GHANA
CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR
AC 08-003

APPLICATION & PROCESS:
COMMERCIAL AIR TRANSPORT WITH SINGLE ENGINE TURBINE AEROPLANE either at night, in IMC or both

SECTION 1 GENERAL

1.1 INTRODUCTION

This Advisory Circular is intended to assist the applicant in the implementation of the requirements specified in the Ghana Civil Aviation Directives and serves as a guide for the certification process.

1.2 PURPOSE

The purpose of this Advisory Circular is to provide:

- an overview of the general requirements for obtaining the specific approval in commercial air transport with single engine turbine aeroplane operations in Instrument Meteorological Conditions;
- guidance on how related information may be implemented into the applicants management system;
- guidance on how certain requirements may be achieved and also serve as a certification tool for GCAA in the conduct and evaluation of relevant requirements for single engine turbine operations in Instrument Meteorological Conditions. .

1.3 STATUS OF THIS AC

This AC is an original issuance.

In Commercial Air Transport (CAT) operations, a single-engine turbine aeroplane may only be operated at night or in IMC if the operator has been granted a SET-IMC specific approval by the authority (GCAA). The Approval must be documented in the OPSPECS.

1.4 BACKGROUND

A. This document addresses the requirements for the specific approval for SET- IMC in commercial air transport and does not address how to go through an AOC certification or how to obtain an Air Operator Certificate. The examples listed herein may be incomplete and may only represent a possible means of a certification for SET-IMC in commercial air transport.

- Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the directives, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.
- Where a directive contains the words “prescribed by the Authority,” the AC may consider to “prescribe” a viable method of compliance, but status of that “prescription” is always “guidance” (never a directive).

B. It is expected that a passenger who purchases a commercial flight ticket for a flight with a single engine turbine aircraft which is operated in IMC or at night has the right to benefit from an equivalent quantitative level of safety irrespective of technical differences such as the number of engines mounted to the aeroplane. Therefore the operator has to prove to the Authority that operations with a single engine aeroplane do not bear a higher total risk than defined by the GCADs and explained in this document.

1.5 APPLICABILITY

This AC is applicable to all operators engaged in commercial air transportation utilizing a single engine turbine powered aeroplane.

1.6 RELATED DIRECTIVES

This Advisory Circular is applicable to relevant requirements found in the following Directives:

- Part 2 of the Ghana Civil Aviation (Flight Standards) Directives
- Part 5 of the Ghana Civil Aviation (Flight Standards) Directives
- Part 7 of the Ghana Civil Aviation (Flight Standards) Directives
- Part 8 of the Ghana Civil Aviation (Flight Standards) Directives
- Part 9 of the Ghana Civil Aviation (Flight Standards) Directives
- Part 14 of the Ghana Civil Aviation (Aerodromes) Directives

1.7 DEFINITIONS & ACRONYMS

The following acronyms are used in this advisory circular:

AC - Advisory Circular
AFM - Aircraft Flight Manual
AMC- Alternate Means of Compliance
APCH - Approach
AOC - Air Operator Certificate
ATC - Air Traffic Control
ATCO - Air Traffic Controller
CAT - Commercial Air Transport
EM - Emergency
FFS - Full Flight Simulator
FH - Flight Hour
FL - Flight Level
FSTD - Flight Simulation Training Devices
GCAA - Ghana Civil Aviation Authority
GCADs - Ghana Civil Aviation Directives
GNSS - Global Navigation Satellite System
IAS - Indicated Airspeed
LIFUS - Line Flying Under Supervision
IMC - Instrument Meteorological Conditions
MEA - Minimum En-route Altitude
MEL - Minimum Equipment List
METAR - Meteorological Aerodrome Report
MMEL - Master Minimum Equipment List
MOCA - Minimum Obstacle Clearance Altitude
MP - Maintenance Programme
OM - Operations Manual
OMA - OPS Manual Part A
OMB - OPS Manual Part B
OMC - OPS Manual Part C

OMD - OPS Manual Part D

OPC - Operator Proficiency Check

OPS - Operations

OPSPECS- Operations Specifications

OSD - Operational Suitability Data

PBN - Performance Based Navigation

RAIM - Receiver Autonomous Integrity Monitory

RNP - Required Navigation Performance

RVR - Runway Visual Range

RVSM - Reduced Vertical Separation Minima

RWY - Runway

SET - Single Engine Turbine

SET-IMC – Single Engine Turbine in Instrument Meteorological Conditions

STC - Supplemental Type Certificate

TAF - Terminal Area Forecast

TC - Type Certificate

VIS - Visibility

VMC - Visual Meteorological Conditions

SECTION 2 INITIAL STEPS WHEN CONSIDERING CERTIFICATION FOR CAT SET IN EITHER IMC,AT NIGHT OR BOTH

The operator should define a realistic project plan, considering the necessary period for a thorough certification and perform a technical or legal assessment of requirements to achieve CAT SET-IMC.

Before submitting any documents to the Authority for evaluation, the operator should assess its ability to meet the published requirements. The following items should be considered to ensure suitability for CAT SET-IMC operations:

- ☐ *The applicant should hold a valid AOC or should be in the process of acquiring an AOC.*
- ☐ *The single engine turbine reliability data by the "world's fleet" for the particular airframe-engine combination should be available from the Type Certificate (TC) holder or Supplemental Type Certificate (STC) holder and shall be submitted to the Authority with the application. The data has to indicate sufficient reliability;*
- ☐ *The engine and airframe combination has been integrated into a specific engine trend monitoring system;*
- ☐ *The on-board equipment as installed and operational; and*
- ☐ *Pilots fulfil the license requirements for SET-IMC.*

2.1 EQUIPMENT REQUIREMENT: AEROPLANES USED FOR CAT SET IN IMC OR AT NIGHT OPERATIONS

Aeroplanes intended to be used in CAT SET-IMC operations must have the following equipment installed and fully operational:

Equipment	Standard	Operator documentation/ evidence	GCAA
Electrical generating System SET-IMC.	two separate electrical generating systems, each one capable of supplying adequate power to all essential flight instruments, navigation systems and aeroplane systems required for continued flight to the destination or alternate aerodrome		❑ ok ❑ not ok
Attitude indicators. SET-IMC.	two attitude indicators, powered from independent sources		❑ ok ❑ not ok
Safety belts .SET-IMC.	for passenger operations, a shoulder harness or a safety belt with a diagonal shoulder strap for each passenger seat		❑ ok ❑ not ok
Weather radar .SET-IMC.	airborne weather-detecting equipment		❑ ok ❑ not ok
Oxygen .SET-IMC.	in a pressurised aeroplane, sufficient supplemental oxygen for all occupants to allow descent, following engine failure at the maximum certificated cruising altitude, at the best range gliding speed and in the best gliding configuration, assuming the maximum cabin leak rate, until sustained cabin altitudes below 13 000 ft. are reached		❑ ok ❑ not ok
Navigation to landing sites .SET-IMC.	an area navigation system capable of being programmed with the positions of landing sites and providing lateral guidance to the flight crew to reach those sites		❑ ok ❑ not ok
Radio altimeter .SET-IMC. **Landing lights** .SET-IMC.	a radio altimeter a landing light, capable of illuminating the touchdown point on the power-off glide path from 200 ft. away		❑ ok ❑ not ok ❑ ok ❑ not ok
Emergency electrical supply .SET-IMC.	an emergency electrical supply system of sufficient capacity and endurance capable of providing power, following the failure of all generated power, to additional loads necessary for all of the following: • the essential flight and area navigation instruments during descent from maximum operating altitude after engine failure; • the means to provide for one attempt to restart the engine; • if appropriate, the extension of landing gear and flaps; • the use of the radio altimeter throughout the landing approach; • the landing light; • one pitot heater; • if installed, the electrical means to give sufficient protection against impairment of the pilot's vision for landing;		❑ ok ❑ not ok

Ignition system .SET-IMC.	an ignition system that activates automatically, or is capable of being operated manually, for take-off, landing, and during flight, in visible moisture;		❑ ok ❑ not ok
Lubrication and debris detection .SET-IMC.	a means of continuously monitoring the power train lubrication system to detect the presence of debris associated with the imminent failure of a drive train component, including a flight crew compartment caution indication;		❑ ok ❑ not ok
Emergency engine power control. SET-IMC.	an emergency engine power control device that permits continuing operation of the engine at a sufficient power range to safely complete the flight in the event of any reasonably probable failure of the fuel control unit.		❑ ok ❑ not ok

Equipment Requirements

2.2 Attitude indicators

A backup or standby attitude indicator built in the glass cockpit installations is an acceptable means of compliance for the second attitude indicator.

2.3 Airborne weather equipment

The airborne weather-detecting equipment should be an airborne weather radar, as specified in GCADs Part 7 or equivalent.

2.4 Area navigation system

The area navigation system should be based on a global navigation satellite system (GNSS) stand- alone receiver or multi-sensor system, including at least one GNSS sensor, to enable at least required navigation performance approach (RNP APCH) operations without vertical guidance.

2.5 Emergency engine power control device

The means that allows continuing operation of the engine within a sufficient power range for the flight to be safely completed in the event of any reasonably probable failure or malfunction of the fuel control unit should enable the fuel flow modulation.

2.6 Required Turbine Engine Reliability For CAT SET In IMC, At Night or both

Before submitting any documents to the Authority for evaluation, the operator should first evaluate turbine engine reliability and check whether the engine-airframe combination provides the required safety level.

To obtain a SET-IMC approval, the operator should obtain the power plant reliability data from either the type certificate (TC) holder, supplemental type certificate (STC) holder or both which should provide evidence that all the following conditions have been complied with:

Subject	Standard	Operator documentation/evidence	GCAA
Turbine reliability .SET-IMC.	an acceptable level of turbine engine reliability is achieved in service by the "world fleet" for the particular **airframe-engine combination**; • The data for the engine-airframe combination should have demonstrated, or be likely to demonstrate, a **power loss rate of less than 10 per million flight hours**. Power loss in this context is defined as any loss of power, including in- flight shutdown, the cause of which may be traced to faulty engine or engine component design or installation, including design or installation of the fuel ancillary or engine control systems.		❑ ok ❑ not ok
Turbine reliability .SET-IMC.	• The **in-service experience with the intended engine-airframe combination should be at least 100 000**hrs, demonstrating the required level of reliability. If this experience has not been accumulated, then, based on analysis or test, in-service experience witha similar or related type of airframe and turbine engine might be considered by theTC/STC holder to develop an equivalent safety argument in order to demonstrate that the reliability criteria are achievable.		❑ ok ❑ not ok

SECTION 3 SETUP OF THE MAIN COMPONENTS FOR CAT SET IN IMC OR AT NIGHT

3.1 Maintenance Instructions and Procedures including Monitoring

3.1.1 Maintenance programme

The following maintenance aspects should be addressed by the operator:

Subject	Standard	Operator documentation/evidence	GCAA
Maintenance programme .SET-IMC.	specific maintenance instructions and procedures to ensure the intended levels of continued airworthiness and reliability of the aeroplane and its propulsion system have been established and included in the operator's aircraft maintenance programme, including all the following: • an engine trend monitoring programme, except for aeroplanes first issued with an individual certificate of airworthiness after 31 December 2004 that shall have an automatic trend monitoring system; • The operator's maintenance programme should include an oil-consumption- monitoring programme that should be based on engine manufacturer's recommendations, if available, and track oil consumption trends. The monitoring should be continuous and take account of the oil added. • An engine oil analysis programme may also be required if recommended by the engine manufacturer. • The possibility to perform frequent (recorded) power checks on a calendar basis should be considered.		❑ ok ❑ not ok

The engine-monitoring programme should describe parameters, which have to be monitored for engine condition monitoring. The programme should also describe any method of data collection and a corrective action process; it should be based on the engine manufacturer's instructions. This monitoring should be used to detect propulsion system deterioration at an early stage allowing corrective action to be taken before safe operation is affected.

3.2 Reliability Programme

Propulsion and associated systems reliability programme

The operator should address the following maintenance aspects:

Subject	Standard	Operator documentation/evidence	GCAA
Maintenance programme .SET-IMC.	• A **propulsion and associated systems' reliability programme** should be established or the existing reliability programme supplemented for the particular engine-airframe combination. This programme should be designed to early identify and prevent problems, which otherwise would affect the ability of the aeroplane to safely perform its intended flight. Where the fleet of SET-IMC aeroplanes is part of a larger fleet of the same engine-airframe combination, data from the operator's total fleet should be acceptable. For engines, the programme should incorporate reporting procedures for all significant events.		❑ ok ❑ not ok
Maintenance programme .SET-IMC.	The engine reliability programme should include, as a minimum: • the engine hours flown in the period, the power loss rate for all causes, and • the engine removal rate, both rates on an annual basis, as well as • reports with the operational context focusing on critical events.		❑ ok ❑ not ok

The information contained in the reliability programme should be readily available (with the supporting data) for use by the operator, Type Certificate (TC) holder or STC holder, and the competent authority to help establish that the reliability levels are achieved. Any adverse trend would require an immediate evaluation to be conducted by the operator in consultation with its competent authority. The evaluation may result in taking corrective measures or imposing operational restrictions.

These reports should be communicated to the TC or STC holder and their competent authorities. The actual period selected should reflect the global utilisation and the relevance of the experience included (e.g. early data may not be relevant due to subsequent mandatory modifications that affected the power loss rate).After the introduction of a new engine variant and whilst global utilisation is relatively low, the total available experience may have to be used to try and achieve a statistically meaningful average.

3.3 Flight Planning Requirements

Risk Period

In the context of commercial air transport operations with single-engined turbine aeroplanes in instrument meteorological conditions or at night (CAT SET-IMC), a risk period is a period of flight during which no landing site has been selected by the operator. In other words, a period of time where the outcome of an engine power loss and subsequent emergency descent with forced landing may lead to a fatal outcome. The maximum cumulative risk period or time span allowing for such a high risk shall not be greater than 15 minutes in total from take-off to landing unless

specifically approved by the Authority and stated as such in the GCADs. The operator will only be granted extensions beyond the 15 minutes risk period after having undergone a thorough certification process indicating that the remaining risk level with the corresponding probability of a fatal outcome can be maintained at the same specified level as for operations with a maximum risk period of 15 minutes.

Flight planning

The operator should consider preparation of flight routings long before offering services withSET-CAT IMC. Ideally, the preparation of routings should be divided into:

- Long term flight preparation:
  - Line studies including assessment and selection of landing sites;
  - evaluation of different flight altitudes allowing to reach emergency landing sites in case of loss of engine power; and
  - use and calculation of the individual length and of total risk periods per routing.
- Short term flight preparation:
  - Procedures with appropriate preparation of flight documentation,use of appropriate weather forecasts (en-route, landing sites)
- Establishing emergency procedures:
  - engine failure management;
  - drift down and navigation procedures; and
  - loss of pressurization management.

Planning including obstacle and drift down considerations

In instrument meteorological conditions or at night and in the event of engine failure, the aeroplane shall be capable of reaching a place at which a safe forced landing can be made from any point of the planned route, unless the operator is approved by the Authority in accordance with the GCADs and makes use of a risk period.

It shall be assumed that, at the point of a potential engine failure, the aeroplane is not flying at an altitude exceeding that at which the rate of climb equals 300 ft. per minute, with the engine operating at maximum continuous power and the en-route gradient is the gross gradient of an engine out gliding descent increased by a safety margin of 0.5 %.

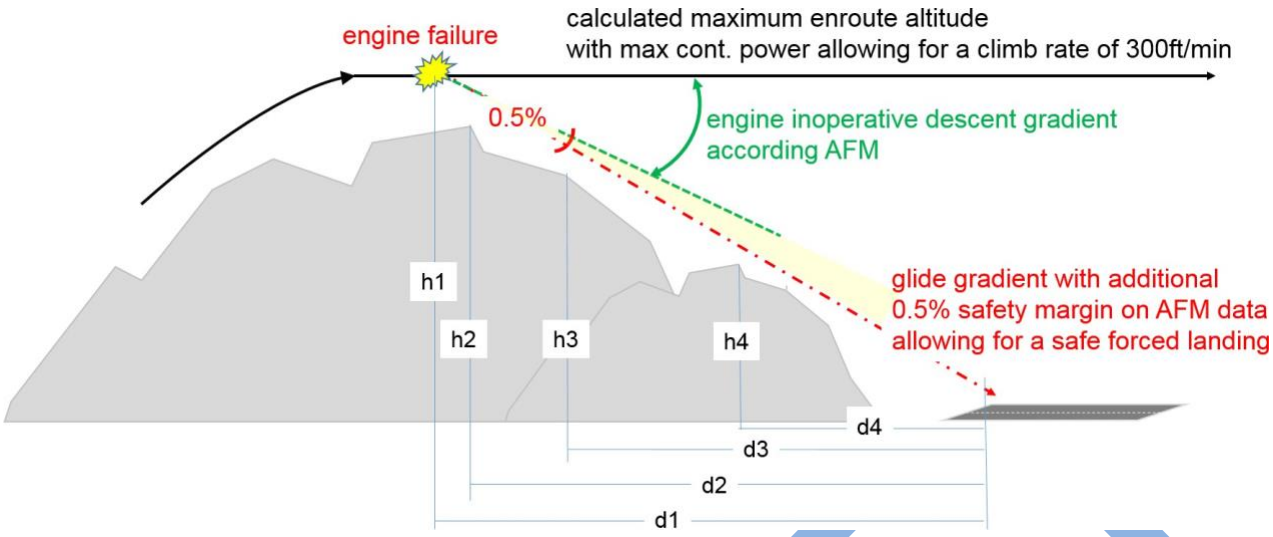


Figure 1

Note: Portions of a flight where the SET-IMC approved operator cannot provide for an engine failure glide procedure in accordance with the model of figure 1 are considered a risk period. Without a specific approval for an extended risk period, the total cumulative risk period may not be longer than 15 minutes per flight (take off to landing).

The operator shall define routes on its network where either GRID MOCA (Minimum Obstacle Clearance Altitude) or MEA (Minimum En-route-Altitude) allows for a safe glide performance to a published and pre-programmed forced landing site allowing also for portions of flight where the aeroplane is in a climb. The operator shall also consider strong upper winds when defining escape routes and descent scenarios.

Flight Planning / Risk Period

Subject	Standard	Operator documentation/evidence	GCAA
Flight Planning	• The operator should establish **flight planning procedures** to ensure that the routes and cruising altitudes are selected so as to have a landing site within gliding range. Notwithstanding this requirement, whenever a landing site is not within gliding range, **one or more risk periods may be used** for the following operations: - over water; - over hostile environment; - over congested areas. Except for the take-off and landing phase, the operator should ensure that: • when a risk period is planned, there is a possibility to glide to a **non-congested area**. • The **total duration of the risk period perflight should not exceed 15 min** unless the operator has established, based on a risk assessment carried out for the route concerned, that the cumulative risk of fatal accident due to an engine failure for this flight remains at an acceptable level. • Any extension of the Risk Period beyond 15 min will have to be approved by Authority and stated in the GCADs		❑ ok ❑ not ok
Aerodrome operating minima Take-off operations aeroplanes	General • Take-off minima should be expressed as visibility or runway visual range (RVR) limits, taking into account all relevant factors for each aerodrome planned to be used and aircraft characteristics. Where there is a specific need to see and avoid obstacles on departure and/or for a forced landing, additional conditions, e.g. ceiling,should be specified. Required RVR/VIS • For single-engined turbine aeroplane operations approved in accordance with (SET-IMC), thetake-off minima specified by the operator should be expressed as RVR/ VIS values not lower than: For day only with no specific RWY lights or marking requirements: RVR/VIS 500m provided the pilot is able to continuously identify the take-off surface and maintain directional control. Day: RVR/VIS 400m provided at least runway edge lights or runway centre line markings are available. At night at least runway edge lights and runway end lights or runway centre line lights and runway end lights shall be available. • Unless the operator is making use of a risk period, whenever the surface in front of the runway does not allow for a safe forced landing, the RVR/VIS		❑ ok ❑ not ok

	• values should not be lower than 800 m. In this case, the proportion of the flight to be considered starts at the lift-off position and ends when the aeroplane is able to turn back and land on the runway in the opposite direction or glide to the next landing site in case of power loss. • The reported RVR/VIS value representative of the initial part of the take-off run can be replaced by pilot assessment.		

Note: It is assumed that for the portion of flight, which must be considered inside a risk period, in case of engine failure, the pilot will try to perform a forced landing whilst avoiding endangering people and infrastructure on ground.

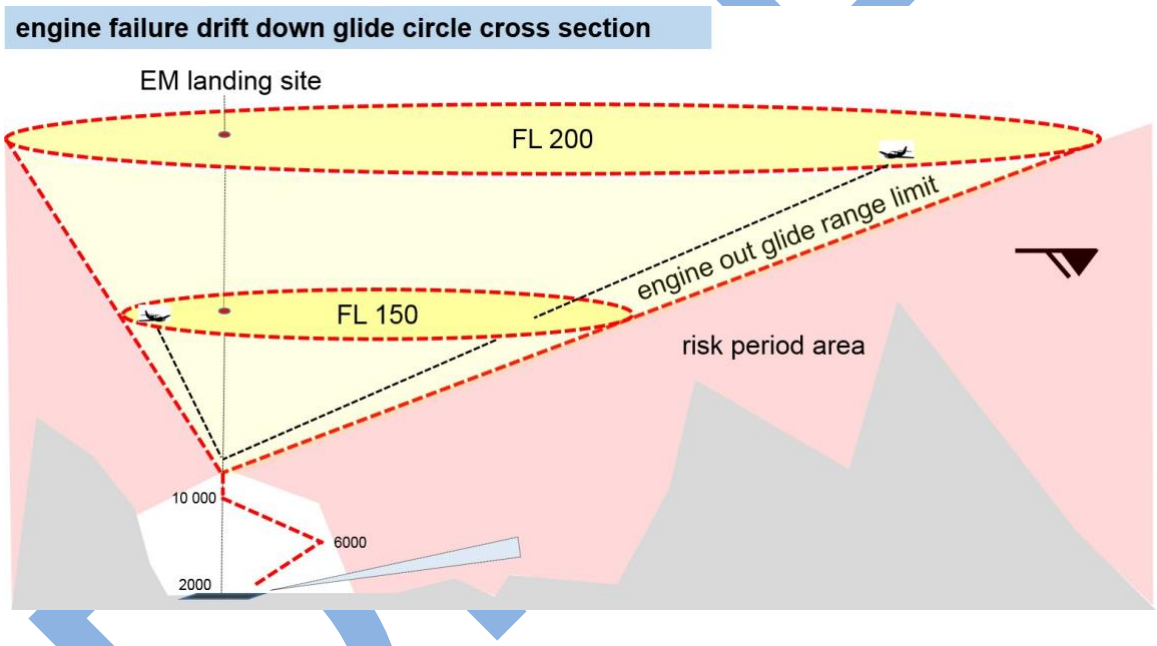


Figure 3: sample of an engine failure drift down calculation - cross section schema

Route assessment criteria for flight planning

Subject	Standard	Operator documentation/evidence	GCAA
Flight Planning (c)	The operator should establish **criteria for the assessment of each new route**. These criteria should address the following: • the selection of aerodromes along the route; • the identification and assessment, at least on an annual basis, of the continued suitability of landing sites (obstacles, dimensions of the landing area, type of the surface, slope, etc.) along the route when no aerodrome is available; the assessment may be performed using publicly available information or by conducting on-site surveys (e.g. google maps or similar) • assessment of en-route specific weather conditions that could affect the capability of the aeroplane to reach the selected forced landing area following loss of power (icing conditions including gliding descent through clouds in freezing conditions, headwinds, etc.); • consideration of landing sites' prevailing weather conditions to the extent that such information is available from local or other sources; expected weather conditions at landing sites for which no weather information is available should be assessed and evaluated taking into account a combination of the following information: local observations; • regional weather information (e.g. significant weather charts); terminal area forecast (TAF)/meteorological aerodrome report (METAR) of the nearest aerodromes; • protection of the aeroplane occupants after landing in case of adverse weather.		❑ ok ❑ not ok
Flight Planning (d)	• At the flight-planning phase, any selected landing site should have been assessed bythe operator as acceptable for carrying out a safe forced landing with a reasonable expectation of no injuries to persons in the aeroplane or on the ground. • All information reasonably practical to acquire should be used by the operator to establish the characteristics of landing sites.		❑ ok ❑ not ok
Flight Planning (e) **Programming forced landing sites**	• Landing sites suitable for a diversion or forced landing should be programmed into the navigation system so that track and distance to the landing sites are immediately and continuously available. • None of these pre-programmed positions should be altered in-flight.		❑ ok ❑ not ok

When selecting landing sites, the operator shall consider the influence of wind on the descent path and conduct the flight at appropriate flight altitudes which provide sufficient margin for the glide path to the landing site in case of an engine failure.

Influence of wind on the Descent Path and Glide Range

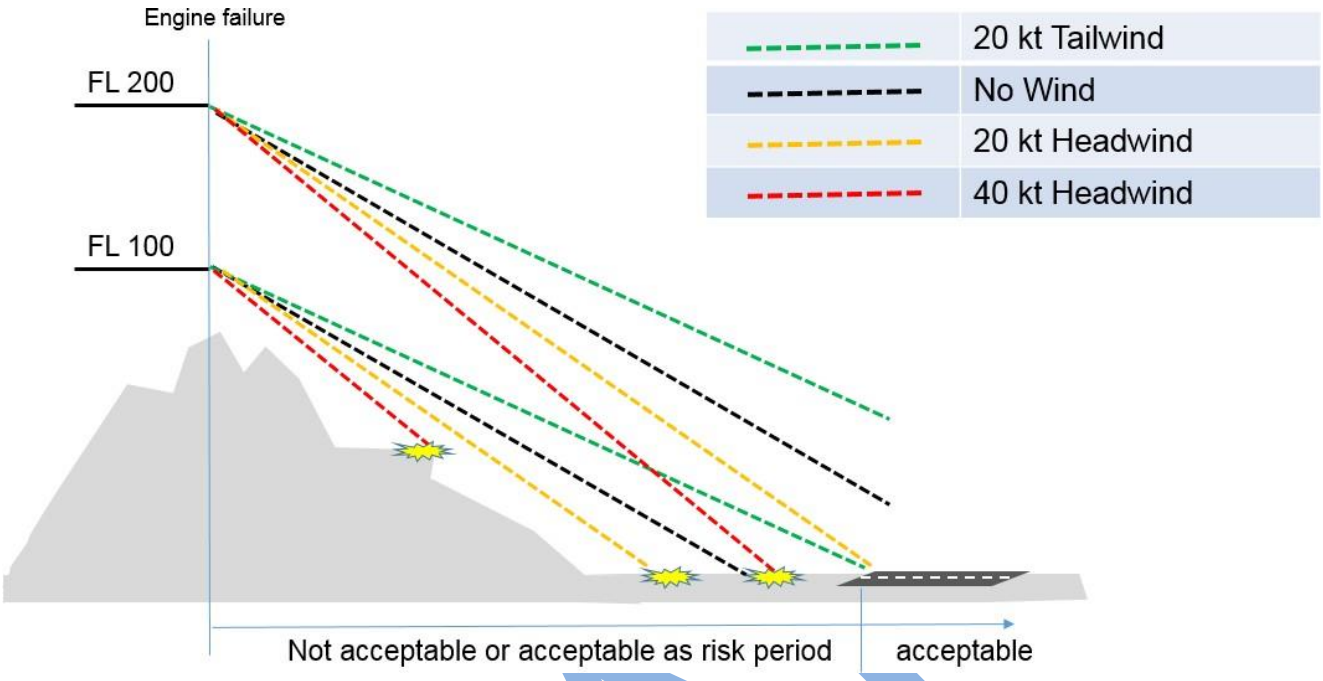


Figure 5: Sample diagram indicating the influence of wind on the descent path and glide range

Route selection

Subject	Standard	Operator documentation/evidence	GCAA
Route and Instrument Procedure Selection	The following should be considered by the operator, as appropriate, depending on the use of a Risk Period: **Departure** • The operator should ensure, to the extent possible, that the instrument departure procedures to be followed are those guaranteeing that the flight path allows, in the event of power loss, the aeroplane to land on a landing site. **Arrival** • The operator should ensure, to the extent possible, that the arrival procedures to be followed are those guaranteeing that the flight path allows, in the event of power loss, the aeroplane to land on a landing site. **En-route** • The operator should ensure that any planned or diversionary route should be selected and be flown at an altitude such that, in the event of power loss, the pilot is able to make a safe landing on a landing site.		❑ ok ❑ not ok

3.4 Setup of Normal Procedures

Operating procedures shall be defined and established specifying the equipment to be carried, including its operating limitations and appropriate entries in the MEL have to be considered. Normal procedures shall also cover the flight planning requirements and the monitoring and incident reporting requirements.

Note: Normal procedures should point out the fact that for every route to be flown a specific risk assessment should be produced which must meet an acceptable level of safety with the necessary mitigating measures before operation commences.

3.5 Setup of Contingency and Non-Normal Procedures

The operator shall develop or adopt the manufacturer's emergency and non-normal procedures, which support the handling of the aircraft during an emergency and a subsequent forced landing with no engine power available. Procedures during non-normal or emergency situations should be in line with human performance limitations. The operator has to consider the following conditions when defining non-normal procedures:

- limited time availability
- reduced aircraft instrumentation (flying on battery power)
- reduced internal lights at night
- automatic flight capabilities on battery power
- availability of charts and readability of the latter in reduced light
- programming the navigation equipment on emergency battery power
- reduced situational awareness on remaining instrumentation

3.6 The Safety Risk Assessment for a Specific Route

a) Introduction

The risk assessment methodology should aim at estimating for a specific route the likelihood of having fatalities due to emergency landing caused by engine failure. Based on the outcome of this risk assessment, the operator may be granted an extension of the duration of the risk period beyond the maximum allowed duration if no landing site is available within gliding range. The Authority will evaluate and may approve operations. This approval must be obtained prior to planning cumulative risk periods beyond 15 minutes from take-off to landing.

b) Safety Targets

The overall concept of SET-IMC operations is based on an engine reliability rate for all causes of 10 per million flight hours, which permits in compliance with SET-IMC requirements an overall fatal accident rate for all causes of 4 per million flight hours. Based on accident databases, it is considered that the engine failure event does not contribute more than 33% to the overall fatal accident rate. Therefore, the purpose of the risk assessment is to ensure that the probability of a fatal accident for a specific flight following engine failure remains below the **target fatal accident rate** of $1.\mathbf{3} \times 10^{-6}$ (flight hours).

c) Methodology

The methodology aims at estimating the likelihood of failing to achieve a safe forced landing in case of engine failure. A safe forced landing is defined as a landing on an area for which it is reasonably expected that no serious injury or fatalities will occur due to the landing even though the aeroplane may suffer extensive damage.

This methodology consists of creating a risk profile for a specific route, including departure, en-route and arrival airfields and runways, by splitting the proposed flight into appropriate segments (based on the flight phase or the landing sites selected), and by estimating the risk for each segment should the engine fail in one of these segments. This risk profile is considered to be an estimation of the probability of an unsuccessful forced landing if the engine fails during one of the identified segments. When assessing the risk for each segment, the height of the aeroplane at which the engine failure occurs, the position relative to the departure or destination airfield or to an emergency landing site en-route, and the likely ambient conditions (ceiling, visibility, wind and light) should be taken into account, as well as the standard procedures of the operator (e.g. U-turn procedures after take-off,use of synthetic vision, descent path angle for standard descent from cruising altitude, etc.). The duration of each segment determines the exposure time to the estimated risk. The risk is estimated based on the calculation below:

$$Segment\ risk\ factor = \frac{\text{segment exposure time [sec]}}{3600 \text{ X } probability\ of\ unsuccessful\ forced\ landing\ in\ this\ segment \text{ X assumed engine failure rate per flight hour (FH)}}$$

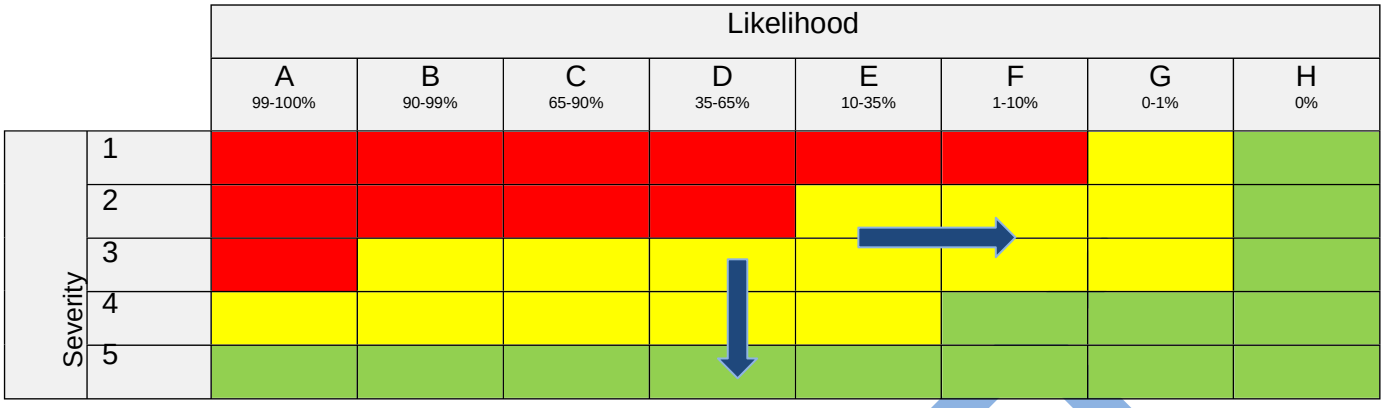
By summing up the risks for all individual segments, the cumulative risk for the flight due to engine failure is calculated and converted to risk on a 'per flight hour' basis.

Note: The total risk must remain below the **target fatal accident rate of** 1.3×10^{-6} as under (b)above

Risk tolerability and mitigating measures

The operator shall evaluate all risks associated with any specified route used for CAT SET operations in IMC or at night. When analysing the associated risks along the planned route, the operator has to take into consideration expected weather including cloud ceiling, ground visibility, precipitation, icing, wind, thunderstorms, sandstorms, volcanic ash, ATC radar coverage, RVSM, PBN and RAIM, daylight, expected traffic volume and determine that an acceptable level of safety can be maintained, even in case of an engine failure, otherwise the operator has to mitigate the risk by variable measures such as:

- Re-route the flight via an area with more landing sites available
- Re-route the flight via an area where weather, en-route and landing sites are acceptable
- Filing the flight at a higher cruising altitude to cater for longer distance glide range
- Delay the flight to avoid conflict with active weather along the planned route.



Likelihood	
A	Certain
B	Almost certain
C	Likely
D	Possible
E	Moderate likely
F	Possible but not likely
G	Remote possible
H	Impossible

Severity	
5	No consequences (no costs)
4	Minor consequences (minor costs)
3	Limited impact on systems, no injury, moderate costs
2	Significant degradation of systems, critical, injury
1	Severe damage to systems, injury or fatality, full loss

not tolerable	should be mitigated	tolerable

3.7 Landing Site Assessment Selection of emergency landing sites

Subject	Standard	Operator documentation/evidence	GCAA
Requirements for the suitability of a landing site	A landing site is an aerodrome or an area where a safe forced landing can be performed by day or by night, taking into account the expected weather conditions at the time of the foreseen landing. The landing site should allow the aeroplane to completely stop within the available area, taking into account the slope and the type of the surface. The slope of the landing site should be assessed by the operator in order to determine its acceptability and possible landing directions. Both ends of the landing area, or only the zone in front of the landing area for one- way landing areas, should be clear of any obstacle which may be a hazard during the landing phase.		❑ ok ❑ not ok

Considerations for determining an emergency landing site

When selecting landing sites along the route to be operated, it is recommended to prioritise the different types of landing sites as follows:

1. aerodromes with available runway lighting;
2. aerodromes without available runway lighting;
3. non-populated fields with short grass, vegetation or sandy areas.

When assessing the suitability of a landing site which is not an aerodrome, it is recommended to consider the following criteria:

- size,
- shape and type of surface of the emergency landing site
- obstacles on the approach to the landing site

A landing site should provide for high probability of survival and a low risk of injury during a forced landing even if the aircraft does not touch down on the centre line of the defined landing surface or when overrunning the defined landing strip or RWY. Ideally, multiple approach tracks for the landing site should be possible in case of misjudgment of the descent path. The landing site should have a width of at least 45 meters, unless the landing site is a runway of an aerodrome.

The operator shall provide data and instructions on the drift down procedures covering:

- Best glide speed vs aircraft weight and bank limitations
- Glide range at different altitudes (NM/1000ft) or height loss versus distance and wind
- Height loss for a 360° turn with engine failure
- Standard descent angle with high and low rate of descent
- Turn radius in NM with various IAS and altitudes
- Impact of wind component on glide range from different altitudes
- Let down procedure in VMC
- Impact of flaps and gear extension on drift down performance

3.8 Training Programme (Training and Checking)

To obtain a SET-IMC approval from the Authority, the operator shall provide evidence thatspecific training programme covering the listed elements are covered.

Use of simulator training device (FFS or FSTD)

Subject	Standard	Operator documentation/evidence	GCAA
Use of simulator	For **conversion training and checking**, where a suitable full flight simulator (FFS) or a suitable flight simulation training device (FSTD) is available, it should be used to carry out training on the items under (a) and checking of the items under (b) below for SET-IMC operations conversion training and checking.		❑ ok ❑ not ok
Use of simulator	Following conversion training and checking, the next **recurrent training session and the next OPCs** including SET-IMC operations items should be conducted in a suitable FFS or FSTD, where available.		❑ ok ❑ not ok

Conversion Training

Subject	Standard	Operator documentation/evidence	GCAA
Training programme	A training and checking programme covering SET IMC relevant items as listed below for the flight crew members involved must be implemented.		❑ ok ❑ not ok
Conversion training(1) **Normal procedures**	• anti-icing and de-icing systems operation; • navigation system procedures; • radar positioning and vectoring, when available; • use of radio altimeter; • use of fuel control, displays interpretation;		❑ ok ❑ not ok

Conversion training(2) **Non-normal procedures**	• pressurisation system failures; • electrical system failures; • engine-out descent in simulated IMC; • anti-icing and de-icing systems failures; • navigation system failures;		❑ ok ❑ not ok
Conversion training (3) **Emergency procedures**	• engine failure shortly after take-off; • fuel system failures (e.g. fuel starvation); • engine failure other than the listed above: recognition of failure, symptoms, type of failure, measures to be taken, and consequences; • depressurisation; • engine restart procedures • choice of an aerodrome or landing site; • use of an area navigation system; • air traffic controller (ATCO) communications; • use of radar positioning and vectoring (when available); • use of radio altimeter; • practice of the forced landing procedure until touchdown in simulated IMC, with zero thrust set, and operating with simulated emergency electrical power.		❑ ok ❑ not ok

Conversion checking

Subject	Standard	Operator documentation/evidence	GCAA
Conversion checking	The following items should be checked following completion of the SET-IMC operations conversion training as part of the operator's proficiency check (OPC): • conduct of the forced landing procedure until touchdown in simulated IMC, with zero thrust set, and operating with simulated emergency electrical power; • engine restart procedures; • depressurisation following engine failure; • engine-out descent in simulated IMC.		❑ ok ❑ not ok

Recurrent training

Subject	Standard	Operator documentation/evidence	GCAA
Recurrent training	Recurrent training for SET-IMC operations should be included in the recurrent training requirement for pilots carrying out SET-IMC operations. This training should include all items under conversion training above.		❑ ok ❑ not ok

Recurrent checking

Subject	Standard	Operator documentation/evidence	GCAA
Recurrent checking	The following items should be included into the list of required items to be checked following completion of SET-IMC operations recurrent training as part of the OPC: • conduct of the forced landing procedure until touchdown in simulated IMC, with zero thrust set, and operating with simulated emergency electrical power; • engine restart procedures; • depressurisation following engine failure; • emergency descent in simulated IMC.		❑ ok ❑ not ok

3.9 Crew Composition

Crew composition

Subject	Standard	Operator documentation/evidence	GCAA
SET-IMC operations approval	Unless the pilot-in-command has a minimum experience of **100 flight hours** under instrument flight rules (IFR) with the relevant type or class of aeroplane including line flying under supervision (LIFUS), the **minimum crew should be composed of two pilots**. (Refer to GCADs 8.4 and 8.7.2.3(G)) A lesser number of flight hours under IFR on the relevant type or class of aeroplane may be acceptable to the Authority when the flightcrew member has significant previous IFR experience.		❑ ok ❑ not ok

3.10 Implementation of SET-IMC into the Operators OM System

In addition to items which are applicable to every CAT operator, the CAT SET-IMC operators shall implement SET-IMC specific items into the OM system.

Operators documentation for CAT SET-IMC operations

Subject	Standard	Operator documentation/evidence	GCAA
SET-IMC operations approval OPS Manual Part A	**Operations manual A** For commercial air transport operations with single- engined turbine aeroplanes in instrument meteorological conditions or at night (CAT SET IMC) approved in accordance with GCAD Part 8.7.2.3 • (a) the procedure for route selection with respect to the availability of surfaces, which permits a safe forced landing; • (b) the instructions for the assessment of landing sites (elevation, landing direction, and obstacles in the area); and • (c) the instructions for the assessment of the weather conditions at those landing sites.		❑ ok ❑ not ok
Operations Manual Part B (OMB)	**Operations manual B** • Limitations associated to operations • Normal and non-normal or emergency procedures for single engine operations in IMC or at night including instructions in case of an engine failure in flight to proceed to an emergency landing site		❑
MEL	**MEL** • In addition to the normal requirements applicable to CAT operators, the MEL shall consider the requirements as outlined in chapter 2.1 of this AC. All equipment as listed in 2.1 shall be operative before take off.		❑

OPS Manual Part C	**Operations manual Part C** • Information related to landing sites available for operations approved in accordance with chapter 2.7 of this AC and GCAD Part 14, including: • (a) a description of the landing site (position, surface, slope, elevation, etc.); • (b) the preferred landing direction; and • (c) obstacles in the area.		❑
OPS Manual Part D (OMD)	**Operations manual Part D** • Specific elements as described in chapter 2.8 of this AC have to be implemented into the OMD.		❑

3.11 Minimum Equipment List

The operator shall develop a Minimum Equipment List (MEL) based on the Master Minimum Equipment List (MMEL) and the appropriate operational suitability data (OSD).

The MEL shall be submitted to the Authority for approval together with the application package for obtaining a formal approval for CAT SET-IMC operations.

Subject	Standard	Operator documentation/evidence	GCAA
Eligibility	• the operator has submitted a MEL which is based on the MMEL and OSD data for formal approval.		❑ ok ❑ not ok

SECTION 4 CAT SET-IMC Certification Process

Upon receiving an application for the issue of a specific approval or changes thereof, the Authority will assess the application in accordance with the relevant requirements of the GCADs and conduct, an appropriate inspection of the SET-IMC operations if required.

4.1 Evaluation of Application

As part of the certification procedures for the approval of commercial air transport with single engine turbine aeroplanes at night or in instrument meteorological conditions (SET-IMC), the Authority shall verify compliance with the applicable requirements of the GCADs.

The following elements will be checked by the Authority:

Subject	Standard	Operator documentation/evidence	GCAA
Eligibility	• the aeroplane shall be eligible for SET-IMC operations. • the maintenance and operational procedures are adequate; • a training programme for the flight crew involved in these operations has been established; and • the operator has adequately assessed the risks of the intended operations		❑ ok ❑ not ok

In particular, the Authority shall assess the operator's safety performance, experience and flight crew training, as reflected in the data provided by the operator with its application, to ensure that the intended safety level is achieved.

With regards to the operator's specific SET-IMC flight crew training, the Authority shall ensure that it complies with the applicable requirements of the GCADs, and that it is appropriate to the operations envisaged.

Further, the Authority shall assess the operator's ability to achieve and maintain an acceptable level of power plant reliability by reviewing its engine-trend-monitoring programme and propulsion reliability programme, which are to be established in accordance with GCADs Part 8.

Note: The Authority may impose temporary restrictions to the operations (e.g. limitation to specific routes) until the operator is able to demonstrate that it is capable of operating safely in compliance with all the applicable requirements.

The following elements will be specified by the Authority within the approval:

Subject	Standard	Operator documentation/evidence	GCAA
Eligibility	When issuing the approval, the Authority will specify following elements: • the particular engine-airframe combination; • the identification by registration of the individual aeroplanes designated for single-engined turbine aeroplane operations at night and/or in IMC; and • the authorised areas and/or routes of operation		❑ ok ❑ not ok

4.2 Evaluation of the Operational Capability – Demonstration Flight

The Authority shall ensure that demonstration flights are conducted for observation where the operator has to demonstrate meeting the applicable requirements listed herein with the planned aeroplane before any CAT SET-IMC approval is granted. The demonstration will cover flight planning and any preflight procedures, as well as a demonstration of the following simulated emergency procedures in simulated IMC/night:

The following elements shall be evaluated by the Authority during a demonstration flight:

Subject/Directive	Standard	Operator documentation/evidence	GCADs
Demonstration Flight	• the total failure of the propulsion system; and • total loss of normally generated electrical power. In order to mitigate the risks associated with the conduct of such emergency procedures, the following should be ensured • in case the intended operation is for single pilot (non -passenger), then the crew should be composed of the commander using view-limiting devices for the purpose of simulating IMC/night and a second rated pilot whose responsibility is to help maintain visual separation from other aircraft, clouds, and terrain • the flight should be conducted in visual meteorological conditions (VMC) by day, and additional, more restrictive weather minima may be established for the demonstration of the procedures involving higher risks; and • touch drills should be used when simulating a total failure of the propulsion system.		❑ ok ❑ not ok

SECTION 5 CAT SET-IMC in Daily Operations

5.1 Annual Reports to the Authority

The Authority shall track reliability of CAT SET-IMC operators.

Subject	Standard	Operator documentation/evidence	GCAA
Annual report	After obtaining the initial approval, the operator should implement a process to ensure making available to the Authority on a bi-annual basis a report related to its SET-IMC operations containing at least the following information: • the number of flights operated;the number of hours flown; • a review of the engine-trend-monitoring programme; • a review of the propulsion reliability programme, • The number of occurences related to CAT SET-IMC		❑ ok ❑ not ok

BI-ANNUAL REPORT to the AUTHORITY

After obtaining the initial approval, the operator should make available to the Authority on a bi-annual basis a report related to its SET-IMC operations containing at least the following information:

a) the number of flights operated;

b) the number of hours flown; and

c) any relevant data such as number of occurrences which may indicate the achieved safety level including a bi-annual review of the engine-trend-monitoring and the propulsion reliability programme.

End of Advisory Circular

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