Australian Government
Civil Aviation Safety Authority

PRINCIPLE

(OPS.17) Rotorcraft performance class

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Acknowledgement of Country

The Civil Aviation Safety Authority (CASA) respectfully acknowledges the Traditional Custodians of the lands on which our offices are located and their continuing connection to land, water and community, and pays respect to Elders past, present and emerging.

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Contents

Terminology

Acronyms and abbreviations

Table 1. List of acronyms and abbreviations

Acronym/abbreviation	Description
AAL	above aerodrome level
AEO	all engines operating
AC	advisory circular
AFM	aircraft flight manual
AMC	acceptable means of compliance
DPATO	defined point after take-off
DPBL	defined point before landing
FATO	final approach and take-of area
fpm	feet per minute
HOGE	hover out of ground effect
HV	height velocity
IFR	instrument flight rules
IMC	instrument meteorological conditions
LDP	landing decision point
LSALT	lowest safe altitude
MOPSC	maximum operational passenger seating configuration
OEI	one engine inoperative
PERR	power loss exposure risk reports
PIC	pilot in command
PC	performance class
PC1	performance class 1
PC2	performance class 2
PC2WE	performance class 2 with exposure
PC3	performance class 3
RTODRR	rejected take-off distance required - rotorcraft

Acronym/abbreviation	Description
SFLA	suitable forced landing area
SFL	suitable forced landing
SMS	safety management system
TCH	type certificate holder
TDP	take-off decision point
TODAR	take-off distance available - rotorcraft
TODRR	take-off distance required - rotorcraft
VFR	visual flight rules

Definitions

Table 2. List of definitions

Term	Definition
adequate vertical margin	has the same meaning as section 10.02 of the Part 133 MOS
aerodrome	has the same meaning as section 3 of the Civil Aviation Act 1988
avoid area of the HV envelope	has the same meaning as section 1.04 of the Part 133 MOS
D	has the same meaning as section 10.01 of the Part 133 MOS
defined point after take-off	has the same meaning as section 10.01 of the Part 133 MOS
defined point before landing	has the same meaning as section 10.01 of the Part 133 MOS
elevated helicopter clearway	has the same meaning as AC 139.R-01 (also known as a virtual clearway)
exposure time	has the same meaning as section 10.01 of the Part 133 MOS
final approach and take-off area	has the same meaning as paragraph 1.04(2) of the Part 133 MOS
flight crew member	has the same meaning as Part 1 of the CASR Dictionary
flight manual	references to flight manual, for an aircraft flight manual has the same meaning as clause 37 of Part 2 of the CASR Dictionary
landing decision point	has the same meaning as section 10.01 of the Part 133 MOS
minimum flight altitude	has the same meaning as paragraph 1.04(2) of the Part 133 MOS
rejected take-off distance available - rotorcraft	has the same meaning as section 10.01 of the Part 133 MOS

Term	Definition
rejected take-off distance required - rotorcraft	has the same meaning as section 10.01 of the Part 133 MOS
relevant obstacle	has the same meaning as section 10.01 of the Part 133 MOS
S	has the same meaning as section 10.01 of the Part 133 MOS
take-off decision point	has the same meaning as section 10.01 of the Part 133 MOS
take-off distance available - rotorcraft	has the same meaning as section 10.01 of the Part 133 MOS
take-off distance required - rotorcraft	has the same meaning as section 10.01 of the Part 133 MOS
touchdown and lift off area	has the same meaning as AC 139.R-01
Virtual clearway (or elevated helicopter clearway)	A helicopter clearway that has been raised to a level that provides obstacle clearance
V_{TOSS}	has the same meaning as section 10.01 of the Part 133 MOS

Reference to regulations

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this principle are references to the *Civil Aviation Safety Regulations 1998* (CASR).

Reference to aerodrome

The term aerodrome is used throughout this document to mean helicopter landing site, heliport, helipad or landing site as is applicable to the operation.

For example, if aerodrome is used in reference to performance class 1 (PC1) operations it means one of the places mentioned above with the required available space, surface characteristics, visual cues and strength to support PC1 operations in the relevant rotorcraft.

1. Assessment scope

Inspectors use this protocol suite to assess an operator's policies and procedures for the management of rotorcraft performance under Subpart 133.F. Rotorcraft performance class, which outlines the requirements for rotorcraft take-off, initial climb, en-route, approach and landing performance, is required for air transport operations. This principle document can also be used for the assessment of an aerial work operator who elects to operate under a performance class (PC).

1.1 Assessment of a significant change application

Operators may submit their exposition to support PC operations as a significant change. Examples where an application for significant change may be required are:

- the addition of a new rotorcraft to their operations
- an application for performance class 2 with exposure (PC2WE) operations
- an application from a medical transport operator for an approval under regulation 133.015 for the purposes of subregulation 133.335(4).

1.2 Assessment worksheet user instructions

This principle provides guidance to the inspector when using the associated Worksheet (OPS.17) Rotorcraft performance class. The worksheet provides inspectors with a regulation-based tool for recording the outcomes of the assessment. It is set out as follows:

- user instructions
- assessment worksheets
- assessment summary
- approval data sheet.

2. Assessment

2.1 Performance class – general

The operator's exposition/operations manual must describe their rotorcraft performance policies and procedures for the performance class(s) within which their rotorcraft will be operated.

Operators who will only be operating in performance class 3 (PC3), visual flight rules (VFR) by day <10 maximum operational passenger seating configuration (MOPSC), are required to address the applicable general performance requirements and the PC3 requirements for their rotorcraft, regardless of whether they are single or multi-engine.

Some rotorcraft may be capable of operating over a range of PCs, depending on the category of operation being undertaken. For example, a rotorcraft capable of both day VFR and instrument flight rules (IFR) operations could be operated in PC3 by day under the VFR and PC2WE or above for IFR operations, provided its MOPSC is < 10.

Subparagraph 133.335(1)(c)(iii) does not differentiate rotorcraft being operated under the IFR in visual meteorological conditions, it simply requires rotorcraft operated under the IFR to be operated in PC2WE or above PC capability.

In such scenarios, the exposition/operations manual's policy, process and procedures should clearly articulate how this overlap of PC capability is managed by the operator. This process should describe how a PC3 departure under the VFR by day is managed and transitioned to an IFR operation (if necessary to change operational category), which will require PC1 enroute capability and obstacle accountability and PC2WE or above capability at the destination aerodrome.

To be suitable, in situations where early entry to instrument meteorological conditions (IMC) is likely, or IMC is likely to be encountered below the minimum flight altitude for the flight, the flight must be in PC2WE or above from take-off, so relevant obstacles in the IFR/IMC climb out are considered in the planning stage for the operation.

2.1.1 Adequate vertical margin

An adequate vertical margin obstacle clearance criteria must be stipulated by an operator in a number of situations when rotorcraft flight manual data is not available. To be suitable, the concepts for establishing this margin regarding size of rotorcraft, field of view, nature of obstacles and environmental conditions, outlined in section 5.3 of AC 133-01 Performance class operations, should be considered by the operator.

Due to the unique capabilities and cockpit configurations, wherever possible, an inspector who is type rated on the particular rotorcraft should be used to assess the suitability of the operator's nominated adequate vertical margin.

2.1.2 Pre-flight determination of performance

The operator's general performance processes and procedures must describe how factors and calculations for pre-flight determination of performance are addressed in their performance pre-flight planning and in-flight replanning stages of a flight.

To be suitable, the operator's procedures must ensure the pilot in command (PIC) applies the necessary factors for headwind and tailwind, unless they are already applied by the aircraft flight manual (AFM) performance data. If the performance factors are already applied, the procedure must confirm this is the case by reference to the AFM entry. If tail wind operations are not permitted, either by the AFM or the operator's general performance policy, this must be outlined in the exposition/operations manual.

> Note: See section 5.2 of AC 133-01 Performance class operations for guidance.

Pre-flight determination of relevant obstacles

From a performance policy perspective, the requirement for pre-flight determination of 'relevant obstacles' is specific to operators who conduct performance class 1 (PC1), performance class 2 (PC2) or performance class 2 with exposure (PC2WE) operations.

The exposition/operations manual for operators who conduct PC1, PC2 or PC2WE operations must have processes and procedures for determination of relevant obstacles.

Operators who conduct PC3 and PC2 and PC2WE operations prior to defined point after take-off (DPATO) must ensure their performance procedures require their rotorcraft to clear an obstacle, if any, under the take-off flight path by at least the adequate vertical margin for the rotorcraft for the take-off and initial climb stage of the flight. For PC3, Part 133 does not specifically require an operator to determine if an obstacle is a 'relevant obstacle', however a PC3 operator must ensure the PIC is aware of the obstacle environment under the take-off flight path.

Performance process and procedure considerations for the operator must also be linked to, and procedurally supported by, the exposition/operations manual content for regulation 133.170 in regard to procedures to determine information about aerodromes, specifically paragraph 133.170(2)(k).

To be suitable, these procedures must:

- identify the relevant take-off climb surface (or splay) for the procedure being used
- identify the relevant take-off climb surface (or splay) for the category of operation day, night, VFR or IFR
- for PC1 operations, include a process for relevant obstacles within the applicable splay to be identified as a result of formal surveys conducted by persons qualified to carry out such surveys (e.g. registered surveyors)
- include a process in which the results of the surveys, if not already published by an aerodrome or heliport operator, are published in the operator's exposition
- For PC2 or PC2WE operations, include a risk-based process in which relevant obstacles within the applicable splay may be identified by operator or PIC surveys. These surveys must meet the applicable criteria and conditions outlined in the Part 133 Manual of Standards (MOS)
- include a process which results in operator surveys being published in the operator's exposition
- include a process which describes how operations will be conducted based on the application of runway and obstacle data from certified aerodromes or heliports with associated authorised instrument approach obstacle-controlled environments
- include a process which describes how operations will be conducted based on the application of runway and obstacle data from aerodromes or heliports not with associated authorised instrument approach obstacle-controlled environments
- include a process for an annual review of survey data and survey data capture processes (this may be integrated into the safety management system (SMS)).

Section 5.2 of AC 133-01 provides specific guidance on acceptable obstacle determination requirements for PC1, PC2 and PC2WE. Additionally, section 6.6 of AC 133-01 describes a series of flight profile spreadsheets (outlined in the associated documents for AC 133-01), designed to assist heliport operators to gain a practical understanding of the requirements for appropriate gradients requiring obstacle protection and the associated airspace requirements at their heliport.

These spreadsheets can also form part of the operator's PC pre-flight operational planning processes and procedures and be used by the operator's flight crew members to determine take-off decision point (TDP) or rotate point (RP) heights to ensure appropriate obstacle clearance is maintained throughout the take-off and initial climb for PC1, PC2 and PC2WE operations.

To be suitable, if an operator utilises this material, the operator must have a process to confirm the flight manual data, environmental and operational considerations are correct and applicable to their rotorcraft type and model and to their operational situations when permitting flight crew members to consult the spreadsheets for their operations.

This can be achieved by the operator running several desktop assessments using the AFM data and the spreadsheets for a series of simulated departures and confirming their accuracy for their operations. The results of these desktop assessments should be included with their PC exposition/operations manual submitted data as verification of the use of the relevant flight profile spreadsheet.

2.1.3 Incorporation into the training and checking system

The operators training and checking system must include both non-recurrent and recurrent training for the conduct of operations under a performance class.

To be suitable, the training and checking will include, as is relevant to the operator's operations, the following:

- Competency for PC1 and PC2 operations:
  - theory
  - supervised line flying.
- Competency for PC2WE operations:
  - theory
  - obstacle assessment
  - supervised line flying.
- Competency for PC3 operations:
  - theory, including flight planning
  - obstacle assessment
  - adequate vertical margin assessment
  - supervised line flying.

2.2 Performance class 1 (PC1)

PC1 can be described as operations with performance such that, in the event of a critical engine failure, performance is available to enable the helicopter to safely continue the flight to an appropriate landing area, unless the failure occurs prior to reaching the TDP or after passing the landing decision point (LDP), in which case the helicopter must be able to land within the rejected take-off or landing area required for the rotorcraft.

Unless the rotorcraft is operated with one engine inoperative (OEI) hover out of ground effect (HOGE) capability, operations in PC1 require strict compliance with AFM Category A procedures, operating techniques and weights, as described in the rotorcraft's Category A procedure flight manual supplement. Therefore, assessment of the technical aspects of the operator's PC1 performance policy and PC1 exposition content must be conducted by an inspector qualified on the rotorcraft under consideration.

2.2.1 Procedures

An air transport operator intending to operate in PC1, whether they are mandated by Part 133 to do so or not, is required by section 10.27 of the Part 133 MOS to have exposition procedures covering the following items:

- procedures for the PIC of the rotorcraft, for a flight to determine whether the rotorcraft's take-off weight for the flight is within the limits required to comply with Division 7 of the Part 133 MOS
- procedures for the PIC to determine the following for the flight:
  - the most suitable flight path and track for take-off
  - take-off obstacle clearance requirements
  - the TDP for the take-off of the rotorcraft
  - enroute obstacle clearance requirements
  - the most suitable flight path and track for the approach and landing, or baulked landing of the rotorcraft

  - baulked landing obstacle clearance requirements
  - the landing decision point for the landing of the rotorcraft.

For dot point one, to be suitable, the procedures must describe the operator's take-off, enroute operations and landing procedure selection methodology for particular routes and heliport or helideck operations. Unless restricted to ground level operations only, this methodology should include processes for operations into ground level and elevated onshore facilities and cover clear area and confined (restricted) area operations. If offshore or shipboard operations are permitted and conducted as PC1 operations, these must also be covered by the operator's procedures.

2.2.2 Take-off

For PC1, the take-off stage can be considered as commencing from the take-off associated with the Category A procedure to be conducted, and continuing to the end of the take-off distance required - rotorcraft (TODRR).

For dot point 2 in section 2.2.1 of this principle, for the PC1 take-off (and landing) there are three types of Category A procedures (different names may be used in different AFMs):

- the clear area
- the confined (restricted) area
- the helipad (ground level and elevated) take-off procedures.

Dependant on the rotorcraft, Category A performance capabilities, confined area and helipad procedures may have additional short field, vertical, back-up or lateral transition procedures.

To be suitable, the exposition/operations manual must describe the operator's policy on each of these procedures to be used, and detail a pre-take off process for the PIC to satisfy themselves of: :

- the suitability of the heliport and surrounding obstacles for PC1 operations (refer to paragraph 5.2.6 of AC 133-01)
- the application of pre-flight determination of performance factors
- the determination of the limiting weight for the take-off, which is driven by the most limiting of:
  - weight limit for the procedure
  - 100 fpm first segment V_{TOSS} climb
  - 150 fpm second segment climb
  - weight limit to allow a reject within the rejected take-off distance required - rotorcraft (RTODRR)
  - weight limit to ensure the take-off distance required - rotorcraft (TODRR) does not exceed the take-off distance available - rotorcraft (TODAR) (with some exceptions)
  - weight limit to ensure the OEI climb gradient achieved exceeds the obstacle free gradient and maintains the required obstacle clearance.
  - If back-up or lateral transition procedures are used, the operator's exposition/operations manual must describe how obstacles in these areas are identified and cleared by the adequate vertical margin for the rotorcraft during all engines operating (AEO) flight and OEI flight phases. This can be achieved by the operator requiring the PIC to ensure there are no obstacles within the take-off safety zone, as described within the AFM procedure.

Inspectors should note that there will be occasions when the arrival and departure segments are not diametrically opposed, or when the back-up procedure has a lateral element which places the rotorcraft in a displaced position from centreline of the take-off flight path. In these situations, for back-up or lateral procedures to be suitable (as it remains the responsibility of the operator to ensure that obstacle clearance is planned and achieved), the exposition/operations manual must describe how obstacles in these areas are identified and cleared for the AEO climb and OEI descent for the back-up or lateral flight at the aerodrome.

For aerodromes located in complex environments where third party persons or property may be impacted by the operation of the rotorcraft or its downwash (during such operations), to be suitable, the operator's exposition/operations manual must describe how these persons or property are protected during operations.

If extended TDP operations are permitted, the exposition must describe when they are to be utilised. Inspectors should note the process for their use is outlined in the AFM Category A procedure, therefore it does not need to be repeated in the exposition/operations manual unless the operator wishes to include them for clarity.

2.2.3 PC1 Take-off and initial climb

In all cases, if an engine fails at or beyond the TDP, the rotorcraft is accelerated to at least V_{TOSS} prior to commencing a climb.

The end of the TODRR is marked by the point where V_{TOSS}, a positive rate of climb, and 35 ft obstacle clearance, are all achieved. From this point to 200 ft above aerodrome level (AAL) is the first segment element of the initial climb, which must be able to be flown with an OEI performance capability to achieve a climb rate of at least 100 ft per minute at 200 ft AAL. At 200 ft AAL, if not already at V_Y, the rotorcraft is accelerated to V_Y and must, from that point, have a performance capability to be able to achieve an OEI climb rate of 150 ft per minute at 1000 ft AAL.

Additionally, and most relevant for the safe continuation of the flight, once beyond the TODRR, the rotorcraft's OEI performance capability must ensure, until the minimum flight altitude for the flight is achieved, clearance from a relevant obstacle of at least 35 ft for VFR flight. For IFR flight, additional obstacle clearance height must be added, equalling 1.0% of the distance travelled from the end of the final approach and take-of area (FATO) (e.g. an additional 33 ft clearance for every 1000 m travelled).

As PC1 operations occur at aerodromes where obstacle surveys have taken place, the simplest procedural method to allow for IFR flights is to add 1.0% onto the measured obstacle-free gradient for the take-off flight path.

To be suitable, the operator's exposition/operations manual must include PC1 pre-flight planning processes and procedures that provide a practical outline of how the performance capability for the procedure to be used is assured for the obstacle free gradient available in the take-off direction.

As the take-off stage and the take-off and initial climb stage requirements are complementary and overlapping, an operator may describe compliance with these two stages in a combined manner for PC1 operations.

2.2.3.1 Raised incline plane and virtual (elevated helicopter) clearway in the take-off and initial climb stage

The concept of the raised incline plane and a virtual or elevated helicopter clearway allow for the presence of high obstacles immediately in front of, or some distance beyond the aerodrome in use, while still allowing PC1 operations.

The raised incline plane may be located at the edge of the FATO or, when combined with a virtual clearway, some distance from the FATO, at the first point where obstacles are protruding above the FATO elevation. A raised incline plane works on the same principle as the supplementary take-off distance available (STODA) for aeroplane runways; where reductions in obstacle-free gradients are achieved by reducing the take-off distance available. In the rotorcraft case, this is taken even further by raising the origin of the obstacle-free gradient.

The objective of a virtual or elevated helicopter clearway is to allow the origin of the take-off climb surface to be extended horizontally beyond the boundary of a heliport, so that a descent below the aerodromes obstacle limit surface (OLS) in the TODRR can be avoided in an OEI continued take-off after TDP.

If raised incline plane, PC1 operations and/or virtual or elevated helicopter clearway operations are permitted by the operator. To be suitable, the processes and procedures for how and when these are permitted must be described in the take-off and initial climb elements of the operator's exposition/operations manual.

Operators who utilise these processes require close discussion with heliport operators to ensure data appropriate for the desired Category A procedure is available and remains valid. The method of obtaining this data, and ensuring it remains valid for the location, must also be included in the exposition/operations manual.

Refer sections 6.4 and 6.5 of AC 133-01 for guidance on raised incline plane and virtual or elevated helicopter clearway processes. By their nature, for PC1 operations, raised incline plane and virtual or elevated helicopter clearways will normally be specific to particular aerodromes where the data which ensures the validity of the obstacle free gradient can be preserved, is monitored and managed by the aerodrome operator. If this is not the case, this task will fall to the rotorcraft operator and the exposition/operations manual must include the operator's process for this task.

2.2.4 Enroute

PC1 enroute provides for two alternatives in regard to the rotorcraft's required OEI performance capability:

a. the rotorcraft must be able to achieve and maintain a rate of climb of at least 50 ft per minute at the minimum flight altitude for each point in the enroute stage of the flight; or

b. the rotorcraft must be able to comply with the requirements for conducting a drift-down manoeuvre.

Additionally, the rotorcraft must be able to approach and land, or conduct a baulked landing, in accordance with the requirements of the Part 133 MOS, with OEI, at an appropriate destination aerodrome.

Minimum flight altitude is defined on the basis of category of operations as follows for a point on the route, or a route segment, of a flight of a rotorcraft:

- for an IFR flight, or VFR flight at night, the published lowest safe altitude (LSALT) for the route or route segment, or the pilot determined LSALT for the route or route segment; or
- for a VFR flight at night, when not using the LSALT, 1 000 ft above the highest feature or obstacle on the ground or water within 10 nautical miles ahead, and to either side of the rotorcraft at that point; or
- for a VFR flight by day over a populous area — 1 000 ft above the highest feature or obstacle within a horizontal radius of 300 m of that point on the ground or water immediately below the rotorcraft; or
- for a VFR flight by day, other than over a populous area — 500 ft above the highest feature or obstacle within a horizontal radius of 300 m of that point on the ground or water immediately below the rotorcraft.

To be suitable, the operator's exposition/operations manual must outline their policy in regard to PC1 enroute operational capability.

Compliance with item (a) above is achieved by reference to the AFM OEI rate of climb performance data, as such the exposition/operations manual need not repeat that information. However, the operator's instructions should require flight crew to confirm this requirement is complied with, in the pre-flight planning stage of the flight, for the most limiting minimum flight altitude for the flight.

If drift down procedures are permitted, the exposition/operations manual must include instructions on when these are permitted and the processes and procedures for drift down operations in the required operational categories (VFR by day, VFR at night or IFR) utilised by the operator. To be suitable, the operator's drift down procedures for IFR and VFR at night must include processes which ensure that the PIC does not contravene the Part 91 minimum height requirements for IFR flights or VFR at night (as applicable) for the rotorcraft’s track for the drift-down manoeuvre to the destination aerodrome.

To be suitable for VFR operations by day, the operator's drift down procedures must ensure the rotorcraft can remain at least 1 000 ft above the highest obstacle on the ground or water within 900 m ahead of, and to either side of, the rotorcraft at each point on the rotorcraft’s track for the drift-down manoeuvre to the destination aerodrome.

The operator's procedures must assume the critical engine fails at the most critical point along the route, and the effects of wind direction and strength on the flight path.

2.2.5 Approach and landing, or baulked landing

Most of the preceding sections regarding the take-off and initial climb stage apply to the approach and landing or baulked landing state of a PC1 flight. Simply described, landing at a location should satisfy two sets of criteria:

a. For an engine failure at or after LDP, where the rotorcraft must be able to land and stop on the touchdown and lift off area (TLOF) within the FATO of the aerodrome.

b. For an engine failure at or before the LDP, when the rotorcraft must be able to perform a baulked landing, meeting the same obstacle clearance required for the take-off procedure at the aerodrome.

For the PC1 approach and landing, or baulked landing there are three types of Category A procedures (different names may be used in RFMs):

- the clear area

- the confined (restricted) area
- the helipad (ground level and elevated) take-off procedures.

To be suitable, the exposition/operations manual must describe the operator's policy on the use of the each of these procedures to be used, and detail the pre-flight preparation and pre-landing processes for the PIC to satisfy themselves of:

- the suitability of the heliport and surrounding obstacles for PC1 operations (refer to paragraphs 5.2.6 and 6.8.2 of AC 133-01)
- the application of pre-flight determination of performance factors
- the application of in-flight updated data to the approach, landing and baulked landing performance
- the determination of the limiting weight, which is driven by the most limiting of:
  - weight limit for the procedure
  - 100 fpm first segment V_{TOSS} climb
  - 150 fpm second segment climb
  - weight required for the rotorcraft to safely land and stop with OEI within the landing distance available for a landing of the rotorcraft at the aerodrome
  - the weight limit to ensure the OEI climb gradient achieved exceeds the obstacle free gradient and maintains the required obstacle clearance in any baulked landing climb.

2.3 Operations in performance class 2 (PC2)

Operations in PC2 can be summarised as a multi-engine rotorcraft with performance such that, in the case of critical power-unit failure, it is able to safely continue the flight, except when the failure occurs prior to a defined point after take-off (DPATO), or after a defined point before landing (DPBL), in which case a forced landing may be required.

Operations in PC2 permit advantage to be taken of an AEO procedure for a short period during take-off and landing — while retaining engine failure accountability in the climb, descent and cruise. The benefits include the ability to:

- use (the reduced) distances scheduled for AEO — thus permitting operations to take place at smaller heliports and allowing airspace requirements to be reduced
- operate when the suitable forced landing area (SFLA) distance available is located outside the boundary of the heliport
- operate when the take-off-distance available is located outside the boundary of the heliport
- use existing Category A profiles and distances when the surface conditions are not adequate for a PC1 rejected take-off but are suitable for an SFLA (e.g. when the SFLA surface is outside the control of the heliport operator).

2.3.1 Procedures

An air transport operator intending to operate in PC2, whether they are mandated by Part 133 to do so or not, is required by section 10.28 of the Part 133 MOS to have exposition procedures covering the following items:

- procedures for the PIC of the rotorcraft, for a flight to determine whether the rotorcraft's take-off weight for the flight is within the limits required to comply with Division 8 of the Part 133 MOS:
- procedures for the PIC to identify relevant obstacles for the flight under subsection 10.32(6) of the Part 133 MOS.

> Note: Unlike PC1, PC2 operations permit pilot surveys of obstacles.

- procedures for the PIC to determine the following for the flight:
  - the most suitable flight path and track for take-off
  - take-off obstacle clearance requirements
  - the defined point after take-off for the take-off of the rotorcraft
  - enroute obstacle clearance requirements
  - the most suitable flight path and track for the approach and landing, or baulked landing of the rotorcraft
  - baulked landing obstacle clearance requirements
  - the defined point before landing for the landing the rotorcraft
- procedures for the PIC to determine a contingency plan for the failure of an engine during the take-off stage, take-off and initial climb stage, or approach and landing or baulked landing stage of the flight, including a procedure to identify an SFLA for the flight:
  - for an engine failure during take-off — before the defined point after take-off for the rotorcraft
  - for an engine failure during landing — after the defined point before landing for the rotorcraft.

2.3.2 Take-off and initial climb

> Note: The take-off and initial climb stages are described concurrently due to their overlapping procedural and compliance requirements.

PC2 is an AEO take-off which, from DPATO, must be capable of meeting the requirements for OEI obstacle clearance in the initial and subsequent climb and enroute phases should an engine failure occur.

To be suitable, the operator's procedures must ensure the take-off mass is the mass that gives at least the minimum required climb performance of 150 ft/min (0.76 m/s), at 1 000 ft (300 m) above the take-off aerodrome, and must also ensure the required obstacle clearance is obtained.

The procedures must ensure, in the pre-flight planning stage, the take-off mass is modified when it does not provide the required OEI clearance from obstacles in the take-off-flight path (exactly as in PC1) after DPATO. Examples of where this could occur are a PC2 take-off from a heliport where the flight path must clear an obstacle, such as a ridge line (or line of buildings), which can neither be:

- flown around using VFR and see and avoid; nor
- cleared using the minimum climb gradient given by the take-off mass (150 ft/min at 1 000 ft).

In this instance, the operator's procedures must ensure the take-off mass is modified (using data contained in the AFM) to give an appropriate climb gradient.

Procedurally, there are three elements of the PC 2 take-off, each with associated related actions which need to be considered by the PIC in the case of an engine failure:

a. the actions in the event of an engine failure — up to the point where a forced-landing will be required
b. the actions in the event of an engine failure — from the point where OEI obstacle clearance is established (DPATO)
c. the pre-considered actions in the event of an engine failure — in the period between points (a) and (b).

Pre-consideration of the action required for an engine failure at any point between (a) and (b) is necessary as it is likely that the planned flight path will have to be abandoned, and whilst the rotorcraft can effectively continue the OEI take-off, the point at which obstacle clearance using the OEI climb gradients has not yet been reached and the SFLA is or may be no longer available. Therefore, the operator must have outlined, in the exposition, what the pilot must have considered (before take-off) as contingency options in the event of an engine failure during that short period.

Dependant on the take-off aerodrome, any action will likely involve turning manoeuvres. Therefore, unless prohibited in the operator's procedures, the effect of turns on performance must also be considered.

Suitable forced landing areas (SFLA)

Subsection 4.1 of AC 133-01 provides guidance on SFLA's for PC2 operations. Inspectors should review this information prior to assessing an operator's PC2 procedures.

SFLA distances

The establishment of the SFLA availability and distance can be problematic, as it is unlikely that PC2 specific data will be available in the AFM.

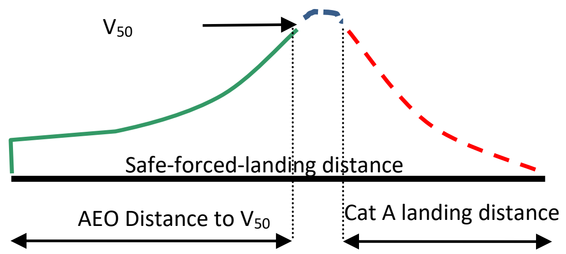
To be suitable, an operator's exposition must include a procedure for establishing SFLA size and necessary available distance for a suitable forced landing (SFL). The rotorcraft's Category A reject distance may be used as a good indication of the SFLA distance required for the take-off.

Any Category A data (or other accepted data, such as operator PC2 operational experience and surveys) may be used to establish the distance. However, once established, it remains valid only if the Category A mass (or the mass from the accepted data) is used and the Category A (or accepted) AEO profile to the TDP is flown.

Considering these constraints, the most useful Category A procedures are the clear area or the short field (restricted area/site) procedures.

If the Category B V_{50} procedure is used to establish DPATO, the operator may use a combination of the distance to 50 ft (15 m) and the Category A 'clear area' landing distance (which is the horizontal distance required to land and come to a complete stop from a point 50 ft (15 m) above the landing surface), to develop a process for calculation of the maximum SFL distance required to be considered in the take-off manoeuvre. These should also consider a reasonable pilot reaction time factor.

Figure 1. Category B (V_{50}) safe forced landing distance



Once a baseline is established, distances do not have to be calculated for every take-off if, by using pilot judgement or standard practice, it can be established that:

- an SFL is possible following an engine failure (notwithstanding that there might be obstacles in the take-off flight path); and
- obstacles can be cleared (or avoided) — AEO in the take-off stage and OEI in the take-off and initial climb stage.

Despite above, if an early entry into an IMC departure is required, the operator's procedure must ensure calculations are carried out and entry to IMC should not occur until an SFLA is no longer required and the required OEI climb gradient can be achieved.

However, standard masses and departures which ensure compliance with Division 8 of the Part 133 MOS can be used, if described in the operator's exposition/operations manual.

Use of Category A data in PC2 procedures

For PC2 when using Category A data only, the SFLA reject distance depends on what is in the PC2 situation for the take-off and the equivalent of the TDP. If an engine fails between TDP and DPATO, the pilot must decide what action is required. It is not necessary for an SFLA distance to be established from any point beyond the equivalent of TDP, as the rotorcraft should have OEI stay up capability, with adequate vertical margin obstacle miss capability, not relevant obstacle miss criteria.

From a rotorcraft design and certification perspective, Category A procedures based on a fixed V_{TOSS} are usually optimised either for the reduction of the rejected take-off distance or the OEI take-off distance required. Category A procedures based on a variable V_{TOSS}, allow either a reduction in required distances (low V_{TOSS}) or an improvement in OEI climb capability (high V_{TOSS}). These optimisations, if they are available in the rotorcraft performance data, are beneficial in PC2 and may be utilised by operators in their PC2 take-off procedures to satisfy the relative dimensions of the take-off site.

In view of the different requirements for PC2 (compared to PC1), it is acceptable for the operator to outline the two calculations (one to establish the SFL distance and the other to establish DPATO) based on different Category A procedures. However, if this method is used, the operator's procedure must ensure the mass resulting from the calculation is not more than the mass from the more limiting of the procedures used.

DPATO and the obstacle clearance gradient

It is necessary for OEI obstacle clearance to be established in the initial climb stage. The starting point for the obstacle clearance gradient (DPATO) must be established.

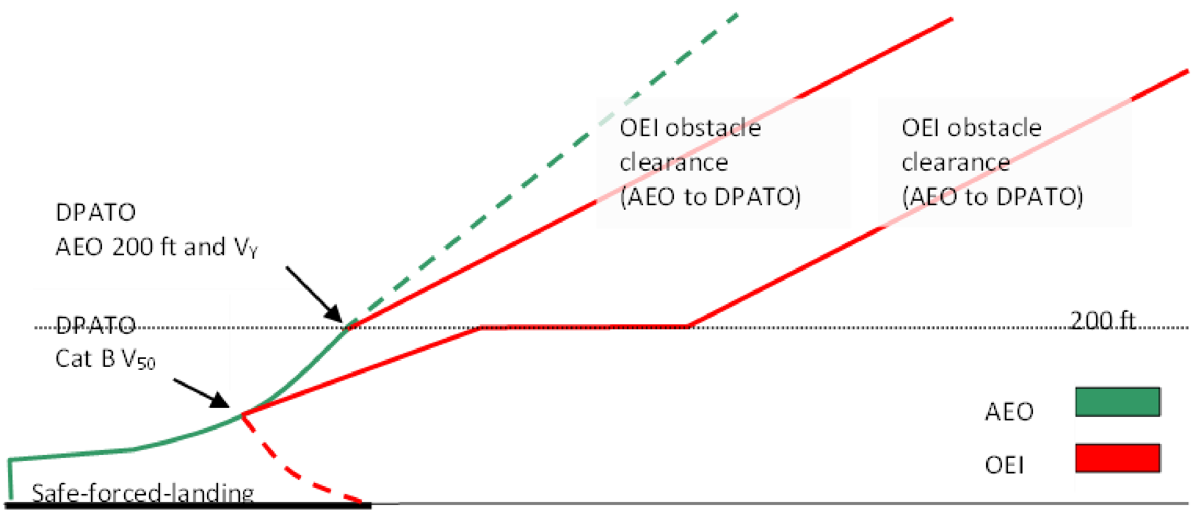
The exact location of the DPATO need not be calculated, as it is coincident with the starting point for the obstacle-free gradient and this gradient must still be determined from the survey conducted by the operator or pilot (using the operator's procedures in accordance with the requirements of the Part 133 MOS). Once the obstacle free gradient is determined, its origin will be likely be DPATO. However, the DPATO cannot be located any higher than 200 ft above obstacles directly below the rotorcraft to maximum height of 300 ft above the heliport or aerodrome. This ensures the acceptance of a capability for a forced landing, and lower obstacle miss criteria for PC2 has a defined limit, beyond which the higher standard of PC1 obstacle clearance is mandatory.

DPATO based on AEO distances

In the simplest case, and if provided, it is suitable for the operator to use the scheduled AEO climb to 200 ft (60 m) at V_Y data to define DPATO, however this may not be flexible enough for all PC2 operations.

If available for the rotorcraft in the AFM, the Category B AEO distance to 50 ft (V_{50}) can be used. However, where this distance is used, to be suitable, the operator's procedures must ensure that the V_{50} climb out speed is associated with a speed and mass for which OEI climb data is available so that, from V_{50}, the OEI flight path can be constructed which is compliant with subsection 10.38(1) of the Part 133 MOS.

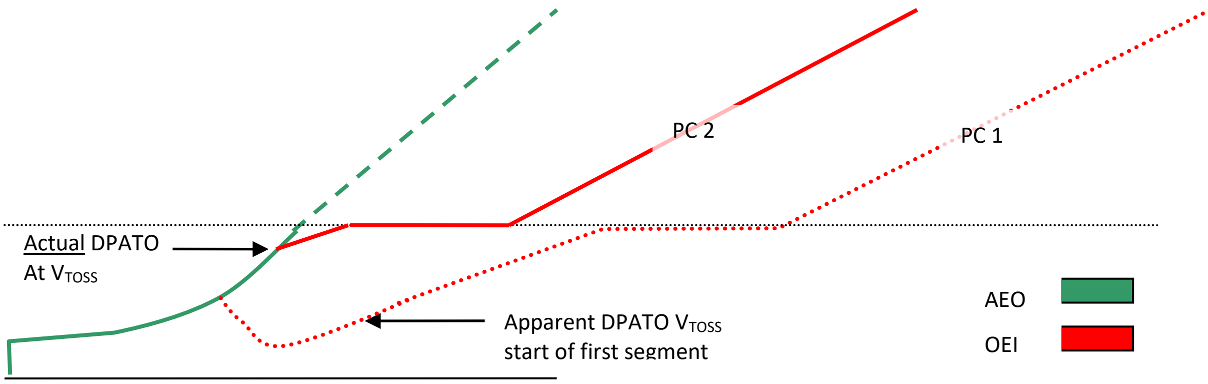
Figure 2. Suggested AEO locations for DPATO



DPATO based on Category A distances

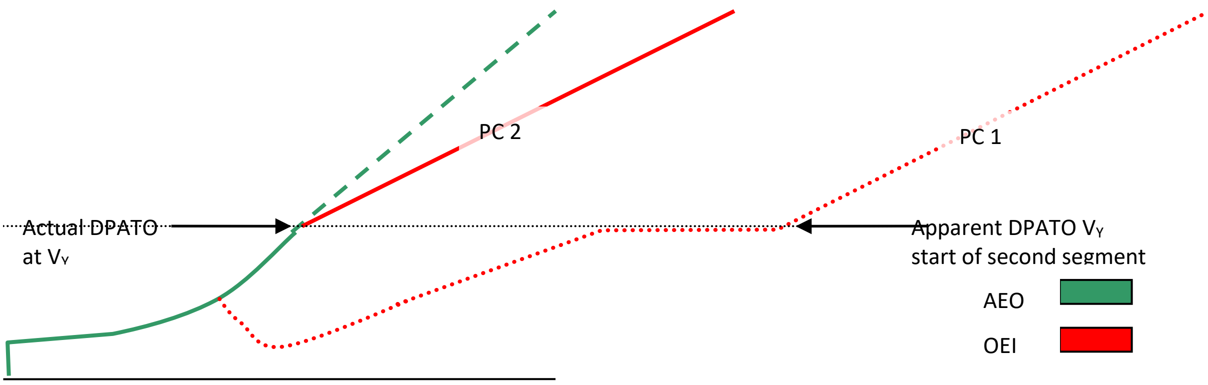
It is not necessary for the operator's procedures to use specific AEO distances if they are not available. A flight path (with OEI obstacle clearance) can be established using Category A distances (see Figure 3 and Figure 4) — which will then be conservative.

Figure 3. Using Category A data; actual and apparent position of DPATO (V_{TOSS} and start of first segment)



Note:	The apparent DPATO is for planning purposes only in the case where AEO data is not available to construct the take-off flight path. The actual OEI flight path will provide better obstacle clearance than the apparent one (used to demonstrate the minimum requirement), as seen from the firm and dashed lines in the above diagram.

Figure 4. Using Category A data; actual and apparent position of DPATO (V_Y and start of second segment)



Use of most favourable Category A data

The use of AEO data is recommended for calculating DPATO when it is available. However, where an AEO distance is not provided in the AFM, distance to V_Y at 200 ft (60 m), from the most favourable of the Category A procedures, can be used by the operator to construct a flight path. This is subject to the requirement that it can be demonstrated that AEO distance to 200 ft (60 m) at V_Y is always closer to the take-off point than the Category A OEI flight path.

If this method is used to satisfy the requirements of the take-off flight path, to be suitable, the last point from where the start of OEI obstacle clearance can be shown (in accordance with section 10.38 of the Part 133 MOS) is at 200 ft (60m)Procedures for calculation of DPATO — a summary

The operator's procedures may define DPATO in terms of speed and height above the take-off surface and should be selected such that AFM data is available to establish the distance from the start of the take-off up to the DPATO.

There are 3 potential methods for calculating the DAPTO.

First potential method

The operator's procedures outline that DPATO is selected as the AFM Category B take-off distance (V_{50} speed or any other take-off distance scheduled in accordance with FAR 29.63), provided that within the distance the rotorcraft can achieve:

- one of the V_{TOSS} values (or the unique V_{TOSS} value if is not variable) provided in the AFM, which must be selected to assure a climb capability according to Category A criteria; or
- V_Y.

Compliance with the take-off and initial climb flight path must be shown from V_{50} (or the scheduled Category B take-off distance if available), prior to this position SFLAs must be available.

Second potential method

The operator's procedures outline that DPATO is selected as equivalent to the TDP of a Category A clear area take-off procedure conducted in the same conditions.

Compliance with the take-off and initial climb flight path would be shown from the point at which V_{TOSS}, a height of at least 10.7 m (35 ft) above the take-off surface, and a positive climb gradient are achieved (which is the Category A clear area take-off distance). SFLAs must be available from the start of the take-off until DPATO.

Third potential method

As an alternative, the operator may outline procedures where DPATO could be selected such that the AFM OEI data is available to establish a flight path initiated with a climb at that speed. This speed should be either:

- one of the V_{TOSS} values (or the unique V_{TOSS} value if is not variable) provided in the AFM, selected to assure a climb capability according to Category A criteria; or
- V_Y.

The height of the DPATO should be at least 10.7 m (35 ft) and can be selected up to 200 ft. Compliance with the take-off and initial climb flight path (section 10.38 of the Part 133 MOS) must be shown from the selected height.

SFLAs

For PC2 operations, the operator must provide procedures to identify and ensure SFLAs are available from the start of the take-off until DPATO.

The Category A 'clear area' rejected take-off distance is a good indication, and suitable method, of estimating the distance required for an SFL into a SFLA.

> Note: Refer section 7.2 of AC 133-01 for additional guidance on PC2 take-off and initial climb.

2.3.3 Enroute

PC2 requirements for enroute flight are identical to the PC1 requirements.

To be suitable for its PC2 operations, the operator's exposition/operations manual must outline their policy and instructions in regard to PC1 enroute operational capability.

If the operator has PC1 procedures in place, these may be cross-referenced in the PC2 section of the exposition/operations manual.

If the operator does not conduct PC1 operations, to be suitable, their PC2 procedures must include the PC1 enroute policy and instructions used by the operator for the PC2 operations.

Refer to section 2.2.4 of this principle for the detail of PC1 enroute requirements.

2.3.4 Approach and landing and baulked landing climb

To be suitable, an operator's procedures for a PC2 approach and landing and baulked landing climb stage of flight must ensure that if an engine fails:

- at any time during the approach prior to DPBL — the helicopter must be able to perform a go-around (baulked landing) meeting the requirements of the take-off flight path obstacle miss criteria; or
- after DPBL — continue OEI flight avoiding all obstacles by the adequate vertical margin until dot point one can be achieved; or
- be able to perform an SFL on the surface into an SFLA or to the heliport's FATO.

The operator's PC2 operational planning procedures must ensure the PIC is able to plan for the landing weight of the rotorcraft to be the most limiting weight (mentioned in the rotorcraft's flight manual) required:

- for the type of approach procedure to be used; and
- to achieve a rate of climb, with OEI, of 150 ft per minute at 1 000 ft above the landing aerodrome; and
- for the rotorcraft to safely land within the landing distance available for a landing of the rotorcraft at the aerodrome; or
- if an engine becomes inoperative before the DPBL for the rotorcraft, the rotorcraft must be able to:
  - conduct a baulked landing; and
  - clear a relevant obstacle, if any, under the baulked landing climb flight path by the required margins described in section 10.40 of the Part 133 MOS.

To allow for the baulked landing flight path, the operator's procedures must ensure obstacles beyond the FATO within the appropriate splay are considered in the same way as if a take-off were being conducted from that FATO. It should be noted for some rotorcraft, the baulked landing flight path may achieve entry into an OEI climb later than an OEI continued take-off. If the operator conducts operations in such rotorcraft, this should be considered in the planning stage for the flight.

To be suitable, the operator's procedures may permit the PIC to identify relevant obstacles and obstacle-free gradients from data supplied by the heliport, the aerodrome operator, the rotorcraft operator, or from pilot assessment.

Where pilot assessment is required, the procedures mentioned in section 7.6 of AC 133-01 may be applied by the operator, and are considered suitable.

If the operator's procedures permit operations above Category A weights, the procedures must also ensure the approach flight path from DPBL remains outside the avoid area of the height velocity (HV) envelope, to ensure an SFL can be conducted with a reasonable expectation of no injuries.

Defined point before landing (DPBL)

To be suitable, the operator's procedures must include a process for establishing DPBL for the types of PC2 approach operations they conduct.

This may include processes where the PIC determines the DPBL (using pilot judgement based on ingrained knowledge gained from the operator's training and checking system) from the point in the approach where a safe OEI climb speed is no longer obtainable and a minimum of 35 ft obstacle clearance can no longer be continuously maintained along the baulked landing flight path.

The ability to achieve an OEI rate of climb that maintains 35 ft above obstacles must be determined by a comparison with the operator surveyed obstacle free gradient from the FATO, as described in the approach planning stage above.

2.4 Operations in performance class 2 with exposure (PC2WE)

Notes

- Due to the procedural and operational similarities associated with PC2 and PC2WE operations, section 2.4 of this principle does not repeat the specific stage requirements for each stage of a flight, but rather concentrates on the critical differences associated with operations with exposure.
- This section should be read in conjunction with section 2.3 of this principle, and for information on DPATO/DPBL and specific stage operations, refer to that section – except for the differences outlined in section 0, they are identical.

PC2WE permits operations without the safety assurance of the SFLA required by PC2. However, SFLAs are just one means of protecting persons and property against the engine failure risk. PC2WE offers operators alternative mitigation strategies based on:

- a defined exposure time limit
- demonstrated engine reliability
- engine maintenance standards
- pilot procedures and training
- operator risk assessments.

Due to complexities around the risk mitigation strategies for PC2WE, CASA requires operators, who intend to operate PC2WE, to be issued specific instruments of approval under regulation 133.015. The approval to operate in PC2WE is specific to the operator and the type and model of rotorcraft, and not specific to location at which PC2WE will take place.

As is the case with any operator approval, its issue will be based on the quality and content of the operator's application.

Subdivision 3 of Division 3 of chapter 10 of the Part 133 MOS outlines the required content of an operator's PC2WE application.

To be suitable, the PC2WE application must include:

- data regarding reliability and sudden power loss for the rotorcraft type and model
- confirmation of the type certificate holder’s (TCH's) modification standard for the rotorcraft for which the data has been obtained
- details of the preventative maintenance actions recommended or required by the holder of the rotorcraft’s type certificate or the holders of the type certificates for the rotorcraft and its engines
- information demonstrating that details of the preventative maintenance actions are included in the rotorcraft’s approved system of maintenance utilised by operator
- the risk assessment procedures for PC2WE flight risks, relevant to the rotorcraft, including the operational and airworthiness measures used to mitigate the identified risks
- details of the operator’s usage monitoring system, which records and stores data related to the rotorcraft’s engines and transmission systems
- information demonstrating that the usage monitoring system is, and is likely to remain, a reliable, accurate, comprehensive and continuously-operating system

- a copy of the rotorcraft's flight manual, stating procedures for a PC2WE flight with the rotorcraft (if any)

> Note: Provided CASA has access to an AFM for the rotorcraft type/model, and the AFM does not contain specific PC2WE procedures to be relied upon by the operator, this copy will be suitable for the application assessment purpose – provided the following dot point is complied with by the applicant.

- the relevant excerpts from the operator's exposition, in which the operator's PC2WE procedures are clearly referenced
- details of the operator's procedures, or any Part 142 operator engaged by the operator, for mandatory training and competency checking of each flight crew member who performs, or is likely to perform, a PC2WE flight with the rotorcraft
- details of the operator's mandatory procedures for reporting to the holder of the rotorcraft's type certificate, or the holders of the type certificates for the rotorcraft and its engines, any of the following arising during a PC2WE flight with the rotorcraft:
  - loss of power control
  - engine shutdown, including a precautionary shutdown
  - power unit failure for any cause, but excluding simulation of power unit failure during training.

The basis of this required content is for the operator to outline how their PC2WE operations in that type and model of rotorcraft can be carried out within the required maximum exposure time for the rotorcraft, and thus achieving the PC2WE target level of safety for the PC2WE operation.

To be suitable, the content of the operator's application must at least meet the detail specified for each item outlined in the content of sections 3, 4, 5 and 6 of AC 133-02.

2.4.1 Power loss exposure risk reports (PERR)

Data for the rotorcraft type and model regarding reliability and sudden power loss are normally included in documents known as power loss exposure risk reports (PERRs).

For the rotorcraft engine/airframe combination under assessment for a PC2WE approval, PERRs must be provided to, or be obtained by CASA, to establish the in-service sudden power loss rate for the rotorcraft/engine combination.

Whilst section 10.18 of the Part 133 MOS requires the applicant to provide this data, it is acceptable for the applicant to provide input from the original equipment manufacturer (OEM) that the rotorcraft has been approved for PC2WE operations, either previously by CASA or by the National Aviation Authority (NAA) of a recognised foreign State – under EASA-OPS Part CAT (EU Regulation n° 965/2012), AMC1 CAT.POL.H.305 or an equivalent standard.

To confirm this and the operator's stated PC2WE maximum exposure time, inspectors must reference the rotorcraft's PERR (which should be provided by the engine TCH or the rotorcraft TCH depending on the way they share the corresponding analysis) to establish the applicant's exposure period calculations are valid.

PERR's for a range of rotorcraft are available in RMS (reference F23/18643). However, if the PERR is out of date or not available, the assessing inspector must contact the OEM/TCH and request an updated copy so the validity check can be carried out.

PC2WE will not be approved for a rotorcraft unless the TCH provides the data described in this section to CASA.

> Note: Refer subsection 4.2 of AC 133-02 for more information.

2.4.2 Maximum permitted exposure time

To be suitable, the applicant's maximum permitted exposure time for their PC2WE procedures must not exceed an exposure period ranging from 9 seconds (worldwide turbine engine fleet average inflight shut down reliability) to 36 seconds (CASA's current PC2WE operations with exposure risk tolerance), based on the rotorcraft's specific engine failure reliability data per 100 000 flight hours.

Based on PERR information, a maximum exposure time of more than 9 seconds, but not more than 36 seconds, may be utilised by the operator in their PC2WE procedures for operations during the take-off, the take-off and initial climb and the approach and landing and baulked landing climb stages of a flight, on the basis of proportional reductions in engine failure rates for the rotorcraft of less than 1 for 100 000 engine hours.

> Note: Refer to sections 4 and 5 of AC 133-02 for assessment considerations.

2.4.3 Requirement for risk assessments

Any operator conducting PC2WE operations will require a formalised risk assessment process within their exposition for the application of PC2WE to their particular operational situations. This risk assessment may form part of the operator's overall risk management processes contained within their SMS, but should include identification of the hazards specific to their operations with exposure and outline control measures in place to mitigate these risks.

To be suitable, the exposition should include the following:

- risk assessment procedures for PC2WE flight risks, relevant to the rotorcraft
- the operational risk management measures used to mitigate the identified risks, including:
  - appropriate PC2WE flight procedures
  - flight crew training and competency checking.

> Note: Refer to subsection 6.3 of AC 133-02 for more information.

2.4.4 PC2WE exposition/operations manual procedures

An air transport operator intending to operate in PC2WE, whether they are mandated by Part 133 to do so or not, is required by section 10.28 of the Part 133 MOS to have exposition procedures covering the following items:

- procedures for the PIC of the rotorcraft, for a flight to determine whether the rotorcraft's take-off weight for the flight is within the limits required to comply with section 10.12 of the Part 133 MOS
- procedures for the PIC to identify relevant obstacles for the flight under subsection 10.32(6) of the Part 133 MOS.

> Note: Unlike PC1, PC2WE operations permit pilot surveys of obstacles

- procedures for the PIC to determine the following for the flight:
  - the most suitable flight path and track for take-off
  - take-off obstacle clearance requirements
  - the defined point after take-off for the take-off of the rotorcraft
  - enroute obstacle clearance requirements
  - the most suitable flight path and track for the approach and landing, or baulked landing of the rotorcraft
  - baulked landing obstacle clearance requirements
  - the defined point before landing for the landing the rotorcraft

- procedures for the take off stage, the take off and initial climb stage, or approach and landing, or baulked landing stage of the flight, which meet the requirements stated in Division 3, Subdivision 2 of chapter 10 of the Part 133 MOS
- a procedure for the operator to ensure the rotorcraft is operated within the maximum permitted exposure time for the rotorcraft, as stated in section 10.11 of the Part 133 MOS.

It is suitable, and quite likely, that an operator's PC2WE procedures and their PC2 procedures may both be utilised in any take-off or approach and landing situation. Therefore, to gain operational flexibility, their procedures for the PIC to determine a contingency plan for the failure of an engine during the take-off stage, take-off and initial climb stage, or approach and landing or baulked landing stage of the flight, including a procedure to identify an SFLA for the flight:

- – for an engine failure during take-off — before the defined point after take-off for the rotorcraft; and
- – for an engine failure during landing — after the defined point before landing for the rotorcraft;

may also be utilised within their combined PC2 and PC2WE operations. To be suitable in such situations, the most limiting operating weight for the operation will be the most limiting weight for the most limiting performance class. Noting PC2WE requires AEO HOGE capability.

Division 3, Subdivision 2 of chapter 10 of the Part 133 MOS requires the operator to include, in their exposition/operations manual, procedures for:

- a defined exposure time limit
- demonstrated engine reliability
- engine maintenance standards
- pilot PC2WE planning and operational procedures
- pilot PC2WE training and competency assessment
- operator risk assessments.

To be suitable, the operator's exposition/operations manual must include these requirements.

2.4.5 Annex A to AC 133-02

CASA has developed considerable PC2WE acceptable means of compliance (AMC) for a series of rotorcraft which it anticipates will be using this performance capability.

Specific sections of Annex A to AC 133-02 provide AMC for PC2WE operations, for a Part 119 exposition or a Part 138 operations manual, for PC2WE operations in the following aircraft:

- AW139 rotorcraft
- Bell 412EP rotorcraft
- BK117 B-2, BK117 B-2 fitted with the LTS101-850B-2 powerplants, and BK117 C-2 (EC-145) rotorcraft
- EC135 P2 rotorcraft
- A109E rotorcraft.

The nominated sections are written as AMC for direct transfer into the applicant's exposition or operations manual. However, for simplicity, they are based on a limited number of Category A procedures and exclude the use of ‘drop-down’ procedures below the level of a helideck.

If this AMC is utilised by the applicant, it is considered suitable. However, as aircraft configurations and installed equipment vary, the information, calculations and performance data presented for each type of rotorcraft mentioned must be confirmed by the operator as appropriate and accurate for the purposes of their operations for that aircraft type, in the configuration it is operated.

The applicant can achieve this by running several desktop assessments, or full flight simulator sessions, using the AMC and their specific AFM data for a series of simulated departures and arrivals – confirming accuracy for their operations.

The results of these assessments can form part of the operator's risk assessment for their application.

Adopting the AMC allows an air operator certificate holder or aerial work certificate holder to satisfy CASA of the PC2WE regulatory requirements. However, they may also propose an alternative means of compliance to the AMC.

Any alternative means will need to be assessed by CASA and found acceptable for the purpose. In such circumstances, an appropriately qualified assessment team from the Regulatory Oversight Division (ROD) and the Flight Standards Branch (FSB) should review the alternative proposals.

2.5 Operations in performance class 3 (PC3)

PC3 operations are operations of with performance such that, in the event of an engine failure at any time during the flight, a forced landing will be required. PC3 operations are applicable to single engine air transport operations, but also to multi-engine air transport operations with MOPSC of 9 or less, in situations where the multi-engine rotorcraft has insufficient OEI 'stay-up' performance and, as a result, is required to force land due to one of its engines failing.

PC3 is designed to be flexible for operators to apply to their operations and, in many instances, just outlines a set of legislative requirements that describe what would be a sensible manner in which to safely operate a rotorcraft with this performance capability.

2.5.1 Procedures

In addition to the applicable general requirements of section 2.1 of this principle, to be suitable, the operator's exposition must include the following, specific PC3 requirements:

- procedures for the PIC of the rotorcraft, for a flight to determine whether the rotorcraft's take-off weight is within the limits required to comply with the requirements stated in Division 9 of the Part 133 MOS.

Inspectors must ensure the operator's procedures direct pilots to a methodology to establish the most limiting take-off weight for the proposed operations, in accordance with the MOS's criteria.

The exposition/operations manual must also include, for the pre-flight planning phase, and should include, for the in-flight replanning phase of a flight:

- procedures for the PIC to determine:
  - the type of take-off procedure required (HIGE or HOGE) from the departure aerodrome, HLS or heliport
  - minimisation of operations in the avoid area of the HV envelope
  - the most suitable flight path and track for take-off
  - take-off obstacle clearance requirements
  - the location of SFLAs for the flight (if available)
  - enroute obstacle clearance requirements, and enroute availability of SFLA's
  - the most suitable flight path and track for the approach and landing, or baulked landing
  - baulked landing obstacle clearance requirements
  - the type of approach and landing required at the destination aerodrome, HLS or heliport
  - any required power margins to ensure safe operations during the take-off or approach and landing etc.

> Note: An example of this requirement for power margin is operation from an elevated heliport/helideck with low or zero winds, where the transition over the deck-edge will result in the loss of ground effect (failure to have HOGE performance may result in a deck-edge strike or an inadvertent pull beyond take-off power — neither of which is operationally acceptable).

- procedures for risk assessment and risk management for flights over populous areas.

Flights over populous areas are permitted under PC3. However, for an exposition or operations manual to be suitable, the operator must include procedures for risk assessment and risk management for these operations.

Part 133 uses performance-based regulation to outline this requirement, an operator could simply list the minimum of hazards, barriers and mitigations that they would have their flight crew members assess and implement as part of their risk assessment and risk control measures, particularly in regard to creating a hazard to third party persons or property. These may be general in nature as they are applicable to 'flights' and not necessarily specific to a flight.

For example, they could be based on the risk assessment process required for operations over populous areas should take into consideration at least the following:

- the circumstances of the operation
- the populous area and terrain over which the operation is being conducted
- the probability of, and length of exposure to, an engine failure and the operator's tolerability of such an event
- the procedures and systems for monitoring and maintaining the reliability of the rotorcraft engine(s)
- the flight crew members training, experience and knowledge of the populous area
- the operational procedures to mitigate the consequences of the critical engine failure
- any additional helicopter equipment, such as a usage monitoring and/or flight tracking and following systems.

To be suitable, the operator must have an exposition/operations manual process which allows the flight crew members to establish that the proposed flight is within the operator's risk tolerance for PC3 air transport operations.

Alternately, if the operator is also an aerial work certificate holder, it is acceptable and suitable for the operator to use a modified version of their Part 138 risk assessment and mitigation processes, appropriately described in their exposition, to perform this function for their air transport operations over populous areas, or their air transport operations generally (including operation over populous areas).

If an operator has a functional SMS, these processes should be incorporated into their overall SMS processes and procedures for their operations.

2.5.2 Avoidance of creation of a hazard

CASA does not consider an aircraft to be creating a hazard by simply flying over populous areas in the normal course of navigation, provided the aircraft adheres to the prescribed distances and altitudes outlined in regulation 91.265 (which also applies to Part 133 operations) and the distances and general requirements mentioned in subsection 10.26(b) and sections 10.42 and 10.43 of the Part 133 MOS.

The distances described in sections 10.42 and 10.43 of the Part 133 MOS are the 'adequate vertical margin', the 'minimum safe height for the flight under Part 91 of CASR or the Part 91 MOS' and 'the minimum flight altitude for each point in the enroute stage of the flight'.

Therefore, to be suitable, inspectors should ensure the operator's procedures are naturally weighted towards minimising operational safety risk in the take-off, take-off and initial climb, and the approach and landing and baulked landing climb stages of flights in populous areas.

Additionally, inspectors should note that for the purposes of regulation 133.340, section 10.26 of the Part 133 MOS requires that, for the flight of rotorcraft in PC3 over a populous area, the rotorcraft be equipped with a particle detection system that monitors the main and tail rotor transmissions of the rotorcraft.

> Note: From December 2023, this system was to also include a flight deck caution indicator and whilst this is very much encouraged by CASA, this requirement may be further deferred via legislative instrument prior to that date.

2.5.3 Enroute SFLA availability (any PC3 operation)

For PC3 enroute, the rotorcraft must be flown in a way that minimises the time the flight is without an available an SFLA.

To be suitable, operators must develop a policy in their exposition/operations manual must include a policy that instructs pilots on the expectations for minimising the time the rotorcraft is operating without available SFLAs.

Inspectors should ensure the policy includes judicious use of pre-departure flight planning tools, as well as guidance and instructions to enhance flight crew knowledge of the availability of SFLAs over the planned tracks of the flight.

> Note: Guidance on this requirement is outlined in section 8.5 of AC 133-01.

It is suitable for the operator to utilise a scalable approach to this policy, such as describing a situation where the flight is:

- operating in areas of mixed terrain features
- operating in areas with scattered SFL areas
- operating in areas of challenging terrain
- autorotative descent training considerations.

2.5.3.1 Operating in areas of mixed terrain features

The practical effect on normal operations is usually minimal, as most areas of operation are of a mixed nature. The operator may accept that little or no deviation from the planned route is necessary to have an SFLA within reach, provided the flight is performed at an appropriate height above ground level and using sound pilot skills and judgement.

In such circumstances, it is acceptable for operations to be flown directly above surfaces that do not allow for an SFL, but at normal flight altitudes, sufficiently flat open areas should be within autorotational gliding distance, or quickly come into autorotational glide distance as the flight progresses.

Flights over such areas normally have an SFLA within reach, or quickly within reach, and should not require further mitigation.

2.5.3.2 Operating in areas with scattered SFL areas

Where the mix of terrain is such that SFLA's are less readily available, to be suitable, further policy consideration is required.

In scattered SFL areas, the operator should outline that adaptation of the flight path may be required, such as:

- climbing before crossing a lake (or other water feature) to have an SFLA available on land on either side within autorotational distance; or
- flying around a stretch of heavily treed country, provided it does not cause a significant deviation of the flight plan track, to have an SFLA more readily available.

In some cases, it may not be feasible to change routing and shorter stretches of the flight might not have an SFLA within autorotational distance.

Flights over such areas are permitted, however it is recommended it is reasonable they be so following a risk assessment, and provided the identified controls and mitigations are applied. Similar risk mitigations to operations over populous areas would be suitable in these situations.

2.5.3.3 Operating in areas of challenging terrain

Some areas are such that SFLA's are few or non-existent for longer stretches. However, if SFLAs are available, the operator's policy may specify planning the route to pass near these to reduce the exposure and address the risk of encountering emergencies that require a precautionary landing (land immediately, land as soon as possible (ASAP)).

When operating over challenging terrain in areas where no, or very few, SFLA's are available to perform an SFL, the operator's policy may permit operations if the result of the risk assessment shows that the risk level is acceptable, and the identified controls and mitigations are properly applied (the same as in areas with scattered SFLAs).

The operator may consider including a procedural requirement for predetermined routes, with known landing areas that are based on previous reconnaissance, to be entered into the navigation database or marked on a map. This process could minimize exposure to the consequences of an engine failure or make potential landing areas more readily identifiable in the case of emergencies that require an autorotation or a land ASAP response.

In assessing an operator's policy and procedures for ensuring that the rotorcraft is flown in a way that minimises the time during the enroute stage of the flight in which an SFLA, for the flight, is not available, inspectors must consider the exposition/operations manual content on the basis of CASA's obligations for performance of its functions under subsection 9A(3) of the *Civil Aviation Act 1988*.

2.5.3.4 Autorotative descent training considerations

Operators operating over populous areas with available SFLA must provide details of training for the operator’s pilots in conducting autorotative descents with the rotorcraft to locations with limited access to an SFLA for a flight of the rotorcraft.

Additional mitigation arises from special training and pilot performance. If enhanced standards for pilot performance in autorotation and precision engine off landing are required, then the risk can be significantly reduced.

Enhanced training standards can be expected to:

- reduce the minimum size of an SFLA that a pilot is capable of reaching
- increase the number of SFL options a pilot has available
- reduce the consequences of a forced landing in hostile environments
- increase the chance of a successful autorotation following a real and unexpected failure.

> Note: Enhanced training should only be carried out in a manner that is considered safe by the operator's training policy and procedures. For example, surface touch down practice – autorotative forced landings may not be required and, if available, flight synthetic training devices may be used for practice of emergency drills and to promote enhanced pilot reaction times to engine and other critical system failures.

3. Revision history

Amendments/revisions for this principle are recorded below in order of the most recent first.

Table 1: Revision history table

Version No.	Date	Parts / Sections	Details
1.2	June 2024	2.1.3	Removed 2.1.3- Pre-flight determination of relevant obstacles, incorporated into 2.1.2.
1.1	May 2024	2.4.1	Amended the RMS reference file for Power-loss Exposure Risk Reports (PERR) to F23/18643
1.0	August 2023	All	First issue