on a site-specific basis to assure that mis-identification of runways, taxiways or other adjacent runways does not occur when using such systems.

For takeoff, pilots should be aware of the operators policy for responding to loss of suitable visual reference during takeoff, in the low and high speed regime, both before and after V<sub>1</sub> (see FAA AC 120-62 "Takeoff Safety Training Aid" for additional information and recommendations for training).

6. Transfer of Control. Procedures should be addressed for transfer of control and transition from non-visual to visual flight for both the pilot in command, second in command, as well as the pilot flying and pilot not flying during the approach. For systems which include electronic monitoring displays, as described in item 5 above, procedures for transition from those monitoring displays to external visual references should be addressed.

7. Acceptable Flight Path Deviations. Pilots should be familiar with the recognition of the limits of acceptable aircraft position and flight path tracking during approach, flare and if applicable roll out. This should be addressed using appropriate displays or annunciations for either automatic landing systems or for manual landing systems or when using electronic monitoring systems such as an independent landing monitor.

8. Wind Limitations. Environmental effects should be addressed. Environmental effects include appropriate constraints for head winds, tail winds, cross winds, and the effect of vertical and horizontal wind shear on automatic systems, flight directors, or other system (e.g., synthetic vision) performance. For systems such as head-up displays which have a limited field of view or synthetic reference systems pilots should be familiar with the display limitations of these systems and expected pilot actions in the event that the aircraft reaches or exceeds a display limit capability.

9. Contaminated Runways. Pilots and aircraft dispatchers should be familiar with the operator's policies and procedures concerning constraints applicable to Category III landings or low visibility takeoffs, on contaminated or cluttered runways. Limits should be noted for use of slippery or icy runways as far as directional control or stopping performance is concerned, and crews should be familiar with appropriate constraints related to braking friction reports. Pilots and aircraft dispatchers should be familiar with the method of providing braking friction reports applicable to each airport having Category III landing operations or low visibility takeoff operations.

10. Airborne System Failures. Pilots should be familiar with the recognition and proper reaction to significant airborne system failures experienced prior to and after reaching the final approach fix and experienced prior to and after reaching Alert Height or Decision Height, as applicable. Expected pilot response to failure after touchdown should be addressed, particularly for Category III operations. Engine inoperative Category III provisions should be addressed, if applicable, including identification of acceptable aircraft and system configurations, assurance of adequate obstacle clearance and missed approach performance, and appropriate use of alternates. If applicable, provisions for “engine inoperative Category III” should be addressed.

11. Go-around Provisions. Pilots are expected to appropriately recognize and react to ground or navigation system faults, failures or abnormalities at any point during the approach, before and after passing Alert Height or Decision Height and in the event an abnormality or failure which occurs after touchdown. Pilots should be familiar with appropriate go-around techniques, systems to be used either automatically or manually, consequences of failures on go-around systems which may be used, the expected height loss during a manual or automatic go around considering various initiation altitudes, and appropriate consideration for obstacle clearance in the event that a missed approach must be initiated below Alert Height or Decision Height.

12. Reporting Anomalies. Pilots should be familiar with the need to report navigation system anomalies or discrepancies, or failures of approach lights, runway lights, touchdown zone lights, center line lights or any other discrepancies which could be pertinent to subsequent Category III operations.

**7.2. Flight Training (Aircraft or Simulator).** Flight training (typically using a simulator) should address the following maneuvers and procedures and may be done individually as Category III maneuvers, or they may be accomplished in appropriate combinations with Category I or Category II maneuvers. When pilots are authorized to use minima for Category I or Category II, as well as Category III, maneuvers may be appropriately combined and done in conjunction with other required approaches necessary for Category I or Category II training and qualification when such combinations are appropriate (e.g., engine-inoperative missed approach). During each of the specified maneuvers or procedures, crewmembers are expected to perform their respective assignments or duties as applicable. In situations where crewmembers are being qualified, other than as part of the complete flightcrew, such as when two pilots in command are being qualified, it may in some cases be necessary to assure that each candidate completes the required maneuvers or procedures involving manual control of the aircraft or other demonstration of proficiency when such demonstration is required for a PIC.

Flight training (typically using a simulator) for Category III approach and landing should address at least the following maneuvers:

1. Normal landings at the lowest applicable Category III minima.

2. A missed approach from the Alert Height or Decision Height (may be combined with other maneuvers).
3. A missed approach from a low altitude that could result in a touchdown during go-around (rejected landing).
4. Appropriate aircraft and ground system failures (may be combined with other maneuvers).
5. Engine failure prior to or during approach (if specific flight characteristics of the aircraft or operational authorizations require this maneuver).
6. Except for aircraft using an automatic Fail Operational roll out system, manual roll out in low visibility at applicable minima (may be combined).
7. Landings at the limiting environmental conditions authorized for Category III for that operator with respect to wind, cross wind components, and runway surface friction characteristics (may be combined).

Flight training (typically using a simulator) for low visibility takeoff (e.g., RVR less than RVR500 ft./150 m), where a flight guidance system is required, should address the following maneuvers and procedures:

1. Normal takeoff,
2. Rejected takeoff from a point prior to  $V_1$  (including an engine failure),
3. Continued takeoff following failures including engine failure, and any critical failures for the aircraft type which could lead to lateral asymmetry during the takeoff, or
4. Rejected takeoff which involve transfer of control from the first officer to the captain, if first officers are authorized to make takeoffs under the specified low visibility conditions (if applicable).

The conditions under which these normal and rejected takeoffs should be demonstrated include appropriate limiting cross winds, winds, gusts and runway surface friction levels authorized. A demonstration should be done at weights or on runways that represent a critical field length. If the flight guidance devices used have not been shown to have failure characteristics which are extremely improbable, a takeoff and rejected takeoff should be demonstrated with failure of the flight guidance device at a critical point of the takeoff.

Training for low visibility taxi and ground operations (e.g., during simulator training, LOFT or other scenarios) are recommended to be conducted to the extent practical and beneficial. If conducted, they should address at least representative items listed in Sections 6.2.8, 7.1.1, and 7.1.3 at typical airports. Alternately, the operator may elect to use airports frequently experiencing low visibility conditions, complex airports on the operator's route system, airports with particular low visibility ground movement difficulties, or rarely used but significant contingency airports (e.g., ETOPS or EROPS diversion

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airports), as determined appropriate by the operator for that operator's route system, aircraft types, training cycle, LOFT scenarios used, and typical line issues being experienced.

### **7.2.1. Initial Qualification.**

1. **Ground Training.** Initial ground training should cover the subjects specified in 7.1 for each pilot in command and second in command and appropriate subjects from 7.1 relevant to other crewmembers when they have assigned responsibilities for Category III landing or low visibility takeoff.

2. **Flight Training.** Flight training should be conducted using an approved simulator capable of performing the appropriate maneuvers specified, and which can appropriately represent the limiting visual conditions related to the minima which are applicable. Where simulation is not available, an aircraft with suitable view limiting device may be used if authorized by the assigned principal operations inspector. While the number of simulator periods, training flights, or length of simulator periods is not specified, the operator is expected to provide sufficient training to assure that crewmembers can competently perform each of the maneuvers or procedures specified in 7.2 to an acceptable degree of proficiency. When Category III minima are based on manual operations using systems like head-up displays or flight directors, a number of repetitions of the maneuvers specified in paragraph 7.2 above may be necessary to assure that each of the required maneuvers can be properly and reliably performed. Guidance for acceptable programs can be found in FAA, FSB reports for specific aircraft types. Operators should adhere to FSB guidelines when published, unless otherwise authorized by AFS-400.

### **7.2.2. Recurrent Qualification.**

1. **Recurrent Ground Training.** Recurrent ground training should provide any necessary review of topics specified in 7.1 to assure continued familiarity with those topics. Emphasis should be placed on any program modifications, changes to aircraft equipment or procedures, review of any occurrences or incidents that may be pertinent, and finally emphasis may be placed on re-familiarization with topics such as mode annunciations for failure conditions or other information which the pilots may not routinely see during normal line operations. Topics to be addressed for each pilot in command, second in command other crewmember or aircraft dispatchers are those topics necessary for the performance of the assigned duties for each respective crewmember.

2. **Recurrent Flight Training.** Recurrent flight training should be conducted using an approved simulator with an appropriate visual system. In the event that simulation is not available, recurrent flight training may be accomplished in the aircraft using suitable view limiting devices, if approved by the principal operations inspector. Recurrent flight training should include at least one Category III approach to a landing if the pilot has not had recent Category III or simulated Category III experience, and one approach requiring a go-around from a low altitude below Alert Height or Decision Height prior to touchdown.

When takeoff minimums below RVR500 are approved, recurrent flight training must include at least one rejected takeoff at the lowest approvable minima, with an engine failure near but prior to V<sub>1</sub>. For both Category III landings and low visibility takeoffs, sufficient training should be provided to assure competency in each of the maneuvers or procedures listed in 7.2.

Recurrent flight training maneuvers may be accomplished individually or may be integrated with other maneuvers required during proficiency training or during proficiency checking. If minima are authorized using several methods of flight control such as both automatic landing and head-up display, then the training program should assure an appropriate level of proficiency using each authorized mode or system. Where Category III minima are based on manual control using flight guidance such as provided by a head-up flight guidance system, appropriate emphasis should be placed on failure conditions which a pilot does not normally experience in line operations.

**7.2.3. Recency of Experience.** Recency of experience requirements specified by section 121.439 or in accordance with AC 120-53 normally provide an assurance of the necessary level of experience for Category III landing or low visibility takeoff operations. In the event that special circumstances exist where crewmembers may not have exposure to the automatic landing system or manual systems such as head-up flight guidance for long periods of time beyond that permitted by section 121.439 or AC 120-53, then the operator should assure that the necessary recency of experience is addressed prior to pilots conducting Category III landings, or low visibility takeoff operations below RVR500.

For automatic landing systems, as a minimum, pilots should be exposed to automatic landing system operation and procedures during training or checking in either the aircraft or in a simulator at least annually, if the crew has not otherwise conducted line landings using an automatic system within the previous 12 months. For manual flight guidance landing or takeoff systems the pilot flying (PF) should be exposed to system operation, procedures, and use during training or checking at least once each 90 days, if the pilot has not otherwise conducted line landings using the manual flight guidance system within the previous 90 days.

**7.2.4. Re-qualification.** Credit for previous Category III qualification in a different aircraft type or variant, or previous qualification in the same type or variant at an earlier time may be considered in determining the type of program, length of program, required maneuvers to be completed or the repetition of maneuvers for re-qualification for Category III operations. Any re-qualification program should assure that the pilots have the necessary knowledge of the topics specified in section 7.1 and are able to perform their assigned duties for Category III or low visibility takeoff considering the maneuvers or procedures identified in section 7.2.

For programs which credit previous Category III qualification in a different type aircraft, the transition program should assure that any subtle differences between aircraft types which could lead to pilot misunderstanding of appropriate characteristics or procedures in the new type must be suitably addressed.

**7.2.5. Cockpit or Aircraft System Differences.** For Category III programs using aircraft which have several variants, training programs should assure that pilots are aware of any differences which exist and appropriately understand the consequences of those differences. Guidelines for addressing differences can be found in FAA AC 120-53 and FSB reports applicable to a particular type.

**7.2.6. Category III Operations with an Inoperative Engine.** For air carriers authorized to initiate a Category III approach with an inoperative engine either through Category III dispatch or equivalent procedures or for engine failures which occur en route, appropriate training should be completed to assure that pilots and aircraft dispatchers can properly apply the provisions of section 10.8. For airlines that do not authorize the initiation of a Category III approach with an engine inoperative as an approved procedure, pilots should at least be familiar with the provisions of sections 10.8.4 and 10.8.5 regarding an engine failure after passing the final approach fix. Additionally, pilots should be made aware of the engine inoperative capabilities of the aircraft by reference to the AFM.

**7.2.7. Training in Conjunction with Advanced Qualification Programs (AQP) or Exemptions for "Single Visit Training."** Appropriate re-qualification or recurrent qualification programs may be adjusted as necessary when incorporated in AQP or other single visit training programs. With such programs, however, each of the areas of knowledge specified by section 7 of this AC must be assured.

**7.2.8. Credit for "High Limit Captains" (Reference section 121.562).** When authorized by the POI, credit for high landing weather minimum limits and required turbojet experience may be authorized consistent with provisions of exemptions authorized for Category III qualification credit.

**7.2.9. Enhanced or Synthetic Vision Systems (Independent Landing Monitor).** Training required for enhanced or synthetic vision systems may be as specified by FAA based on successful completion of proof of concept testing.

**7.3. Checking or Evaluations.** For both initial qualification and recurrent qualification, crewmembers should demonstrate proper use of aircraft systems and correct procedures as follows, unless otherwise specified by an applicable FSB report.

1. For automatic systems, for landing at least one automatic landing to a full stop, and one go-around from a low approach at, or after, decision or Alert Height. The automatic landing to a full stop may be waived for recurrent qualification if the crewmember has accomplished an automatic landing within a period for autoland currency for that operation and aircraft type.
2. For manual systems one landing to a complete stop at the lowest applicable minima and one go-around from low altitude below Alert Height or Decision Height and at least one response to a failure condition during the approach to a landing or a missed approach should be demonstrated.

3. For takeoff below RVR500, pilots should successfully demonstrate one takeoff in the event of an engine failure at, or after,  $V_1$  and one rejected takeoff with an engine failure or other appropriate failure near but prior to,  $V_1$ .

**7.4. Experience with Line Landings.** When a qualification program has been completed using only a simulator program, at least the following experience should be required before initiating Category III operations, unless otherwise specified by an applicable FSB report.

1. For automatic systems at least one line landing using the auto flight system approved for Category III minima should be accomplished in weather conditions at or better than Category II, unless a pilot's qualification has been completed in a Level C or D simulator found acceptable for that autoland system.

2. For manual systems such as head-up flight guidance system, the pilot in command must have completed at least ten line landings, using the approved flight guidance system in the configuration specified for Category III and at suitable facilities (e.g., facilities having appropriate ground facilities for the lowest minima authorized, or equivalent).

**7.5. Crew Records.** The operator should assure that records suitably identify initial and continued eligibility of pilots for Category III operations. Records should note the appropriate completion of training for both ground qualification, flight qualification, and initial training, recurrent training, or re-qualification training, as applicable.

**7.6. Dual Qualification.** In the event that crewmembers are dual qualified as either captain or first officer for checking and performing the duties of the second in command or for crewmembers dual qualified between several aircraft types or variants, appropriate training and qualification must be completed to assure that each crewmember can perform the assigned duties for each seat position and each aircraft type or variant.

For programs involving dual qualification, principal inspectors should approve the particular operators program considering the degree of differences involved in the Category III aircraft systems, the assigned duties for each crew position and criteria such as AC 120-53 related to differences. If a pilot serving as second in command is not expressly restricted from performing the duties of the pilot in command during Category III approaches or low visibility takeoffs below RVR500, then that pilot must satisfactorily complete the requirements for a pilot in command regarding maneuvers specified in section 7.2.

**7.7. Interchange.** When aircraft interchange is involved between operators, flightcrew members and aircraft dispatchers must receive sufficient ground and flight training to assure familiarity and competency with respect to the particular aircraft system or systems of the interchange aircraft. Guidelines for differences should be consistent with those specified in AC 120-53 and FSB reports.

**7.8. Training For Use of Foreign Airports for Category III Operations or Low Visibility**

**Takeoff.** Operators authorized to conduct Category III operations or low visibility takeoffs below RVR600 at foreign airports, which require procedures or limitations different than those applicable within the United States, should assure that flightcrew members and aircraft dispatchers are familiar with any differences appropriate to operations at those foreign airports.

**7.9. Line Checks.** Operators should include assessments of Category III procedures and practices as necessary during line checks when operations are conducted at facilities appropriate for Category III or at facilities appropriate for simulating Category III operations.

**8. AIRPORTS, NAVIGATION FACILITIES AND METEOROLOGICAL CRITERIA.** United States and non-United States airports and runways for Category III are those either having published part 97 SIAPS, or as otherwise specified on the FAA AFS-400 "Category II/Category III status checklist" (FAA Order 8400.8). Requests for authorization to use other airports/runways should be coordinated with AFS-400, through the operator's Certificate Holding District Office (CHDO).

**8.1. Use of Standard Navigation Facilities.** Category III operations may be approved on standard United States or ICAO navigation facilities as follows:

United States Type 3 ILS facilities for which part 97 Category III procedures are published;

United States Type 2 ILS facilities for which a published part 97 Category III procedure has been established;

Other United States Type 3 or Type 2 ILS facilities determined acceptable by AFS-400 for the type of aircraft equipment and minima sought; and

Non-United States facilities meeting ICAO criteria (ICAO Annex 10, ICAO Manual of All Weather Operations DOC 9365/AN910, etc.) and which are promulgated for use for Category III by the "State of the Aerodrome."

**8.2. Use of Other Navigation Facilities or Methods.** Category III operations may be approved using other types of navigation facilities than ILS or using other acceptable position fixing and integrity assurance methods, if proof of concept demonstrations acceptable to FAA are successfully completed:

Other United States facilities approvable for Category III (MLS, GLS, DGPS, or a Type I ILS used in conjunction with an acceptable aircraft integrity assurance system, etc.) are as determined acceptable by AFS-400, and

Non-United States ILS facilities meeting acceptable criteria other than ICAO (e.g., JAA), may be used as determined to be acceptable by AFS-400.

**8.3. Lighting Systems.** Lighting used for Category III must include the following systems, or ICAO equivalent systems, unless approved by AFS-400 (e.g., for Non-United States airports):

United States Standard ALSF1 or ALSF2 approach lights;

United States Standard Touchdown Zone Lights;

United States Standard Runway Centerline Lights;

United States Standard High Intensity Runway Lights;

United States Standard taxiway centerline lights (for any areas of the airport determined to be critical in an FAA accepted Surface Movement Guidance and Control (SMGC) plan), or equivalent;

United States Standard taxiway edge lights (for taxiways not requiring centerline lights);

Suitable ramp and gate area lighting for low visibility operations (for night operations); and

Runway Hold line/Stop Bar lights (if applicable to a FAA approved SMGC plan).

Exceptions to the above lighting criteria may be authorized only if equivalent safety can be demonstrated by an alternate means (e.g., substitution for required approach lighting components due to an approved aircraft system providing equivalent information or performance [such as radar based EVS], or redundant, high integrity, computed runway centerline information, displayed on a HUD).

**8.4. Marking and Signs.** Airports approved for Category III operations must include the following runway and taxiway markings and airport surface signs, or ICAO equivalent, unless approved by AFS-400 (e.g., for Non-United States airports):

United States Standard Precision Instrument Runway Markings.

United States Standard Taxiway edge and centerline Markings.

Runway signs, taxiway signs, hold line signs, taxiway reference point markings (if required by SMGC), and NAVAID (ILS) critical area signs and markings.

Markings and signs must be in serviceable condition, as determined by the operator or FAA Certificate Holding District Office (CHDO). Markings or signs found in an unacceptable condition by an operator should be reported to the appropriate airport authority and CHDO. Operators should discontinue Category II use of those areas of airport facilities or runways where unsafe conditions are known to exist due to markings or signs being inadequate, until remedial actions are taken by the airport authority (e.g., snow removal, rubber deposit removal on runway touchdown zone markings or centerline markings, critical area hold line or runway centerline marking repainting, runway hold line sign snow removal).

**8.5. Low Visibility Surface Movement Guidance and Control (SMGC) Plans.** United States airports conducting takeoff or landing operations below RVR1200 are required to develop a Surface Movement Guidance and Control System (SMGCS) plan. SMGCS operations facilitate low visibility takeoffs and landings and surface traffic movement by providing procedures and visual aids for taxiing aircraft between the runway(s) and apron(s). Specific low visibility taxi routes are provided on a separate SMGCS airport chart. SMGCS operations also facilitate the safety of vehicle movements that directly support aircraft operations, such as aircraft rescue and fire fighting (ARFF) and follow-me services, towing and marshaling.

Advisory Circular 120-57 as amended describes the standards and provides guidance in implementing SMGCS operations such as aircrew training, etc. An operator intending authorization for Category III operations should coordinate with the airport authority regarding their SMGCS plan. Equivalent coordination is also applicable at non-U.S. airports if such a plan is used by that airport.

## **8.6. Meteorological Services and RVR Availability and Use.**

**8.6.1. Meteorological Services.** Appropriate meteorological service (e.g., RVR, Altitude Settings, METAR's, TAF's, Braking Action, NOTAM's, reports) are necessary for each airport/runway intended for use by an operator for Category II, unless otherwise approved by AFS-400. Non-United States facilities should meet criteria of ICAO Doc 9365/AN910, second edition, or later, as amended. This information must be readily available to both the crew and the aircraft dispatcher.

### **8.6.2. RVR Availability and Use.**

**8.6.2.1. RVR Availability.** RVR availability for touchdown zone (TDZ), mid runway (MID), and ROLLOUT RVR (or a corresponding international equivalent location) are as follows. RVR should be provided for any runway over 8000 ft. in length. TDZ and ROLLOUT RVR should be provided for runways less than 8000 ft. Exceptions to this availability for United States operators at international locations may be approved on a case by case basis, by AFS-400, if equivalent safety can be established. Factors considered due to local circumstances at non-United States airports may include such issues as minima requested, characteristics of prevailing local weather conditions, location of RVR sites or RVR calibration, availability of other supporting weather reports on nearby runways, etc.

**8.6.2.2. RVR Use.** RVR use by operators and pilots is as specified in standard operations specifications Part C (see Appendix 7).

However, when approved as an exception in operations specifications, aircraft capable of certificated landing or takeoff distance of less than 4000 ft. may be approved to use a single TDZ, MID, or ROLLOUT transmissiometer as applicable to the part of the runway used (e.g., "Relevant" RVR). For such operations, transmissiometers not used are considered to be optional and advisory, unless the aircraft operation is planned to take place at a speed above safe taxi speed on the part of the runway where the MID or ROLLOUT transmissiometer is located.

For operations in the U.S., RVR must be instrumentally derived. At non-U.S. airports, RVR reports that are not instrumentally derived may be used if their basis is determined to be reliable and accurate by the operator and CHDO/POI.

For operations outside the U.S., operators and pilots should be familiar with any application and unique use of RVR at the airports to be used. This should include any differences in standard reporting, calibration, or RVR readings related to lighting step settings used, and any conversions necessary to be made (e.g., meteorological visibility to RVR conversion).

For meteorological visibility to RVR conversion, when operating at foreign airports where the landing minimums are specified only in RVR, and meteorological visibility is provided, the certificate holder or pilot should convert meteorological visibility to RVR by multiplying the reported visibility by an appropriate factor, as shown in Standard Operations Specifications

(see Appendix 7, Part C, Paragraph C051 for use of an appropriate conversion table). However, the conversion of reported Meteorological Visibility to RVR provided in paragraph C051 should not be used for takeoff minima or Category III minima, or when a reported RVR is available.

**8.6.3. Pilot Assessment of Takeoff Visibility Equivalent to RVR.** In special circumstances, provision may be made for pilot assessment of takeoff visibility equivalent to RVR to determine compliance with takeoff minima. Authorization for pilot assessment is provided through operations specifications paragraph C078 (see Appendix 7) when a satisfactory procedure is provided to the flightcrew. A pilot may assess visibility at the take off position in lieu of reported TDZ RVR (or equivalent) in accordance with the following:

1. TDZ RVR is inoperative, or is not reported (e.g., ATS facility is closed), or
2. local visibility conditions as determined by the pilot indicate that a significantly different visibility exists than the reported RVR (e.g., patchy fog, blowing snow, RVR believed to be inaccurate due to snow cover or ice), and
3. pertinent markings, lighting, and electronic aids are clearly visible and in service (e.g., no obscuring clutter), and
4. a pilot assessment is made using an accepted method regarding identification of an appropriate number of centerline lights, or markings, of known spacing visible to the pilot when viewed from the flight deck when the aircraft is at the take-off point, and
5. pilot assessment of visibility as a substitute for TDZ (takeoff) RVR is approved for the operator, and observed visibility is determined to be greater than the equivalent of RVR300 (75m), and
6. a report of the pilot's determination of visibility (PIREP) is forwarded to a suitable ATS facility, and if applicable, dispatch facility prior to departure (e.g., if an ATS facility or dispatch facility is

applicable, available, pertinent, and is providing services relevant to the pilot report). A report of pilot visibility is intended to provide information for other operations.

**8.7. Critical Area Protection.** Airports and runways used for Category II or III must have suitable NAVAID (e.g., ILS) critical area protection, as applicable to the ground and aircraft systems used. Procedures equivalent or more stringent than those specified in the Air Traffic Control Handbook (FAA Order 7110.65) as amended, are required. Procedures consistent with ICAO DOC 9365/AN910 are acceptable for non-United States facilities. Where uncertainty regarding acceptability of non-United States airport procedures is a factor, operators or CHDOs should contact AFS-400 (e.g., for non United States airports and runways listed on the FAA Category II/Category III status checklist where doubt exists regarding adequacy of procedures encountered in routine operations) for follow up.

**8.8. Operational Facilities, Outages, Airport Construction, and NOTAM's.** For operations to be initially authorized, operations to continue to be authorized, for an aircraft to be dispatched with the intention of using a facility described above, or for an aircraft to continue to its destination or an alternate with the intent of completing a Category III instrument approach procedure, each of the applicable necessary components or services identified in 8.1 through 8.7 above must be operating, available, or normal as intended for Category III (e.g., NAVAID's, standby power, lighting systems) except as specified below.

Outer, Middle, or Inner Marker beacons may be inoperative unless a Category III operation is predicated on their use (e.g., an AH is predicated on use of an Inner Marker due to irregular terrain, or the aircraft system requires use of a marker beacon for proper flight guidance function).

Lighting systems are in normal status except that isolated lights of an approach light, or runway light system may be inoperative; approach light components not necessary for the particular operation (such as REIL, VASI, RAIL, or SFL) may be inoperative; lights may not be completely obscured by snow or other such contaminants if necessary for the operation (e.g., night); Taxiway, ramp, and gate area lighting components may be inoperative if not essential for the operation to be conducted.

Ground facility standby power capability for the landing airport or alternate (if applicable) must be operative at the time of the aircraft's departure to a Category III destination or alternate.

Category III operations may be continued at airports at which construction projects affect runways, taxiways, signs, markings, lighting, or ramp areas only if the operator has determined that low visibility operations may be safely conducted with the altered or temporary facilities that are provided. In the event of uncertainty as to the suitability of facilities, the operator should consult with their CHDO.

Operators may make the determination as to the suitability of the above facilities regarding unusual weather or failure conditions unless otherwise specified by the airport authority, or FAA.

NOTAM's for NAVAID's, facilities, lighting, marking, or other capabilities must be appropriately considered for both dispatch, and for continued flight operations intending to use a Category III procedure. Operators, aircraft dispatchers, and pilots must appropriately respond to NOTAM's

potentially adversely affecting the aircraft system operation, or the availability or suitability of Category III procedures at the airport of landing, or any alternate airport intended for Category III.

An operator may make the determination that a NOTAM does not apply to the aircraft system and procedures being used for a particular flight if the safety of the operation can be ensured, considering the NOTAM and situation (e.g., a NOTAM specifying Category III Not Available due to the ALS inoperative, for an aircraft that had previously been dispatched based on a Category III ETOPS or EROPS alternate airport flight plan, and no other suitable airport facility is available). In such instances, pilots must be advised of any relevant information to the decision, and any precautions to be taken.

**8.9. Use of Military Facilities.** Military facilities may be used for Category III if authorized by DoD, and if equivalent criteria are met as applicable to United States civil airports.

**8.10. Special Provisions for Facilities Used for ETOPS or EROPS Alternates.** ETOPS operations are extended range operations with twin-engine aircraft, typically conducted over oceanic or remote areas (see Appendix 1 for definitions, or see a current version of AC 120-42 and 14 CFR section 121.161 for requirements or criteria). EROPS operations are those “extended range operations” typically conducted in oceanic or remote areas, regardless of the number of installed engines.

An airport used as an ETOPS or EROPS alternate based on having available Category III engine-inoperative capability should meet at least the following criteria:

Sufficient information about pre-threshold terrain, missed approach path terrain, and obstructions should be available so that an operator can assure that a safe Category III landing can be completed, and that an engine-inoperative missed approach can be completed from AH or DH as applicable, or at any time after passing the AH or DH at least to a point at the end of the landing touchdown zone (TDZ).

Sufficient meteorological and facility status information should be available so that a diverting flightcrew and the aircraft dispatcher can receive timely status updates on facility capability, weather/RVR, wind components, and braking action reports (if applicable), if conditions could or would adversely affect a planned Category III landing during the period of a diversion.

For any alternate airports not routinely used by that operator as a regular destination airport (e.g., EGCC as an alternate for EGLL; BIKF as a North Atlantic alternate), sufficient information should be provided for aircraft dispatchers and pilots to be familiar with relevant low visibility and adverse weather characteristics of that airport that might have relevance to an engine-inoperative operation (e.g., unique lighting or markings, any nearby obstructions or frequently encountered local wind shear or turbulence characteristics, meteorological reports, braking reports, and NOTAM interpretation, appropriate ground taxi route and gate location information, emergency services available).

**8.11. Alternate Minima.** Use of alternate minima are specified in Standard OpSpecs Part C paragraph C055. For applicability of "engine inoperative Category III" capability see section 10.8, and in particular, 10.8.2 items (10) and (11).

Paragraph C055 is issued to all part 121 and part 135 operators who conduct IFR operations with airplanes. This paragraph provides a three-part table from which the operator, during the initial dispatch or flight release planning segment of a flight, determines applicable alternate airport IFR weather minimums for those cases where it has been determined that an alternate airport is required.

**a. Standard Provisions.** Standard provisions of the Part C paragraph C055 operation-specification are applicable to airports with at least one operational navigational facility, or for multiple navigation facilities providing straight-in instrument approach procedures other than precision, or a straight-in precision approach procedure, or a circling maneuver from an instrument approach procedure. The required ceiling and visibility is obtained by adding an increment to the landing minima (e.g., adding 400 ft. to the Category I HAT or, as applicable, the authorized HAA, and by adding 1 statute mile to the authorized landing visibility.

**b. Special Engine Inoperative Provisions.** Special provisions for Category II and Category III engine-out capability are listed in the third part of the table for airports with at least two operational navigational facilities, each providing a straight-in precision approach, including a precision approach procedure to Category II or Category III minima. The required ceiling and visibility for this operational credit is obtained by adding 300 ft. or 200 ft. to the respective lowest Category II or Category III touchdown zone elevation of the two approaches considered, and by adding 1200 ft. to the lowest authorized RVR minimum (see Appendix 7 Part C paragraph C055).

**8.12. Flight Planning to Airports That Have Weather Conditions Below Landing Minima.** In certain instances an operator may flight plan (e.g., dispatch) an aircraft to a destination airport even though current weather is reported to be below, or may be forecast to be below landing minima. This is to permit aircraft to begin a flight if there is a reasonable expectation that at or near the expected time of arrival at the destination airport, weather conditions are expected to permit a landing at or above landing minima.

Flight Planning (e.g., dispatch) to such airports typically is considered acceptable if the following conditions are met:

- 1) All requirements are met to use the landing minima at the destination and at each alternate airport on which the flight plan (e.g., dispatch) is predicated (e.g., aircraft, crew, airport facilities, NAVAID's).
- 2) If Alternate minima credit is applied based on availability of Category III capability, or Engine inoperative Category III capability, then each of the airborne systems otherwise applicable to use of that capability must be available at the time of flight planning (e.g., flight guidance system, anti skid, thrust reverse capability, as applicable to the aircraft type and Category III authorization for that operator)

- 3) ETA at the destination airport considers any necessary holding fuel that may be required while the aircraft waits for weather improvement.
- 4) Air Traffic conditions are considered for potential delay due to other aircraft arrivals or departures at the destination and at each alternate airport.
- 5) At least two qualifying alternates are available, the first of which considers the aircraft flying to the below minima intended destination, then holding for a time as determined by the operator awaiting approach or weather improvement, then flying to the closest alternate, then completing an approach and missed approach at that airport, and then flying to the second alternate and landing with appropriate reserve fuel.

## **9. CONTINUING AIRWORTHINESS/MAINTENANCE.**

**9.1. Maintenance Program.** Unless otherwise approved by FAA, each operator should have an approved continuous airworthiness maintenance program (CAMP). The approved continuous airworthiness maintenance program should typically include any necessary provisions to address lower landing minima (LLM) or low visibility takeoff in accordance with the operator's intended operation and the manufacturers recommended maintenance program, MRB requirements or equivalent requirements, or any subsequent FAA designated requirements (e.g., AD's, mandatory service bulletins). Emphasis should be on maintaining and ensuring total system performance, accuracy, availability, reliability, and integrity for the intended operations.

**9.2. Maintenance Program Provisions.** The maintenance program should be compatible with an operator's organization and ability to implement and supervise the program. Maintenance personnel should be familiar with the operators approved program, their individual responsibilities in accomplishing that program, and availability of any resources within or outside of the maintenance organization that may be necessary to assure program effectiveness (e.g., getting applicable information related to the manufacturer's recommended maintenance program, getting information referenced in this AC such as service bulletin information).

Provision for low visibility operations may be addressed as a specific program or may be integrated with the general maintenance program.

Regardless whether the maintenance program is integrated or is designated as a specific program for Lower Landing Minima (LLM), the maintenance program should at least address the following:

- 1) Maintenance procedures necessary to ensure continued airworthiness relative to low visibility operations.
- 2) A procedure to revise and update the maintenance program.

- 3) A method to identify, record or designate personnel currently assigned responsibility in managing the program, performing the program, maintaining the program, or performing quality assurance for the program. This includes identification of any contractor or sub-contractor organizations, or where applicable, their personnel.
- 4) Verification should be made of the lower landing minima systems and configuration status for each aircraft brought into the maintenance or lower minimum program. Unless otherwise accepted by FAA, each aircraft should meet relevant criteria specified by the applicable aircraft manufacturer or avionics manufacturer for associated systems and equipment (e.g., Valid U.S. TC, appropriate STC records and compliance, assessment of status of any engineering orders, AD's, service bulletins or other compliance).
- 5) Identification of modifications, additions, and changes which were made to qualify aircraft systems for the intended operation or minima, if other than as specified in the AFM, TC or STC.
- 6) Identification of additional maintenance requirements and log entries necessary to change minima status.
- 7) Any discrepancy reporting procedures that may be unique to the low visibility program. If applicable, such procedures should be compatibly described in maintenance documents and operations documents.
- 8) Procedures which identify, monitor and report lower minimum system and component discrepancies for the purpose of quality control and analysis.
- 9) Procedures which define, monitor and report chronic and repetitive discrepancies.
- 10) Procedures which ensure aircraft remain out of lower minimum status until successful corrective action has been verified for chronic and repetitive discrepancies.
- 11) Procedures which ensure the aircraft system status is placarded properly and clearly documented in the aircraft log book, in coordination with maintenance control, engineering, flight operations, and dispatch, or equivalent.
- 12) Procedures to ensure the downgrade of an aircraft low visibility capability status, if applicable, when maintenance has been performed by persons other than those trained, qualified, or authorized to use or approve procedures related to low visibility operations.
- 13) Procedures for periodic maintenance of systems ground check, and systems flight check, as applicable. For example, following a heavy maintenance, suitable checks may need to be performed prior to return to service.

14) Provisions for an aircraft to remain in a specific low visibility capability status (e.g., Category II, Category III, Fail-Operational, Fail Passive) or other designated operational status used by the operator.

15) Provision should be made for periodic operational sampling of suitable performance. Typically, at least one satisfactory approach should have been accomplished within a specified period approved for that operator, unless a satisfactory systems ground check has been accomplished. A recording procedure for both satisfactory and unsatisfactory results should be included. Fleet sampling is not typically acceptable in lieu of specific aircraft assessment. Typically at least one satisfactory low visibility system operational use, or a satisfactory systems ground check, should be accomplished within 30 days, for an aircraft to remain in Category III status. Any extension to an aircraft sampling period limit beyond 30 days, or use of statistical fleet sampling should be consistent with the manufacturer's current sampling recommendations and be based on the demonstrated reliability of that operator's aircraft flight guidance system performance in service. Failure of an operator to maintain an acceptable reliability record should result in timely and appropriate remedial action, and should lead to reconsideration of suitability of any sampling period extensions or fleet statistical sampling authorizations.

**9.3. Initial And Recurrent Maintenance Training.** Operator and contract maintenance personnel including mechanics, maintenance controllers, avionics technicians, personnel performing maintenance inspection or quality assurance, or other engineering personnel if applicable, should receive initial and recurrent training as necessary for an effective program. The training curriculum should include specific aircraft systems and operator policies and procedures applicable to low visibility operations. Recurrent training should typically be accomplished at least annually, or when a person has not been involved in the maintenance of the specified aircraft or systems for an extended period (e.g., greater than 6 months). Training may lead to a certification or qualification (e.g., for lower landing minima "LLM") if the operator so designates such qualification in that operator's approved program.

The training should at least include, as applicable:

1) An initial and recurrent training program for appropriate operator and contract personnel. Personnel considered to be included are maintenance personnel, quality and reliability groups, maintenance control, and incoming inspection and stores, or equivalent organizations. Training should include both classroom and at least some "hands-on" aircraft training for those personnel who are assigned aircraft maintenance duties. Otherwise, training may be performed in a classroom, by computer based training, in simulators, in an airplane or in any other effective combination of the above consistent with the approved program, and considered acceptable to FAA.

2) Subject areas for training should include: Operational concepts, aircraft types and systems affected, aircraft variants and differences where applicable, procedures to be used, manual or technical reference availability and use, processes, tools or test equipment to be used, quality control, methods for testing and return to service, signoffs required, proper Minimum Equipment List (MEL) application, general information about where to get technical assistance as necessary, necessary coordination with

other parts of the operator's organization (e.g., flight operations, dispatch), and any other maintenance program requirements unique to the operator or the aircraft types or variants flown (e.g., human factors considerations, problem reporting).

- 3) Procedures for the use of outside vendors or vendor's parts that ensures compatibility to program requirements and for establishing measures to control and account for parts overall quality assurance.
- 4) Procedures to ensure tracking and control of components that are "swapped" between systems for trouble shooting when systems discrepancies can not be duplicated. These procedures should provide for total system testing and/or removal of aircraft from lower minimum status.
- 5) Procedures to assess, track and control the accomplishment of changes to components or systems pertinent to low visibility operations (e.g., AD's, service bulletins, engineering orders, FAR requirements).
- 6) Procedures to record and report lower minimum operation(s) that are discontinued/ interrupted because of system(s) malfunction.
- 7) Procedures to install, evaluate, control, and test system and component software changes, updates, or periodic updates.
- 8) Procedures related to the minimum equipment list (MEL) remarks section use which identify low visibility related systems and components, specifying limitations, upgrading and downgrading.
- 9) Procedures for identifying low visibility related components and systems as "required inspection items" (RII), to provide quality assurance whether performed in-house or by contract vendors.

**9.4. Test Equipment/Calibration Standards.** Test equipment may require periodic re-evaluation to ensure it has the required accuracy and reliability to return systems and components to service following maintenance. A listing of primary and secondary standards used to maintain test equipment which relate to low visibility operations should be maintained. It is the operator's responsibility to ensure these standards are adhered to by contract maintenance organizations. Traceability to a national standard or the manufacturer's calibration standards should be maintained.

**9.5. Return To Service Procedures.** Procedures should be included to upgrade or downgrade systems status concerning low visibility operations capability. The method for controlling operational status of the aircraft should ensure that flightcrews, maintenance and inspection departments, dispatch, and other administrative personnel as necessary are appropriately aware of aircraft and system status.

The appropriate level of testing should be specified for each component or system. The manufacturer's recommended maintenance program or maintenance instructions should be considered when

determining the role built-in-test-equipment (BITE) should play for return to service (RTS) procedures, or for use as a method for low visibility status upgrade or downgrade.

Contract facilities or personnel should follow the operator's FAA approved maintenance program to approve an aircraft for return to service. The operator is responsible for ensuring that contract organizations and personnel are appropriately trained, qualified, and authorized.

**9.6. Periodic Aircraft System Evaluations.** The operator should provide a method to continuously assess or periodically evaluate aircraft system performance to ensure satisfactory operation for those systems applicable to Category II or III. An acceptable method for assuring satisfactory performance of a low visibility flight guidance system (e.g., autoland or HUD) is to periodically use the system and note satisfactory performance. A reliable record such as a logbook entry or computer ACARS record showing satisfactory performance within the previous 6 months for Category II, or previous 30 days for Category III, is typically an acceptable method for assuring satisfactory system operation (see Section 9.2 item 15).

Periodic flight guidance system/autoland system checks should be conducted in accordance with procedures recommended by the airframe or avionics manufacturer, or by an alternate procedure approved by the FAA. For periodic assessment, a record should be established to show when and where the flight guidance/autoland system was satisfactorily used, and if performance was not satisfactory, to describe any remedial action taken.

Use of the flight guidance/automatic landing system should be encouraged to assist in maintaining its availability and reliability.

**9.7. Reliability Reporting And Quality Control.** For a period of 1 year after an applicant has been authorized reduced minima, a monthly summary should be submitted to the certificate holding office. The following information should be reported:

- a.** The total number of approaches tracked, the number of satisfactory approaches tracked, by aircraft/system type, and visibility(RVR), if known or recorded.
- b.** The total number of unsatisfactory approaches, and reasons for unsatisfactory performance, if known, listed by appropriate category(e.g., poor system performance, aircraft equipment problem/failure; ground facility problem, ATS handling, lack of critical area protection, or other).
- c.** The total number of unscheduled removals of components of the related avionics systems.
- d.** Reporting after the initial period should be in accordance with the operators established reliability and reporting requirements.

**9.8. Configuration Control/System Modifications.** The operator should ensure that any modification to systems and components approved for low visibility operations are not adversely

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affected when incorporating software changes, service bulletins, hardware additions or modifications. Any changes to system components should be consistent with the aircraft manufacturer's, avionics manufacturer's, industry or FAA accepted criteria or processes.

**9.9. Records.** The operator should keep suitable records (e.g., both the operator's own records and access to records of any applicable contract maintenance organization). This is to ensure that both the operator and FAA can determine the appropriate airworthiness configuration and status of each aircraft intended for Category III operation.

Contract maintenance organizations should have appropriate records and instructions for coordination of records with the operator.

## **9.10. FAR 129 Foreign Operator Maintenance Programs.**

**9.10.1. Maintenance of FAR 129 Foreign Registered Aircraft.** For part 129 operators of Foreign registered aircraft (e.g., section 129.14 is not applicable), the cognizant CAA is the CAA of the operator. For those situations, FAA may implicitly accept that the maintenance program is considered to be acceptable if the cognizant CAA has approved it, and if the operator or CAA indicates that the program meets U.S. criteria, U.S. equivalent criteria (e.g., criteria such as JAA criteria), or ICAO criteria (e.g., Annex 6 and Doc 9365/AN910 "Manual of All Weather Operations"), and the cognizant CAA has authorized Category II or Category III U.S. operations. FAA then issues the pertinent part 129 Category II/III OpSpec based on the other CAA's approval for that operator. However, FAA reserves the prerogative to assure competence of both the operator and authorizing and supervising CAA, depending on whether the CAA or operator are considered to be from a category 1, 2, or 3 country (safety classification not a low visibility landing classification), and if there have been any reported problems with the operator or CAA. Evidence of the operator satisfying or being consistent with the manufacturer's recommended maintenance program should serve as evidence of an acceptable maintenance program, regardless of the capability of the CAA or the operator, unless FAA has specifically addressed maintenance requirements beyond those of the manufacturer for that aircraft type (e.g., required service bulletin compliance or Airworthiness Directive compliance related to the flight guidance system).

**9.10.2. Maintenance of FAR 129 Foreign Operated U.S. "N" Registered Aircraft.** Foreign operators of U.S. "N" Registered Aircraft (e.g., those operators to which section 129.14 is applicable) should have maintenance programs equivalent to that required for a U.S. part 121 operator. Use of the part 91 provisions for General Aviation are not applicable or appropriate. Principal Operations Inspector Approval of Category II/III OpSpecs for a part 129.14 operator may implicitly be considered to also accept the maintenance program adequacy. Accordingly, coordination between the applicable POI and PMI is necessary before part 129 OpSpec authorization is completed. The FAA is ultimately the cognizant CAA for the maintenance program in this instance, if the aircraft is N registered. The FAA may however, accept the oversight of the operators CAA if that CAA is judged by FAA to have equivalent processes, criteria and procedures for oversight of maintenance programs (e.g., JAA countries). The basis for any such maintenance

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program should be the recommended airframe manufacturer (or avionics vendor) program, considering any adjusted MRB requirements.

## **10. APPROVAL OF UNITED STATES OPERATORS.**

Approval for Category I, II and III is through issuance of or amendments to Operations Specifications (OpSpecs). The authorizations, limitations, and provisions applicable to Category I, Category II or Category III are specified in Part C of the OpSpecs. Sample OpSpecs are provided in Appendix 7.

Operations specifications authorizing Category I operations that use ICAO standard NAVAID's are normally approved by the certificate holding district office or regional flight standards office without further review and concurrence. All Category II or Category III operations normally require both regional flight standards and AFS-400 review and concurrence before approval.

### **10.1. Operations Manuals and Procedures.**

**a. Manuals.** Prior to Category approval, appropriate flightcrew operating manuals, flight manuals, airline policy manuals, maintenance manuals, training manuals, and related aircraft checklists, quick reference handbooks, or other equivalent operator information, should satisfactorily incorporate pertinent Category III provisions.

Information covered in ground training, and procedures addressed in flight training should be available to pilots in an appropriate form for reference use.

**b. Procedures.** Prior to Category approval, provisions of section 6 of this AC for procedures, duties, instructions, or any other necessary information to be used by flightcrews and aircraft dispatchers should be implemented by the operator.

Crew member duties during the approach, flare, rollout, or missed approach should be described. Duties should at least address responsibilities, tasks of the pilot flying the aircraft and the pilot not flying the aircraft during all stages of the approach, landing, rollout and missed approach. The duties of additional crewmembers, if required, should also be explicitly defined.

Specification of crewmember duties should address any needed interaction with the aircraft dispatcher or maintenance (e.g., addressing resolution of aircraft discrepancies and return to service).

The applicant's qualification program should incorporate specific Category II/III procedural responsibilities for the pilot in command and second in command in each of the ground training subject areas listed in paragraph 7.1, and each of the flight training subject areas listed in paragraph 7.2.

**10.2. Training Programs and Crew Qualification.** Training programs, AQP programs (if applicable), crew qualification and checking provisions and standards, differences qualification (AC 120-53) if applicable, check airmen qualification, line check, route check, and IOE programs should each

satisfactorily incorporate necessary Category III provisions, as applicable (see sections 7.2 through 7.4). An acceptable method to track pertinent crewmember Category III qualification and recency should be established (see section 7.5).

For manually flown Category III systems (e.g., HUD FD's, Hybrid HUD/Autoland) ensure that provisions are made for each flightcrew member to receive the appropriate training, qualification, and line experience before that particular crewmember is authorized to use the pertinent Category III minima.

**10.3. Flight Planning (e.g., Dispatch, MEL, Alternate Airports, ETOPS or EROPS).** MEL and CDL provisions should be addressed, as necessary, for Category III operations. The flight planning (e.g., pilot or aircraft dispatcher) should ensure appropriate consideration of reported and forecast weather, field conditions, facility status, NOTAM information, alternate airport designation, engine-inoperative missed approach performance, crew qualification, airborne system status, and fuel planning. For ETOPS or EROPS operations, a satisfactory method to address item 8.10 above should be demonstrated.

**10.4. Formulation of Operations Specification (e.g., RVR limits, DH or AH, equipment, field lengths).** Proposed OpSpecs should list pertinent approved RVR limits, DH or AH use provisions, "Inner Marker based DH or AH" provisions (if applicable), required transmissometers, airports/runways, aircraft equipment provisions for "normal" and, if applicable, "engine-inoperative" operations, landing field length provisions, and any other special requirements identified by the CHDO or AFS-400 (e.g., ETOPS or EROPS Category III). The operator's manuals, procedures, checklists, QRH's, MEL's, dispatch procedures and other related flightcrew information should be shown to be consistent with the proposed OpSpecs.

**10.5. Operational/Airworthiness Demonstrations.** Appropriate "airborne system suitability" and "operational use suitability" demonstrations must be completed as described in sections 10.5.1 and 10.5.2, unless otherwise specified by AFS-400. The purpose of these operational demonstrations is to determine or validate the use and effectiveness of the applicable aircraft flight guidance systems, training, flightcrew procedures, maintenance program, and manuals applicable to the Category III program being approved. Operators of aircraft having FAA approved AFM's referencing AC 120-28D as the criteria used as the basis for Category III airworthiness demonstration already are considered to meet provisions of section 10.5.1, and typically need only address provisions of section 10.5.2. for verification of operational use suitability.

**10.5.1. Airborne System Suitability Demonstration.** Low visibility takeoff and landing requirements for Category I, Category II, and Category III are related to operating rules addressed by Standard OpSpecs and 14 CFR parts 1, 61, 91, 97, 121, 125, and 135. These provisions apply continuously, as defined at the time of a particular Category I, II, or III operation. Airworthiness rules (14 CFR parts 23, 25, etc.,) primarily apply at the time a "certification basis" is established for type certificate (TC) or supplemental type certificate (STC) and do not necessarily reflect "present" requirements, except through issuance of AD's updated with an amended type certificate or new STC

application. Accordingly, operationally acceptable demonstrations addressing suitability of airborne systems for Category III, as applicable, must be successfully completed initially, and acceptable system status must be maintained by an operator to reflect compliance with current operating rules and airworthiness requirements, to initially operate or continue to operate to Category III minima.

To minimize the need for repeating initial airborne system operational suitability demonstrations for each operator, airborne system suitability is usually demonstrated in conjunction with airworthiness approval (TC or STC) of airborne system components such as flight guidance systems, autoland, flight directors, HUD's, flight instrument and alerting systems, radio altimeters, inertial systems, and air data systems. This approach to determination of airborne system suitability is taken to optimize use of analysis and flight demonstration resources for operators, aircraft manufacturers, avionics manufacturers, and the FAA. Accordingly, airborne system suitability is normally demonstrated through an initial airworthiness demonstration meeting applicable provisions of Appendices to this AC (or combined airworthiness/operational evaluation for new systems or concepts, or where otherwise necessary).

Demonstration to an acceptable earlier version of AC 120-28 or equivalent criteria may continue to be used for demonstration of aircraft/airborne systems initially type certificated prior to issuance of this AC 120-28D revision as applicable to the particular aircraft or airborne system (e.g., current production aircraft using earlier AC's 120-28/A/B/C.)

However, previously demonstrated aircraft or airborne systems seeking Category III credits specified only in provisions of revised AC 120-28D (e.g., Hybrid Autoland/HUD Category III) must meet criteria specified in this AC.

Acceptable results of such airworthiness evaluations are usually described in section 3 (Normal and Non-Normal Procedures) of the FAA approved AFM or AFM Supplement. Certificate Holding District Offices should ensure that aircraft proposed for Category III have completed such an appropriate airborne system operational suitability demonstration, and that result should normally be reflected in the approved AFM or AFM Supplement, unless otherwise specified by AFS-400.

For aircraft certified by FAA through section 21.29 (Certain Non-United States manufactured aircraft), AFM provisions applicable to Category III may vary. In certain instances AFM provisions may not be consistent with United States policy or rules applicable to Category III. In such instances, CHDO prior coordination with AFS-400 is appropriate to provide appropriate guidance to operators regarding applicability of various AFM provisions (e.g., DH and RVR limitations, acceptable NAVAID use, alerting system use, and required versus recommended crew procedures).

In the event of special circumstances such as FAA Category III acceptance of an aircraft certificated by a Non-United States airworthiness authority which has only foreign AFM Category III approval, or acceptance of additional credit for existing systems, operational assessments in accordance with criteria in this AC, or equivalent criteria, may be necessary. In such instances, AFS-400 specifies applicable criteria.

**10.5.2. "Operator Use Suitability" Demonstration.** At least one-hundred (100) successful landings should be accomplished in line operations using the low visibility landing system installed in each aircraft type applicable to the Category III authorization. Demonstrations may be conducted in line operations, during training flights, or during aircraft type or route proving runs.

If an excessive number of failures (e.g., unsatisfactory landings, system disconnects) occur during the landing demonstration program, a determination should be made for the need for additional demonstration landings, or for consideration of other remedial action (e.g., procedures adjustment, wind constraints, or system modifications).

The system should demonstrate reliability and performance in line operations consistent with the operational concepts specified in section 4. 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 aircraft in the fleet, limited opportunity to use runways having Category II/III procedures, or inability to obtain ATS critical 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 the Technical Programs Division (AFS-400).

Landing demonstrations should be accomplished on U.S. facilities or international facilities acceptable to FAA which have Category II or III procedures. However, at the operator's option, demonstrations may be made on other runways and facilities if sufficient information is collected to determine the cause of any unsatisfactory performance (e.g., critical area was not protected). No more than 50 percent of the demonstrations may be made on such facilities.

If an operator has different models of the same type of aircraft using the same basic flight control and display systems, or different basic flight control and display systems on the same type of aircraft, the operator should show that the various models have satisfactory performance, but the operator need not conduct a full operational demonstration for each model or variant.

**10.5.2.1. Data Collection For Airborne System Demonstrations.** Each applicant should develop a data collection method (e.g., form to be used by flightcrew) to record approach and landing performance. Data should be collected whenever an approach and landing is attempted using the Category III system, regardless of whether the approach is abandoned, unsatisfactory, or is concluded successfully. The resulting data and a summary of the demonstration data should be made available to the CHDO for evaluation. The data should, as a minimum, include the following information:

1. Inability to Initiate an Approach. Identify deficiencies related to airborne equipment which preclude initiation of a Category III approach.
2. Abandoned Approaches. Give the reasons and altitude above the runway at which approach was discontinued or the automatic landing system was disengaged.

3. Touchdown or Touchdown and Rollout Performance. Describe whether or not the aircraft landed satisfactorily (within the desired touchdown area) with lateral velocity or crosstrack 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 centerline and the runway threshold, respectively, should be indicated in the report. This report should also include any Category III system abnormalities which required manual intervention by the pilot to ensure a safe touchdown or touchdown and rollout, as appropriate.

**10.5.2.2. Data Analysis.** Unsatisfactory approaches using facilities approved for Category II or III where landing system signal protection was provided should be fully documented. The following factors should be considered:

1. ATS Factors. ATS factors which result in unsuccessful approaches should be reported. Examples include situations in which a flight is vectored too close to the final approach fix/point for adequate localizer and glide slope capture, lack of protection of ILS critical areas, or ATS requests the flight to discontinue the approach.
2. Faulty NAVAID Signals. NAVAID (e.g., ILS localizer) irregularities, such as those caused by other aircraft taxiing, over-flying the NAVAID (antenna), or where a pattern of such faulty performance can be established should be reported.
3. Other Factors. Any other specific factors affecting the success of Category III operations that are clearly discernible to the flightcrew should be reported. An evaluation of reports discussed in subparagraphs 10.5.2.1 (1), (2), and (3) will be made to determine system suitability for further Category III operations.

**10.5.2.3. Approval of Landing Minima.** When the data from the operational demonstration has been analyzed and found acceptable, an applicant may be authorized the lowest requested minima consistent with this AC and applicable standard operations specifications. Several examples are provided below.

For Category III, fail passive operations where the operator was initially authorized RVR1000 (300 m) to begin a demonstration program, following successful demonstration that operator may be authorized to operate to minima of RVR600 (175 m).

For Category III fail operational operations, where the operator was initially authorized RVR1000 (300 m) to begin a demonstration program, following successful demonstration that operator may be authorized to operate to minima of RVR600 (175 m) or RVR300 (75 m) as applicable.

If the Category III rollout control system has been shown to meet the appropriate provisions of Appendix 3, and the airborne and ground systems including applicable ILS, GLS or MLS (e.g., xLS), Surface Movement Guidance and Control (SMGCS), and weather reporting (e.g., RVR) are each suitable, then operations approvals for operations below RVR300 (75 m) may be authorized. Such authorizations are considered only for specific facilities on a case by case basis, based on suitable and successful operational

experience for each particular operator and aircraft type, and must have included actual operations in weather conditions at or below RVR600, using minima of RVR300.

For additional examples of minima step down provisions acceptable to FAA see paragraphs 10.9 and 10.10.

**10.6. Eligible Airports and Runways.** An assessment of eligible airports, runways, and airborne systems must be made in order to list appropriate runways on OpSpecs. Runways authorized for particular aircraft in accordance with existing operations listed on the AFS-400 Category II/Category III status checklist may be directly incorporated in OpSpecs, or incorporated by reference if published part 97 SIAPS are available. Aircraft type/runway combinations not shown should be verified by airborne system use in line operations at Category II or better minima, prior to authorization for Category III. Airports/aircraft types restricted due to special conditions (e.g., irregular underlying terrain) must be evaluated in accordance with Appendix 8, prior to OpSpecs authorization.

If applicable, the operator should identify any necessary provisions for periodic demonstration of the airborne system on runways other than those having Category II or III procedures (e.g., periodic autoland performance verification, using runways served only by a Category I procedure).

A status checklist for facilities which have published Category II or III procedures can be viewed on the Internet using the following address to access the FAA's Flight Standards Service home page:

**FAA Category II/Category III Status Checklist**

<http://www.faa.gov/avr/afshome.htm>

To access this list, search the menu for Air Transportation and select All Weather Operations. The desired section can then be selected from the All Weather Operations home page menu.

**10.7. Irregular Pre-Threshold Terrain and Other Restricted Runways.** Airports/runways with irregular pre-threshold terrain, or runways restricted due to NAVAID or facility characteristics (see FAA Category II/Category III Status Checklist in section 10.6) may require special evaluation, or limitations. Certificate Holding District Offices (CHDO's) of operators desiring operations on these runways should contact AFS-400 to identify pertinent criteria and evaluation requirements. Various procedures used by FAA to assess irregular pre-threshold terrain are described in Appendix 8.

**10.8. Engine-Inoperative Operations and ETOPS or EROPS Alternates based on Category III.** Low visibility landing minima are typically based on normal operations. For non-normal operations, flightcrews and aircraft dispatchers are expected to take the safest course of action to resolve the non-normal condition. The low weather minima capability of the aircraft must be known and available to the flightcrew and aircraft dispatcher.

In certain instances, sufficient airborne system redundancy may be included in the aircraft design to permit use of an alternate configuration such as "engine inoperative capability" for initiation of a Category III approach. Use of an engine inoperative configuration is based on the premise that the engine non-normal condition is an engine failure that has not adversely affected other airborne systems. Systems which should be considered include systems such as hydraulic systems, electrical systems or other relevant systems for Category III that are necessary to establish the appropriate flight guidance configuration.

An alternate engine inoperative configuration also is based on the premise that catastrophic engine failure has not occurred which may have caused uncertain, or unsafe collateral damage to the airframe, or aerodynamic configuration.

In instances when AFM or operational criteria is not met, and a Category III approach is necessary, because it is the safest course of action, (e.g., in flight fire), the flightcrew may use emergency authority. The flightcrew should determine to the extent necessary the state of the aircraft and other diversion options to ensure that an approach in weather conditions less than Category II is the safest course of action.

Four cases are useful in considering engine inoperative Category III capability, and engine inoperative approach authorization:

1. Flight planning (e.g., Dispatch) is based on aircraft configuration, reliability, and capability for "engine inoperative Category III" (see Section 10.8.2).
2. An engine fails en route, but prior to final approach (see Section 10.8.3).
3. An engine fails during the approach after passing the final approach fix, but prior to reaching the Alert Height or Decision Height (see Section 10.8.4).
4. An engine fails during approach after passing the Alert Height or Decision Height (see Section 10.8.5).

Section 5.17 provides airworthiness criteria for demonstration of Category III engine out capability. Sections 10.8.1 through 10.8.5 below address criteria for use of aircraft with "engine inoperative Category III" capability.

**10.8.1. General Criteria for Engine-Inoperative Category III Authorization.** Aircraft capability for "engine-inoperative Category III" should be approved in accordance with the provisions of paragraph 5.17, and Appendix 3.

Regardless of whether an operator is or is not operationally authorized for "engine inoperative Category III", it must be clear that having this aircraft capability should not be interpreted as requiring a Category

III landing at the "nearest suitable" airport in time (e.g., does not require landing at the nearest suitable Category III qualified airport - section 121.565).

POI's should ensure that the following conditions are met:

1. Operations must be in accordance with the "engine inoperative Category III" AFM provisions (e.g., within demonstrated wind limits, using appropriate crew procedures).
2. Demonstrated/acceptable configurations must be used (e.g., AFDS modes, flap settings, electrical power sources, MEL provisions).
3. WAT limits must be established, and Engine-inoperative Missed Approach obstacle clearance from the TDZ must be ensured. This data should be readily available for flight planning (e.g., to the aircraft dispatcher) either by pre-determined certification listing or through appropriate engine-inoperative programming in automated flight planning and performance systems.
4. Appropriate training program provisions for engine inoperative approaches must be provided (see paragraph 7.2.6).
5. Pilots must be aware that they are expected to take the safest course of action, in their judgment, in the event that unforeseen circumstances or unusual conditions occur that are not addressed by the "engine-inoperative" Category III demonstrated configuration (e.g., uncertain aircraft damage, possible fire, weather deterioration).
6. Operations Specifications must identify the type of "engine-inoperative" Category III operations authorized. Types of operations are described in sections 10.8.2 through 10.8.5 below.

**10.8.2. Engine Inoperative "Flight Planning."** The operator (e.g., aircraft dispatcher) may consider "engine inoperative Category III" capability in planning flights for a takeoff alternate, en route (ETOPS or EROPS) alternate, re-dispatch alternate, destination, or destination alternate only if each of the following conditions are met:

1. The operator (e.g., aircraft dispatcher) has determined that the aircraft is capable of engine inoperative Category III.
2. Appropriate procedures, performance, and obstacle clearance information must be provided to the crew to be able to safely accomplish an engine inoperative missed approach at any point in the approach. If applicable, similar information must also be readily available to the aircraft dispatcher.
3. Appropriate operational weather constraints must be considered and specified as necessary regarding cross wind, head wind, tail wind limits considering the demonstrated capability specified in the AFM.

4. Weather reports or forecast must indicate that specified alternate minimums or landing minimums will be available for the runway equipped with approved Category III systems and procedures. The operators use of engine inoperative capability credit should consider both the availability and reliability of meteorological reports and forecasts, the time factors involved in potential forecast accuracy, the potential for variability in the weather at each pertinent airport, and the ability for the crew and, if applicable, aircraft dispatcher to obtain timely weather reports and forecast updates during the time the flight is en route. Flight planning considerations must account for any expected ATS delays that might be experienced during arrival due to weather, snow removal, or other factors.

5. Notices to airmen or equivalent information for airport and facility status should be reviewed to ensure that they do not preclude the accomplishment of a safe engine inoperative approach on the designated runway using approved Category III procedures (e.g., temporary obstructions). Any change in NOTAM status of facilities related to use of landing minima or alternate minima must be provided to the crew in a timely manner while en route.

6. If the engine inoperative configuration is different than a normal landing configuration, a means to determine the landing distance of the section 121.195(b) distance must be available for the pertinent engine inoperative aircraft configuration (e.g., landing flap setting). This distance is to ensure sufficient runway to provide for any limitations on the use of reverse thrust or other factors that could pertain to an inoperative engine landing (e.g., reduced flap settings used for an engine inoperative approach). This data may be based on basic aircraft data otherwise available and need not be redemonstrated for "engine-out" cases.

7. The expectation for runway surface condition based on pilot and operator (e.g., aircraft dispatcher) interpretation of the available weather reports, field conditions, and forecasts is that the applicable runway is likely to be free from standing water, snow, slush, ice, or other contaminants at the time of landing. The flightcrew must be advised of any adverse change in this expectation while en route.

8. Criteria otherwise applicable to "all engine" Category III, such as flightcrew or dispatcher training, crew qualification, and availability of suitable procedures must also be addressed for the engine inoperative landing case, if they are not the same as for the "all engine" case.

9. The operator is approved for operations based on engine inoperative Category III capability. In addition, operator responsibilities for engine inoperative credit should be equivalent to that of current normal operations when an en route landing system failure causes degraded landing capability. If an inflight failure causes further degradation of engine inoperative landing capability, the flightcrew (if applicable, in conjunction with the aircraft dispatcher) should determine an acceptable alternative course of action (e.g., specification of different en route diversion options, revised fuel reserves plan, or revised flight plan routing).

10. When engine inoperative Category III provisions are applied to identification of any destination or destination alternate, more than one qualifying destination alternate is required. This is to

provide for the possibility of adverse area wide weather phenomena, or unexpected loss of landing capability at the first designated alternate airport.

11. An appropriate ceiling and visibility increment is added to the lowest authorized minimums when credit for an alternate airport or airports is sought (e.g., 200 ft. DH additive and appropriate RVR additive; see Appendix 7 - Operations Specification Example).

12. The airborne system should be shown through "in-service" performance that for fail-operational systems, landing system availability is at least 99% from takeoff to 500' HAT on approach, and for fail-passive systems, system availability is at least 95% from takeoff to 500' HAT on approach (see Appendix 3 section 6.5.1).

It should be noted that even if the aircraft, flightcrews, and operator are authorized for engine inoperative Category III, flightcrews are not required to use a Category III approach to satisfy requirements of section 121.565. Notwithstanding section 121.565, pilots may elect to take a safe course of action by landing at a more distant airport than one at which a Category III approach may be required. Conversely, pilots may elect to conduct the Category III approach as the safest or a safe course of action.

#### **10.8.3. Engine Inoperative En Route.** For engine failure en route, a pilot may initiate an "engine inoperative" Category III approach under the following conditions:

1. The airplane flight manual normal or non-normal sections specify that engine inoperative approach capability has been demonstrated and procedures are available.
2. The pilot and, if applicable, aircraft dispatcher have taken into account the landing runway length needed for the inoperative engine configuration and corresponding approach speeds, and obstacle clearance can be maintained in the event of a missed approach.
3. The pilot and, if applicable, aircraft dispatcher have determined that the approach can be conducted within the wind, weather, configuration, or other relevant constraints demonstrated for the configuration.
4. The pilot and, if applicable, aircraft dispatcher have determined from interpretation of the best available information that the runway is expected to be free from standing water, snow, slush, ice, or other contaminants.
5. The pilot is confident that the aircraft has not experienced damage related to the engine failure that would make an engine inoperative Category III approach unsuccessful, or unsafe.
6. The operator is approved and the pilot is qualified to conduct a Category III engine inoperative approach.

7. The pilot and, if applicable, aircraft dispatcher consider that conducting a Category III approach is a safe and appropriate course of action.

**10.8.4. Engine Failure During Approach, Prior to Alert Height or Decision Height.** If the aircraft, operator, and crew meet paragraphs 5.17 for the aircraft and sections 10.8.2 or 10.8.3 for operational use, a Category III approach may be continued if an engine failure is experienced after passing the final approach fix.

In the event that an aircraft has not been demonstrated for engine inoperative Category III approach capability, or the operator or crew have not been authorized for Category III engine inoperative approaches, then, regardless of flight phase, continuation of an approach in the event of an engine failure is permitted only in accordance with the emergency authority of the pilot to select the safest course of action.

**NOTE:** For some aircraft configurations, it may be necessary to discontinue the approach after passing the final approach fix or final approach point; re-trim the aircraft for an inoperative engine, and then re-initiate the approach in order to be able to appropriately complete a satisfactory Category III landing.

**10.8.5. Engine Failure After Passing Alert Height or Decision Height.** If an engine fails after passing the Alert Height or Decision Height, the procedure specified in the airplane flight manual for normal or non-normal operations should be followed. All Category III approvals must consider the case of engine failure at, or after, DH or AH. Standard operations specifications are considered to address this case. "Engine inoperative Category III capability" is not specifically a factor in determining response to this situation.

**10.9. New Category III Operators.** New operators should follow demonstration period provisions of section 10.5.2. Additionally, typical acceptable minima step down provisions approvable by FAA are as follows:

Starting from Category I	
Fail - Passive Landing System	100 ft. DH/RVR1000 then 50 ft. DH/RVR600
Fail - Operational Landing System	100 ft. DH/RVR1000 then RVR600, then RVR300

Starting from Category II	
Fail - Passive Landing System	50 ft. DH/RVR600
Fail - Operational Landing System	RVR600 then RVR300

Each runway/procedure not already being used by any operator of a similar type aircraft must be successfully demonstrated by a line service or an evaluation landing using the Category III system and procedures, in Category II or better conditions, for each aircraft/system type (e.g., B767, L1011). Once this capability has been successfully demonstrated by any operator for a particular runway and aircraft

type, subsequent operators may take credit for that demonstration and need not re-demonstrate suitable performance. However, the operator must appropriately address special airports/runways as noted in section 10.7 and the FAA Category II/Category III Status Checklist.

**10.10. Credit for Experienced Category III Operators for New Authorizations.** Experienced operators are considered to be those operators having successfully completed their initial 6 month/ 100 Category III landing demonstration period, and have current operations specifications authorizing use of lowest applicable or intended Category III minima. Sections 10.10.1 through 10.10.3 below address examples of Category III program changes where "experienced operator" credit may apply.

Operators authorized for Category III using one class of system (e.g., autoland) but who are introducing a significantly different class of system as the basis for a Category III authorization (e.g., manually flown Category III approaches using a HUD) are typically considered to be "New Category III operators" for the purposes of demonstration period provisions and acceptable minima "step down" provisions for that class of system (see section 10.9).

**10.10.1. New Airports/Runways.** New airports/runways may be added to an experienced Category III operators OpSpecs without further demonstration, if the same or equivalent aircraft/airborne system for the approach are shown on the Category II/III status checklist.

Otherwise, the operator needs to accomplish a line service landing at Category II or better weather conditions to ensure satisfactory performance. Special runways on the FAA Category II/Category III Status Checklist (e.g., irregular terrain runways) may still require special evaluation.

Prior to approval of Category III minima for a particular aircraft type on any facility not formerly approved for Category III use for that type of aircraft, acceptable flight guidance (e.g., autoland, or autoland and rollout) performance if applicable, should be verified. This verification may be made by airline and/or FAA observation of automatic landings during line operations or training flights in weather conditions at or above Category II minima to determine adequacy of the facility for that type aircraft. In certain special cases, as designated by the FAA, where the characteristics of the pre-threshold terrain may induce abnormal performance in certain automatic flight control systems, additional analysis or flight demonstrations in line service may be required for each aircraft type prior to approval of Category III minima.

**10.10.2. New or Upgraded Airborne System Capability.** Unless otherwise specified by AFS-400, experienced Category III operators may initially use new or upgraded airborne system capabilities/components to the lowest authorized minima established for those systems or components, consistent with the examples provided below. Operators may also request reduced length demonstration periods, consistent with the new airborne systems to be used, FAA FSB requirements, and NAVAIDS, runways, and procedures to be used. Examples of this provision include addition of a new capability such as "engine inoperative" autoland to a system currently approved for "all engine" Category III, or introduction of an updated flight guidance system software version on an aircraft

previously authorized for Category III for that operator. In such cases, the lowest authorized minima may be used, or may continue to be used, without additional demonstration.

**10.10.3. Adding a New Category III Aircraft Type.** Experienced Category III operators may operate new or upgraded aircraft types/systems, or derivative types, using reduced length demonstration periods (e.g., less than 6 months/100 landings) when authorized by AFS-400. Demonstration requirements are established considering any applicable FAA FSB criteria, applicability of previous operator service experience, experience with that aircraft type by other operators, experience of flightcrews of that operator for Category III and the type of system, and other such factors, on an individual basis. Appropriate minima reduction steps may also be established for an abbreviated demonstration period, consistent with prior operator experience, NAVAID's and runways used, and procedures to be used, etc. (e.g., newly acquired B757s being added to Category III OpSpecs, in addition to an operator's currently approved Category III A300 and MD-80 fleets).

**10.11. Category III Program Status Following Operator Acquisitions/Mergers.** Category III operators involved in acquisitions of other operators, or mergers, and their respective CHDO's, must ensure compatibility of programs. Procedures, airborne systems, runways served and any other relevant issues must be addressed before amending operations-specifications, or advising the surviving or controlling operator of the status of Category III OpSpecs of the acquired or merged operator. If CHDO doubt exists regarding applicability or status of Category III OpSpecs provisions for a resulting new, surviving, acquired, or merged carrier, AFS-400 should be consulted.

**10.12. Initiating New Combined Category II and Category III Programs.** Unless otherwise specified by AFS-400, Category II and Category III programs may be initiated simultaneously for new operators, or for existing operators currently approved for Category I. Appropriate provisions of both AC 120-29, as amended, and AC 120-28D are used. Operational Suitability Demonstration programs may be simultaneously conducted as long as procedures and systems applicable to both Category II and Category III minima are assessed (e.g., use of Category II DH vs. Category III AH). The lowest authorized minima established during the evaluation program should be as specified in section 10.9.

**10.13. United States Carrier Category III Operations at Foreign Airports.** An applicant having U.S. Category III approval may be authorized to use Category III minima at foreign airports on the FAA-approved list. Airports are approved and listed when the following conditions are met:

1. The airport is approved for Category III operations by the appropriate foreign airport authority.
2. The visual aids are equivalent to those used for U.S. Category III approaches.
3. Electronic ground aids are at least equivalent to those designated for U.S. Category III approaches.
4. The FAA office having responsibility for the area in which the foreign facility is located has reviewed and verified the conditions in items (1), (2), and (3) above.

The major factors to be considered when approving such airports will be the equivalence with U.S. standards of the approach light systems, high intensity runway lights, in-runway lights, quality and integrity of the approach and landing guidance systems, runway marking, procedures for reporting runway visibility, and airport surface traffic control. Although it is recognized that the systems at foreign airports may not be exactly in accordance with U.S. standards, it is important that any foreign facilities used for Category III provide the necessary information or functions consistent with the intent of the U.S. standards. Carriers desiring Category III approvals at foreign airports or runways not on the FAA-approved list should submit such requests through its FAA principal operations inspector to AFS-400, FAA Headquarters, Washington, D.C.

Typically for airports at which JAA rules apply, U.S. operators may expect to receive authorization to use the most restrictive of either the minima in their U.S. authorization for the aircraft type or flightcrew, or the lowest applicable JAA minima for the airport and runway used.

U.S. operators and pilots of aircraft operating internationally should be familiar with any unique provisions applicable to Category III operations at particular airports outside the U.S. As an example, international operators and pilots should be familiar with the need to convert minima specified in one form (e.g., meteorological visibility) to another different but equivalent form (e.g., RVR – see Section 8.6.2.2 and Appendix 7, Standard Operations-Specifications Part C Paragraph C051 for the applicable conversion table).

Figure 10.13-1 provides a checklist for carriers use to facilitate approval of Category II/III operations at facilities listed in the controlling states Aeronautical Information Publication (AIP). It should be used to ensure suitability of the intended facility and to verify conformance or equivalence with U.S. standards at non-U.S. airports. Completion of this checklist must reflect achieved or completed status, not planned actions for the future. For ICAO states that do not maintain an AIP, a copy of the Notice to Airmen (NOTAM), obstruction data, and/or a reliable and regular method of correspondence with the charting services used by U.S. certificate holders must be attached.

**FACILITY CHECKLIST FOR CATEGORY II/III  
(FOR NON-U.S. FACILITIES)**

AIRPORT (ICAO ID): \_\_\_\_\_ COUNTRY: \_\_\_\_\_ DATE: \_\_\_\_\_

Runway: \_\_\_\_\_ Length: \_\_\_\_\_ Width: \_\_\_\_\_ G/S Angle (deg.): \_\_\_\_\_

Lowest Minima \_\_\_\_\_ (ft./m) Runway TCH \_\_\_\_\_ (ft./m)

Special Limitations (if any):

LIGHTING:

Approach \_\_\_\_ TDZ \_\_\_\_ Centerline \_\_\_\_ HIRL \_\_\_\_ Stopbars \_\_\_\_

Other (e.g., PAPI):

MARKINGS:

Runway \_\_\_\_\_ Taxiway \_\_\_\_\_ Other (e.g., Taxiway Position) \_\_\_\_\_

Critical Area Protection Policy (ceiling/visibility or conditions):

LOC \_\_\_\_\_ G/S \_\_\_\_\_

METEOROLOGICAL DATA: METAR's \_\_\_\_\_ TAF's \_\_\_\_\_

TRANSMISSOMETERS:

(Locations/Lowest RVR reported/readout step increment)

Touchdown \_\_\_\_\_ Mid \_\_\_\_\_ Rollout \_\_\_\_\_

OBSTRUCTION CLEARANCE ASSESSMENT COMPLETION DATE: \_\_\_\_\_

Verified by: certificate holder \_\_\_\_\_, "state of the aerodrome" \_\_\_\_\_, other \_\_\_\_\_

Irregular terrain a factor (Y/N): \_\_\_\_\_ Similar type aircraft currently operate (Y/N) \_\_\_\_\_

NOTAM SOURCE/CONTACT: \_\_\_\_\_

FIELD CONDITIONS SOURCE/CONTACT \_\_\_\_\_

Attached procedure has been developed in accordance with:

FAA Handbook 8260.3B (TERPS) \_\_\_\_ ICAO PANS-OPS Doc. 8168-OPS/611, Vol.-11 \_\_\_\_

Other Criteria Accepted by FAA \_\_\_\_ (indicate criteria) \_\_\_\_\_

Facility reviewed in accordance with ICAO Manual of All Weather Operations, as revised  
(DOC 9365/AN910) chapters 3, 5, and 6 DATE REVIEW COMPLETED: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Attachments List:

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**Figure 10.13 - 1**

**10.14. Category III Operations on Off-Route Charters.** Unless otherwise specified by AFS-400, experienced Category III operators may receive authorization to use Category III minima at United States off-route charter airports and runways as follows:

- 1) The runway must be on the FAA Category II/Category III status checklist, and not be restricted or require special evaluation (e.g., irregular terrain).
- 2) The aircraft used must be the same as or equivalent to an aircraft type already using the facility by another FAA certificated operator (e.g., a charter flight could be considered acceptable using an MD-83 with a "-971 Flight Guidance Control System (FGCS)" at a runway which had current Category III operations authorized for an MD-81 of another operator, but with an earlier but similar FGCS version).
- 3) Pilots must have sufficient information to safely conduct the low visibility operation regarding familiarity with the airport (e.g., SMGC procedures, taxi hold point or gate direction markings, gate location to be used).
- 4) The OpSpecs must authorize off-route charter Category III procedures, and
- 5) The CHDO must be advised of the specific airports, aircraft, crew qualifications and any special provisions to be used.

**10.15. Approval of Category III Minima and Issuance of Operations Specifications.**

Applicants should submit documentation requesting approval of Category III weather minima to the FAA Certificate Holding District Office (CHDO) or Flight Standards District Office (FSDO) responsible for that operator's certificate. The application should demonstrate compliance with the appropriate provisions of applicable sections of this AC, particularly sections 7 through 12. Proposed operations specifications provisions should be included with the application.

The operators application documentation should be evaluated by the CHDO/FSDO and forwarded, with any recommendations, to the Technical Programs Division, AFS-400, FAA Headquarters, Washington, D.C., for review and concurrence. This review and concurrence is necessary prior to CHDO approval of Category III minima.

Following AFS-400 concurrence, OpSpecs authorizing Category IIIa or Category IIIb minima may be issued (see Appendix 7 for sample Operations Specifications examples).

During the period following the issuance of new or revised operations specifications for Category III (typically 6 months), the operator must successfully complete a suitable operations demonstration and data collection program in "line service" for each type aircraft, as the final part of the approval process.

The approval process is considered to be completed following a successful demonstration period. This is to ensure appropriate performance and reliability of the Category III system with that operators aircraft, procedures, maintenance, airports, and NAVAID's. This process must be completed before operations down to lowest requested minima are authorized. Section 10.5 addresses appropriate demonstration process criteria.

In situations involving newly manufactured airplanes or where otherwise authorized by FAA, the operations demonstration and data collection process may be initiated prior to the issuance of Category III operations specifications. Sections 10.9 through 10.12 provide criteria that may be used to establish acceptable operations demonstration time periods, and demonstration program scope for different operator situations, aircraft variants, and low visibility operating experience history.

**10.16. Operations Specification Amendments.** The operator is responsible for maintaining current OpSpecs reflecting current approvals authorized by FAA. Once FAA has authorized a change for airborne systems, new runways, or other authorizations, appropriate and timely amendments to affected OpSpecs should be issued. Issuance of amendments to guidance or procedures in other related material such as the Flight Operations Manual or Training Program may also be required. When updated standard operations specification provisions are adopted by FAA, provisions of those updated operations specifications should normally be applied to each operator's program in a timely manner.

**10.17. Use of Special Obstacle Clearance Criteria (e.g., RNP criteria).** This paragraph addresses use of special criteria such as "Required Navigation Performance" (RNP) criteria. Pending implementation of RNP criteria for public use Standard Instrument Approach Procedures (SIAP's), obstacle assessments using RNP criteria will be conducted on a case-by-case basis, and for Category III, only authorized as an element of special procedures for RNP qualified operators, using RNP qualified aircraft. Early application of RNP for special procedures is typically intended to apply to instrument procedure segments classified as a transition to a final approach segment, or to facilitate definition of suitable missed approach segments. Use of special obstacle clearance criteria or RNP criteria must be approved by AFS-400 for any Category III procedures.

If RNP procedures are used, the operator must have an acceptable method to assure that any waypoints which are considered critical to an instrument procedure (if any) are correctly defined, and are loaded into each applicable aircraft's database, initially, and at each change cycle.

**10.18. Proof-of-Concept Demonstration for New Systems/Methods.** Proof-of-Concept [PoC] as used in this AC is defined as:

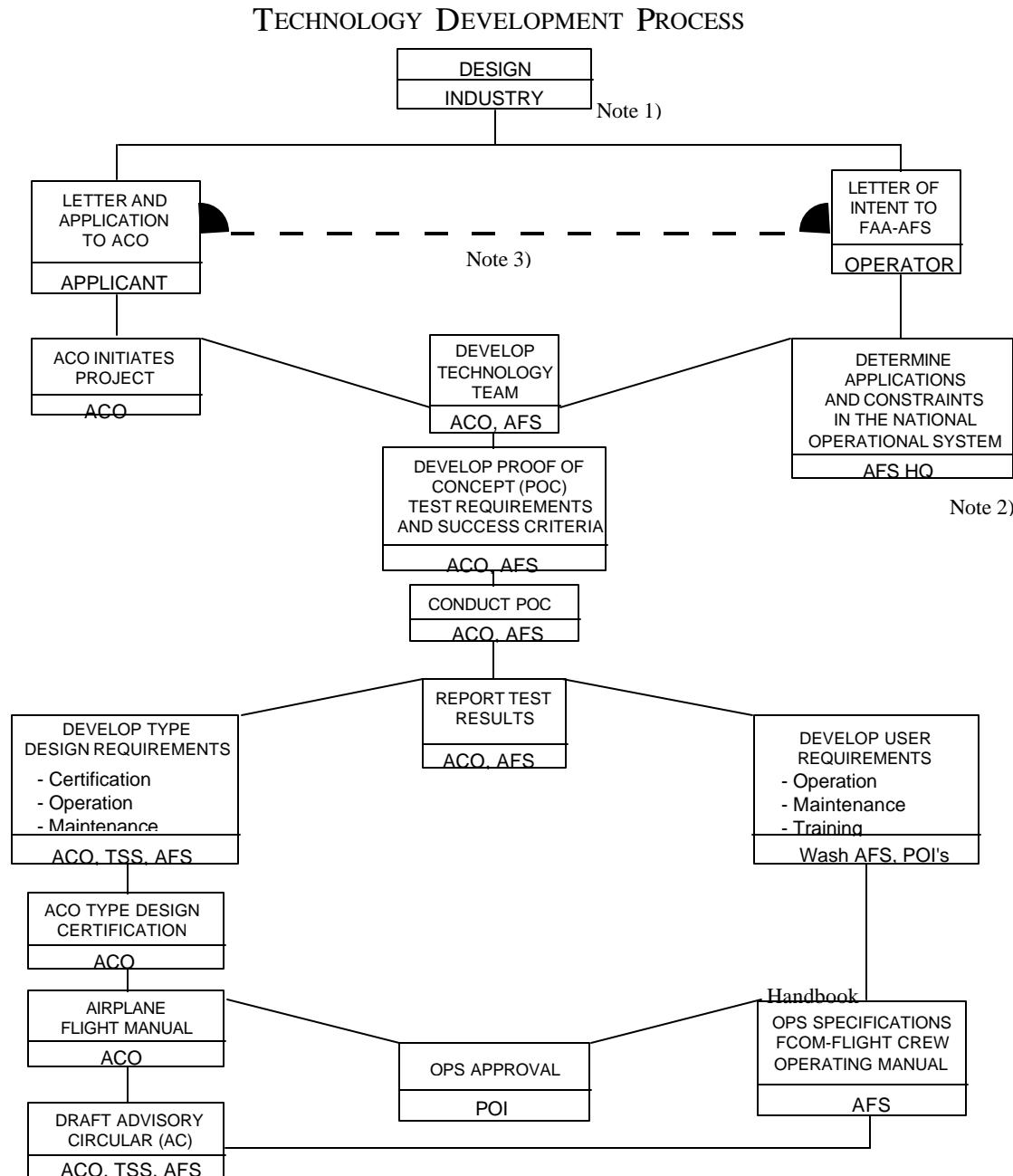
A generic demonstration in a full operational environment of facilities, weather, crew complement, airborne systems and any other relevant parameters is necessary to show concept validity in terms of performance, system reliability, repeatability, and typical pilot response to failures as well as to demonstrate that an equivalent level of safety is provided.

Proof-of-Concept may be established by a combination of analysis, simulation and/or flight demonstrations in an operational environment. PoC is typically a combined effort of FAA airworthiness and operational organizations with the applicant, with input from any associated or interested organizations.

A typical PoC program consists of the following elements:

1. Applicant submits a request to either FAA Aircraft Certification or Flight Standards.
2. Meetings are arranged to include all disciplines involved: Aircraft certification; Flight Standards; National Resource Specialists (NRS's); the applicant, and supporting personnel as necessary (e.g., Air Traffic and representative flightcrews, as appropriate).
3. A test plan is established which includes input from applicable FAA organizations, the applicant, and as applicable, industry user groups.
4. The test plan should include as a minimum: system definition, operations procedures, qualification, training, weather and environment definition, normal, rare-normal, and non-normal conditions to be assessed, flightcrew, test subject, and test crew requirements, test procedures, test safety constraints as applicable, assessment criteria, and analysis, simulator and test aircraft requirements, and a clear understanding of what constitutes a successful test and proof of concept.
5. PoC is conducted using agreed subject pilots, as appropriate.
6. PoC data is collected in a suitable simulator environment and validated in a realistic airplane environment.
7. FAA is responsible for assessing the PoC data which is typically provided to FAA as agreed by FAA and the applicant. FAA reports relevant findings to the applicant and if applicable, interested industry representatives.
8. FAA operations and airworthiness organizations use the data to develop criteria for approval of type designs, certification processes and procedures, operating concepts, facilities, flightcrew/aircraft dispatcher and maintenance qualification, operations specification, operations procedures, manuals, AFM's, maintenance procedures, and any criteria necessary.
9. FAA AC criteria for airworthiness and operational approval typically is a product of PoC assessment.

This process is presented pictorially in the following figure.



**Note:**

- 1) Further modifications to the applicant's original Type Design may require additional technology revisions and/or follow on Proof of Concept testing.
- 2) The AFS group has the responsibility to coordinate with all Industry technology groups (ALPA, APA, ATA, ADF Industry, manufacturers, vendors, DOD, NASA, etc.)
- 3) Both the FAA ACO and FAA AFS should be contacted to provide certification and operational data to the respective offices.

**Index:**  
 ACO - Aircraft Certification Office (Including Aircraft Evaluation Group)  
 AFS - Washington Flight Standards Policy Office  
 TSS - Transport Standards Staff

RRD7/19/94

## **11. FOREIGN AIR CARRIER CATEGORY III AT UNITED STATES AIRPORTS (PART 129 OPERATIONS SPECIFICATIONS).**

**11.1. Use of ICAO or FAA Criteria.** International operators requesting or authorized for Category III at U.S. airports should meet criteria of 11.1.1 through 11.1.3 below.

**11.1.1. Acceptable Criteria.** Criteria Acceptable for use for assessment of international operator's applications for Category III at U.S. airports includes this AC, equivalent JAA criteria, or the ICAO Manual of All Weather Operations DOC 9365/AN910, as amended.

International operators previously approved by FAA in accordance with earlier criteria may continue to apply that earlier criteria. International operators seeking credit for operations addressed only by this revision of AC 120-28D (e.g., Category III HUD operations) must meet criteria of this AC, or equivalent criteria acceptable to FAA, for those applicable provisions.

**11.1.2. Foreign Operator AFM Provisions.** Unless otherwise authorized by FAA, aircraft used by international operators for Category III within the U.S. should have AFM provisions reflecting an appropriate level of Category III capability as demonstrated to or authorized by FAA, or demonstrated to or authorized by an authority recognized by FAA, as having acceptable equivalent Category III airworthiness criteria (e.g., European JAA, Canada MOT, UK CAA).

**11.1.3. Foreign Operator Category III Demonstrations.** International (Foreign) Air Carriers meeting FAA criteria, or criteria acceptable to FAA (e.g., European JAA, ICAO Criteria including Doc 9365/AN910), and having more than 6 months experience in use of Category III operations with the applicable aircraft type may be approved for Category III in accordance with provisions of their own regulatory authority, or in accordance with standard provisions of 14 CFR part 129 OpSpecs, which ever is the more restrictive. A separate demonstration period is not required for FAA if the "State of the Operator" does not require it. However, operators approved in accordance with this provision may nonetheless be subject to additional FAA demonstration for special situations, such as at airports with irregular underlying terrain (see 11.3), or for aircraft types not having flown to U.S. facilities having Category III procedures.

For international (foreign) operators having current U.S. Category III authorization, the Category III demonstration period may be reduced or waived for addition of a new type aircraft to the existing Category III authority. The demonstration period may be reduced or waived to the extent that a successful demonstration has been accepted by FAA for that aircraft type for any other U.S. or international operator.

International (Foreign) Air Carriers not meeting above provisions may be subject to the demonstration described at 10.5.2 and 10.9 (equivalent to those necessary for U.S. operators) as determined applicable by FAA.

**11.2. Issuance of Part 129 Operations Specifications.** International (Foreign) Air Carriers operating to U.S. airports which meet applicable provisions above are approved for Category III through issuance of part 129 OpSpecs (see Appendix 7).

Operators intending Category III operations at U.S. designated irregular terrain airports, or airports otherwise requiring special assessments must successfully complete those assessments prior to use of those facilities.

**11.3. Use of Certain United States Facilities.** Foreign operators typically use Category III procedures in the U.S. which are available as unrestricted public use procedures. However, FAA may also authorize certain restricted public use procedures and special Category III approach procedures for non-U.S. Operators. Typically, these procedures require special airborne equipment capability, special training, or non-standard facility and obstacle assessments. These special procedures are identified on the Category II/III status checklist and are not usually published as a part 97 Category III SIAP.

Foreign operators may be eligible to use certain of these procedures if they meet the same special criteria as would apply to a U.S. operator, and if they are approved by their own authority specifically for the use of the procedure. Some procedures may not be eligible for foreign use because of other applicable restrictions such as a restriction placed on private facility use. Special or restricted procedures require both FAA authorization and specific authorization from the state of the operator's controlling authority for each procedure. This is to ensure that both the operator and foreign authority are aware of the special provisions needed, and to ensure equivalent safety to use of standard ICAO criteria.

Each foreign operator seeking Category III procedure authorization at a facility not published as a standard and unrestricted Category III SIAP, or at any other facilities identified as special or restricted on the FAA Category II/III Status checklist, and that operator's controlling authority must:

1. Be aware of the restrictions applicable to the procedure (e.g., facility status),
2. Provide evidence to FAA of the controlling authority's approval of the operator for each special procedure requested, and
3. Must have the applicable limitations and conditions included in that operator's part 129 OpSpecs for each procedure to be used.

Foreign operators shall not normally be authorized special Category III operations to minima lower than those specified in part 97 Category III SIAPS consistent with ICAO criteria.

## **12. OPERATOR REPORTING, AND TAKING CORRECTIVE ACTIONS.**

**12.1. Operator Reporting.** The reporting of satisfactory and unsatisfactory Category III aircraft performance is a useful tool in establishing and maintaining effective maintenance and operating policy

and procedures. Information obtained from reporting data and its analysis is useful in recommending and issuing appropriate corrective action(s).

Accordingly, for a period of at least 1 year after an applicant has been advised that its aircraft and program meet Category III criteria, and reduced minima are authorized, the operator is to provide a monthly summary to the FAA of the following information:

1. The total number of approaches where the equipment constituting the airborne portion of the Category III system was utilized to make satisfactory (actual or simulated) approaches to the applicable Category III minima (by aircraft type).
2. The total number of unsatisfactory approaches by airport and aircraft registration number with explanations in the following categories - airborne equipment faults, ground facility difficulties, aborts of approaches because of ATC instructions, or other reasons.
3. Notify the certificate-holding office as soon as possible of any system failures or abnormalities which require flightcrew intervention after passing 100 ft. during operations in weather conditions below Category I minima.
4. Upon request, the certificate-holding district office will make this information available to AFS-400 for overall Category III program management, or to assist in assessment of program or facility effectiveness.

This 1 year recording and reporting requirement applies to the initial Category III airplane, however, when maintained over longer periods of time the report data substantiates a successful program and can identify trends, or recurring problems that may not be related to aircraft performance.

**NOTE: The reporting burden contained in this AC does not require Office of Management and Budget approval under the provisions of the Paperwork Reduction Act of 1980, according to section 3502(4)(a).**

**12.2. Operator Corrective Actions.** In addition to the corrective actions contained in the operations and maintenance manuals, operators are expected to take appropriate corrective actions when they determine that conditions exist which could adversely affect safe Category III operations. Examples of situations for which an operator may need to take action restricting, limiting, or discontinuing Category III operations include:

Repeated aircraft system difficulties, repeated maintenance write-ups, chronic pilot reports of unacceptable landing performance, applicable service bulletin issuance, AD's, NAVAID status or performance problems, applicable NOTAM's, airport facility status change, air traffic procedure adjustment, lighting, marking, or standby power system status outages, airport construction, obstacle construction, temporary obstacles, natural disasters, adverse weather, snow banks, snow removal, icy runways or taxiways, deep snow in glide slope critical areas, inability to confirm appropriate critical area protection at non-United States airports, and other such conditions.

Examples of appropriate corrective action could be an adjustment of Category III programs, procedures, training, modification to aircraft, restriction of minima, limitations on winds, restriction of NAVAID facility use, adjustment of payload, service bulletin incorporation, or other such measures necessary to ensure safe operation.