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Federal Office of Civil Aviation FOCA
Safety Division - Flight Operations

FOCA GM/INFO

Guidance Material / Information

Commercial Air Transport with Single Engine Turbine Aeroplane in IMC or at Night

SPA.SET-IMC

Scope	Guide to obtain SPA for CAT SET Ops in IMC or at Night
Applies to	AOC-Holders, ATOs, CAMOs
Valid from	07 January 2021
Purpose	Guidance / Information

Process No	57-02
Business object	033.1-00001/00046/00004
Prepared by	T. Gass, SBFF
Released by	SB policy meet / 07 November 2017
Distribution	Internal / External

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Log of Revision (LoR)

Date	Issue	Revision	Highlight of Revision
01.12.2017	1	0	First Issue
21.06.2018	1	1	Ch. 2.10, 3.1, 3.2 spelling errors
07.01.2021	1	2	Ch 2.6, c) EASA link updated, note to FOCA excel file deleted

List of Effective Chapters

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List of Abbreviations

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The following abbreviations are within this GM/INFO:

Abbreviation	Definition	Abbreviation	Definition
GM/INFO	Guidance Material / Information	EEC	European Economic Community
ACM	Accountable Manager	EFB	Electronic Flight Bag
ADMIN	Administration	EFIS	Electronic Flight Instrument System
AFM	Aircraft Flight Manual	EHS	Enhanced Surveillance
AltMOC	Alternative Means of Compliance	ELS	Elementary Surveillance
AMC	Acceptable Means of Compliance	ELT	Emergency Locator Transmitter
ANS	Air Navigation Services	ENR	Enroute
ANSP	Air Navigation Service Provider	EROPS	Extended Range Operation
AoA	Angle of Attack	EU	European Union
AOC	Air Operator Certificate	EVS	Enhanced Vision System
Art.	Article	EXIS	Exit Identifier Marking System
ATC	Air Traffic Control	FAK	First Aid Kit
ATM	Air Traffic Management	FC	Flight Crew
ATO	Approved Training Organisation	FCOM	Flight Crew Operation Manual
ATSP	Air Traffic Service Provider	FH	Flight Hours
CAM	Continuing Airworthiness Manager	FLTA	Forward Looking Terrain Avoidance
CAME	Continuing Airworthiness Management Exposition	FOCA	Federal Office of Civil Aviation
CAMO	Certified Aircraft Maintenance Organisation	FSTD	Flight Simulator Training Device
CAT	Commercial Air Transport	GEN	General
Ch.	Chapter	GM	Guidance Material
CMM	Compliance Monitoring Manager	GNSS	Global Navigation Sensor System
CoA	Certificate of Airworthiness	GPS	Global Positioning System
CS	Certification Specification	HEMS	Helicopter Emergency Medical Service
CVR	Cockpit Voice Recorder	HF	High Frequency
DEF	Definition	HHO	Helicopter Hoist Operations
IDE	Instrument Data and Equipment	HoA	Highlights of latest Amendment
DOC	Document	ICAO	International Civil Aviation Organisation
EASA	European Aviation Safety Agency	IFBB	Inflight Blind Broadcast
EC	European Commission	IIDS	Inflight Ice Detection System
EDP	Electronic Data Processing	ILS	Instrument Landing System

Abbreviation	Definition
IMC	Instrument Meteorological Conditions
INS	Inertial Reference System
IRU	Inertial Reference Unit
ISS	Issue
JAA	Joint Aviation Authorities
LED	Light Emitting Diode
LoC	List of Effective Chapters
LoP	List of Effective Pages
LoR	Log of Revision
LRCS	Long Range Communication System
LRNS	Long Range Navigation System
LVO	Low Visibility Operation
MCTOM	Maximum Certified Takeoff Mass
MEL	Minimum Equipment List
MLR	Manuals, Logs and Records
MLS	Microwave Landing System
MMEL	Master Minimum Equipment List
MNPS	Minimum Navigation Performance Specification
MOE	Maintenance Organisation Exposition
MOP	Method of Procedure
MOPSC	Maximum Operational Passenger Seating Configuration
MPC	Maximum Passenger Capacity
MPZC	Maximum Passenger Zone Capacity
MRO	Maintenance/Repair and Overhaul
NCC	Non Commercial Complex
No	Number
NOTAM	Notice to Airman
NP	Nominated Person
NPFO	Nominated Person Flight Operations
NPGO	Nominated Person Ground Operations
NVIS	Night Vision Imaging System
OAT	Outside Air Temperature
OM	Operations Manual
OM A	Operations Manual Part A, General / Basic
OM B	Operations Manual Part B, Aircraft Operating Matters
OM C	Operations Manual Part C, Route, Role, Area and Aerodrome, Operating Site Instructions and Information
ORO	Organisation Requirements for Air Operations
OSD	Operational Suitability Data
PA	Public Adress
Para.	Paragraph
PBE	Protective Breathing Equipment
PBN	Performance Based Navigation
PED	Portable Electronic Device
PRA	Proposed Revision / Amendment Form
QAR	Quick Access Recorder
RA	Radar Altimeter
RA	Resolution Advisory
RB	Reference Box
Ref.	Reference
REV	Revision
SET	Single Engine Turbine operations

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0 Introduction

Ch. 0 ISS 1 / REV 0 / 01.12.2017

FOCA provided Guidance Material / Information (GM/INFO) is intended to assist the organisation/ operator in administrative matters and will facilitate liaising with the Federal Office of Civil Aviation (FOCA). It is to be considered a tool to ease processes of obtaining required approvals and authorisations issued by the Federal Office of Civil Aviation (FOCA). Using the GM/INFO will be conducive to establishing compliance with EU requirements and will lead through the respective certification or variation process.

0.1 Legal References

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This GM/INFO is based on the legal references listed below, each in the amended edition:

Commision Regulation (EU) No 216/2008: *Common rules in the field of civil aviation and establishing a European Aviation Safety Agency*

Commision Regulation (EU) No 965/2012:

- Annex I: DEF
- Annex II: Part-ARO
- Annex III: Part-ORO
- Annex IV: Part-CAT
- Annex V: Part-SPA

0.2 Purpose of this GM/INFO

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The purpose of this certification leaflet is to provide:

- an overview over the general requirements to obtaining the specific approval SET-IMC in commercial air transport with single engine turbine aeroplane operations;
- guidance on how related information may be implemented into the organisation management system;
- guidance on how certain requirements may be achieved;

a certification tool for the competent authority to conduct an evaluation on the implementation of Part-ORO and Part SPA.SET-IMC relevant legal requirements.

0.3 Scope

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This document addresses the requiremenents for the specific approval SPA.SET- IMC in commercial air transport and does not address how to go through 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 SPA.SET-IMC in commercial air transport.

Note: 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 competent authority (FOCA). The Approval must be documented in the EASA Form 139.

It is assumed that a passenger who purchases a commercial flight ticket for a flight with a single engine tubine 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 FOCA that operations with a single engine aeroplane does not bear a higher total risk than defined by EASA and explained in this document.

0.4 Terms and Conditions

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When used throughout the GM/INFO the following terms shall have the meaning as defined below:

Term	Meaning	Reference
shall, must, will	These terms express an obligation, a positive command.	EC English Style Guide: Ch. 7.19
may	This term expresses a positive permission.	EC English Style Guide: Ch. 7.21
shall not, will not	These terms express an obligation, a negative command.	EC English Style Guide: Ch. 7.20
may not, must not	These terms express a prohibition.	EC English Style Guide: Ch. 7.20
need not	This term expresses a negative permission.	EC English Style Guide: Ch. 7.22
should	This term expresses an obligation when an acceptable means of compliance should be applied .	EASA Acceptable Means of Compliance publications FOCA policies and requirements
could	This term expresses a possibility.	http://oxforddictionaries.com/definition/english/could
ideally	This term expresses a best possible means of compliance and/or best experienced industry practice.	FOCA recommendation

Note: To highlight information or an editorial note a specific note box is used.

- The use of the male gender should be understood to include male and female persons.

1 Initial Steps when Considering Certification for CAT SET in IMC or at Night

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

Before submitting any documents to the FOCA for evaluation, the operator should assess whether he will be able to meet the published requirements. Following items should be considered to ensure suitability for CAT SET-IMC operations:

☐ *An Air Operator Certificate (AOC) with required management structure must be in place or the organisation is fulfilling the provisions for an AOC when applying for the latter in Switzerland. FOCA has published extensive guidance and certification leaflets supporting the certification of an AOC;*

☐ *The single engine turbine reliability data by the «world's fleet» for the particular airframe-engine combination data should be available from the type certificate holder or supplementary type certificate holder and shall be submitted to the FOCA with the application. The data has to indicate sufficient reliability;*

☐ *The engine and airframe combination is integrated into a specific engine trend monitoring system;*

☐ *The on-board equipment as listed in chapter 1.1 is installed and operative;*

☐ *Pilots fulfil the license requirements for SET-IMC*

1.1 Equipment Requirement Aeroplanes Used for CAT SET in IMC or at Night Operations

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

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
Electrical generating System SPA.SET-IMC.110 (a)	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 SPA.SET-IMC.110 (b)	two attitude indicators, powered from independent sources		❑ ok ❑ not ok
Safety belts SPA.SET-IMC.110 (c)	for passenger operations, a shoulder harness or a safety belt with a diagonal shoulder strap for each passenger seat		❑ ok ❑ not ok
Weather radar SPA.SET-IMC.110 (d)	airborne weather-detecting equipment		❑ ok ❑ not ok
Oxygen SPA.SET-IMC.110 (e)	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 SPA.SET-IMC.110 (f)	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 SPA.SET-IMC.110 (g)	a radio altimeter		❑ ok ❑ not ok
Landing lights SPA.SET-IMC.110 (h)	a landing light, capable of illuminating the touchdown point on the power-off glide path from 200 ft. away		❑ ok ❑ not ok
Emergency electrical supply SPA.SET-IMC.110 (i)	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;		❑ ok ❑ not ok

	• 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;		
Ignition system SPA.SET-IMC.110 (j)	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 SPA.SET-IMC.110 (k)	a means of continuously monitoring the power train lubrication system to detect the presence of debris associated with the imminent failure of a drivetrain component, including a flight crew compartment caution indication;		❑ ok ❑ not ok
Emergency engine power control SPA.SET-IMC.110 (l)	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

Details on equipment requirements according to applicable AMCs

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.

Airborne weather equipment

The airborne weather-detecting equipment should be an airborne weather radar, as defined in the applicable Certification Specification — European Technical Standard Order (CS-ETSO) issued by the Agency, or equivalent.

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.

Acceptable standards for the area navigation system are ETSO-145/146c, ETSO-C129a, ETSO-C196a or ETSO-C115 issued by the Agency, or equivalent.

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/malfunction of the fuel control unit should enable the fuel flow modulation.

1.2 Required Turbine Engine Reliability for CAT SET in IMC or at Night

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Before submitting any documents to the FOCA 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 by the competent authority, the operator should obtain the power plant reliability data from the type certificate (TC) holder and/or supplemental type certificate (STC) holder which should provide evidence that all the following conditions have been complied with:

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
Turbine reliability SPA.SET-IMC.105 (a)	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 SPA.SET-IMC.105 (a)	• The **in-service experience with the intended engine-airframe combination should be at least** **100 000** h, demonstrating the required level of reliability. If this experience has not been accumulated, then, based on analysis or test, in-service experience with a similar or related type of airframe and turbine engine might be considered by the TC/STC holder to develop an equivalent safety argument in order to demonstrate that the reliability criteria are achievable.		❑ ok ❑ not ok

2 Setup of the Main Components for CAT SET in IMC or at Night

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2.1 Maintenance Instructions and Procedures including Monitoring

Ch. 2.1 ISS 1 / REV 0 / 01.12.2017

Maintenance programme

The following maintenance aspects should be addressed by the operator:

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
Maintenance programme SPA.SET-IMC.105 (b)(a)	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 in accordance with Annex I to Regulation (EU) No 1321/2014 (Part-M), 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.

2.2 Reliability Programme

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Propulsion and associated systems reliability programme

The operator should address the following maintenance aspects:

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
Maintenance programme SPA.SET-IMC.105 (b)(b)	• 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		❑ ok ❑ not ok

	from the operator's total fleet should be acceptable. For engines, the programme should incorporate reporting procedures for all significant events.		
Maintenance programme SPA.SET-IMC.105 (b)(b)	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) holders, and the competent authority to help establish that the reliability level set out in AMC1 SPA.SET-IMC.105(a) is 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 holder and the competent authority. 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 to achieve a statistically meaningful average.

2.3 Flight Planning Requirements

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Risk Period general

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 FOCA and stated as such in the EASA form 139 under number 18. 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 general

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

- Long term flight preparation as 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, 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, 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 FOCA in accordance with Annex V (Part-SPA), Subpart L 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 %.

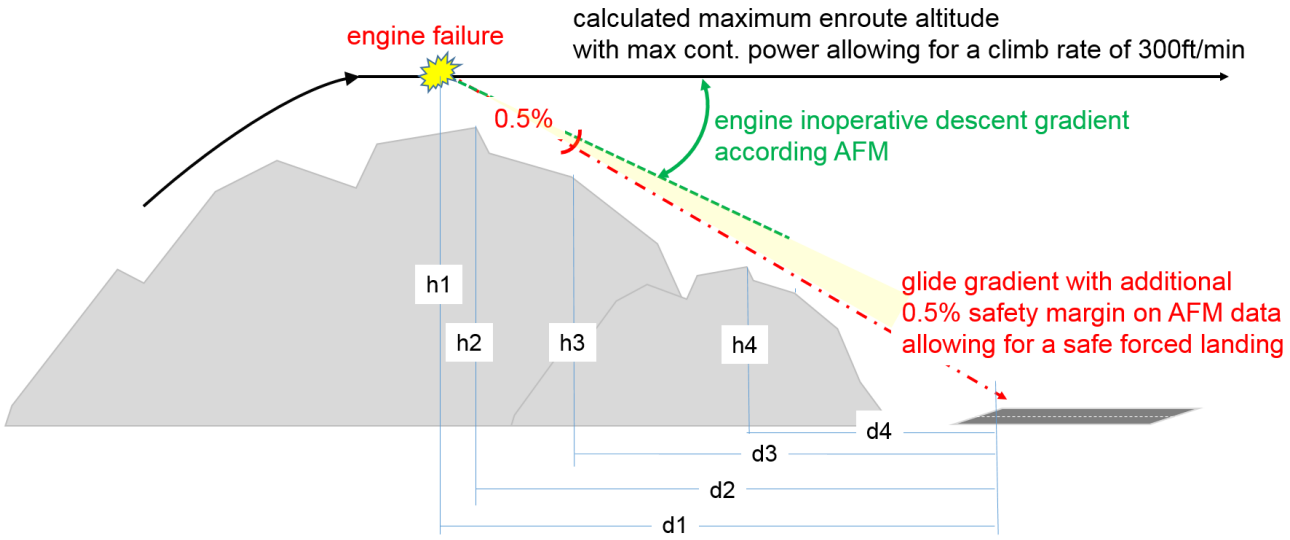

Figure 1

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/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105(d)(2) Flight Planning (a)(b)	• 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 per flight should not exceed 15 min** unless the operator has established, based on a		❑ ok ❑ not ok

	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 acc. GM2 SPA.SET-IMC.105(d)(2). • Any extension of the Risk Period beyond 15 min will have to be approved by FOCA and stated in the EASA Form 139		
AMC1 CAT.OP.MPA.110 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 Subpart L (SET-IMC) of Annex V (Part-SPA) to Regulation (EU) No 965/2012, the take-off minima specified by the operator should be expressed as RVR/CMV 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 centreline markings are available. At night at least runway edge lights and runway end lights or runway centreline 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/CMV 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.		❑ ok ❑ not ok

Glide Circles, Landing Sites and Risk Periods

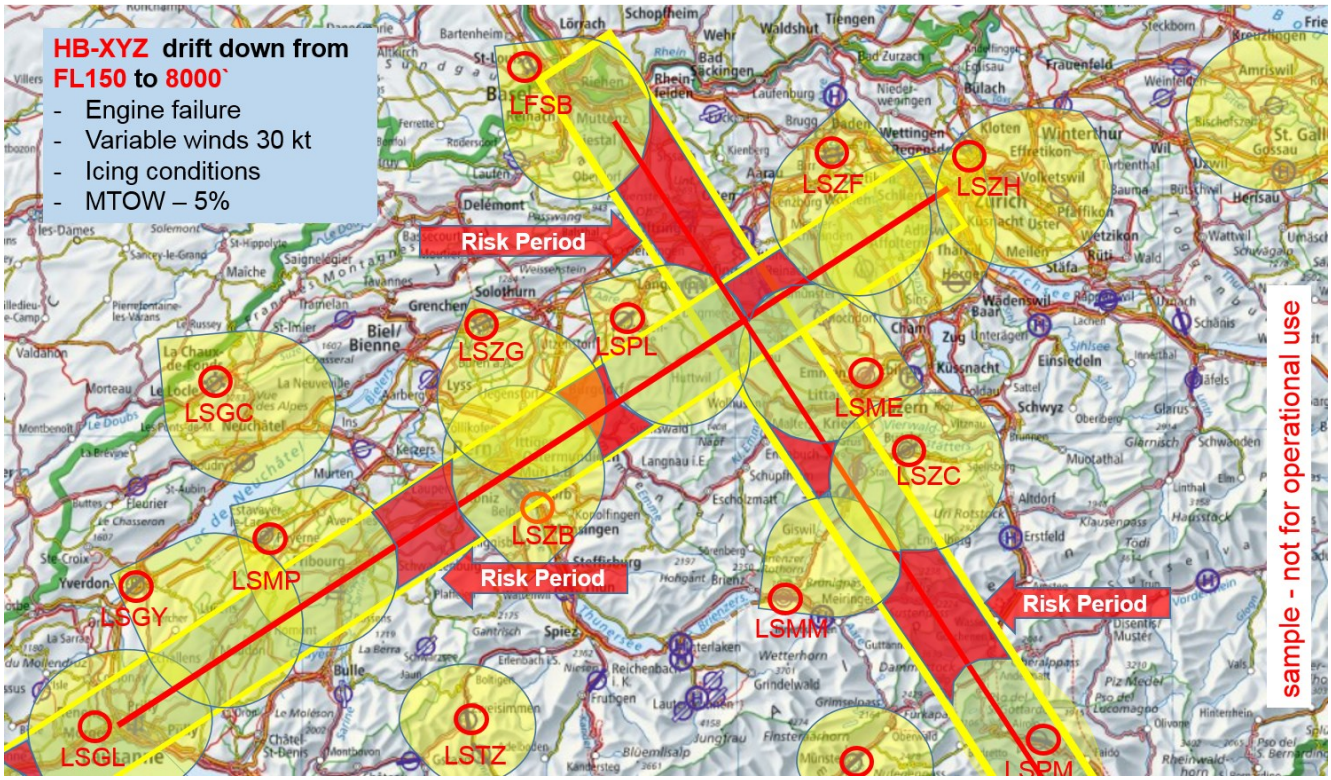

Figure 2: Sample of an en-route chart with associated glide circles plus landing sites and risk periods

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.

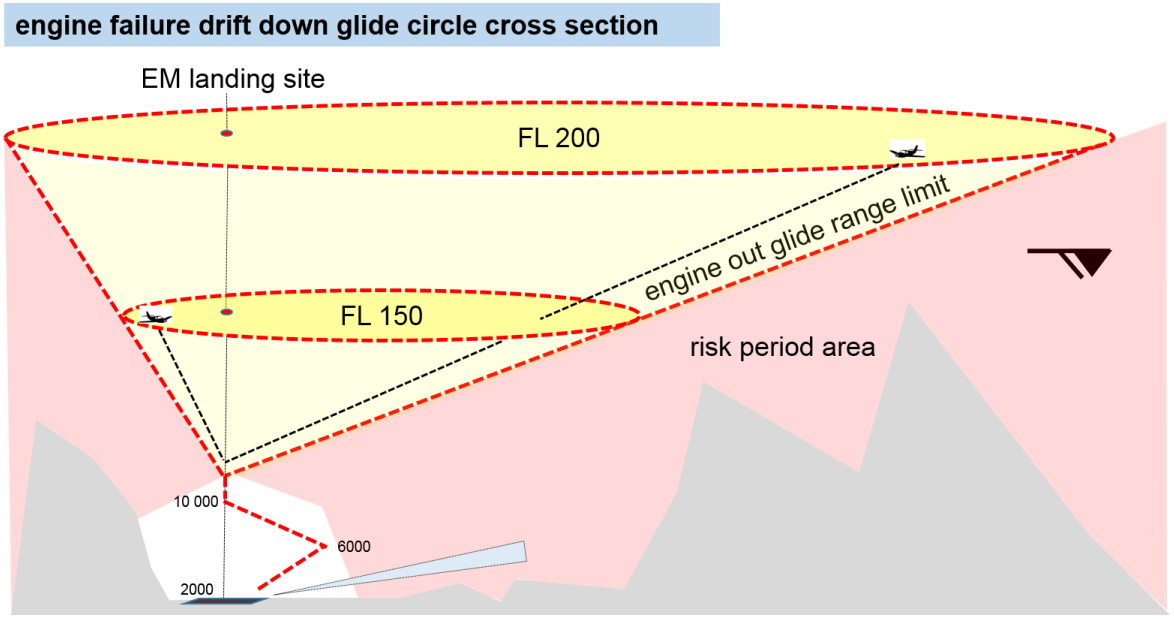

Figure 3: sample of an engine failure drift down calculation - cross section schema

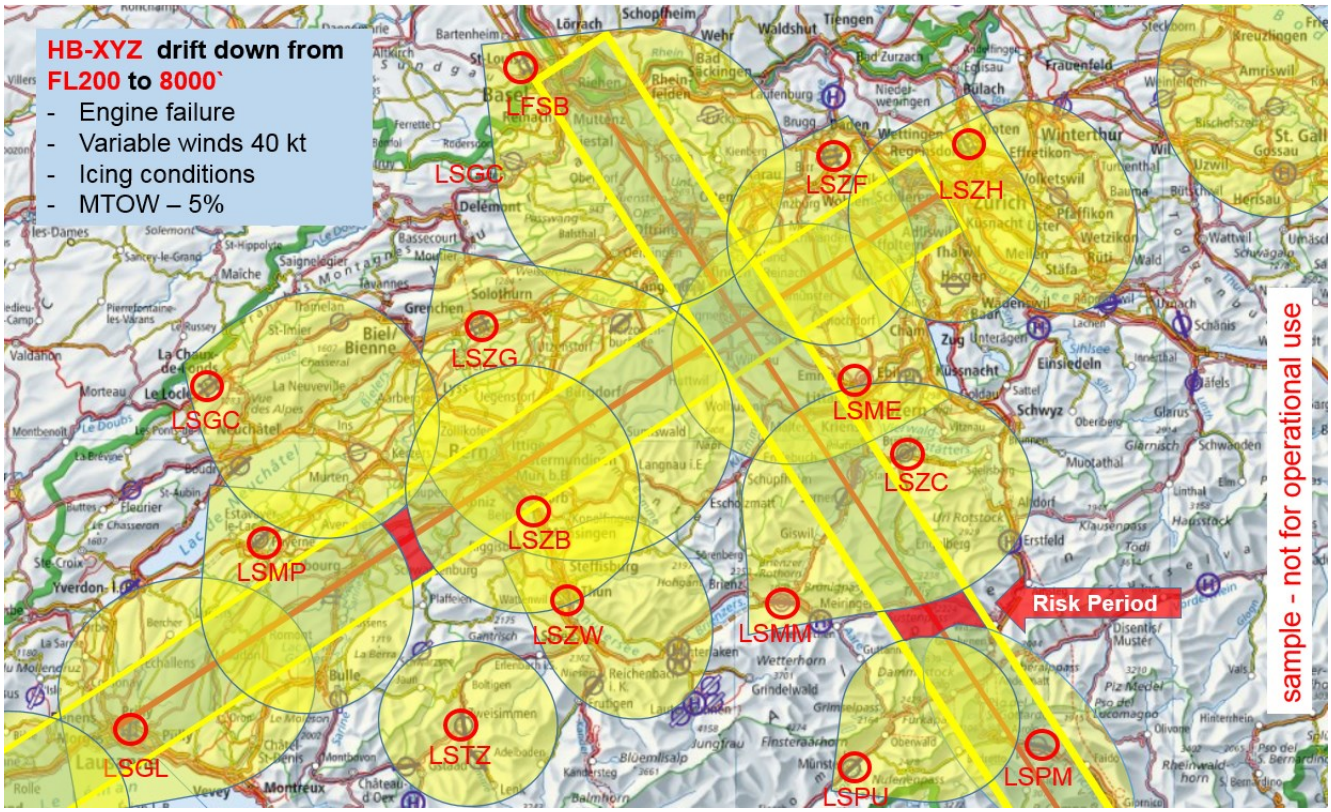

Figure 4: Sample of an en-route chart with associated glide circles plus landing sites and risk periods

Route assessment criteria for flight planning

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105(d)(2) 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);		❑ ok ❑ not ok

	- terminal area forecast (TAF)/meteorological aerodrome report (METAR) of the nearest aerodromes; • protection of the aeroplane occupants after landing in case of adverse weather.		
AMC1 SPA.SET-IMC.105(d)(2) Flight Planning (d)	• At the flight-planning phase, any selected landing site should have been assessed by the 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
AMC1 SPA.SET-IMC.105(d)(2) 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

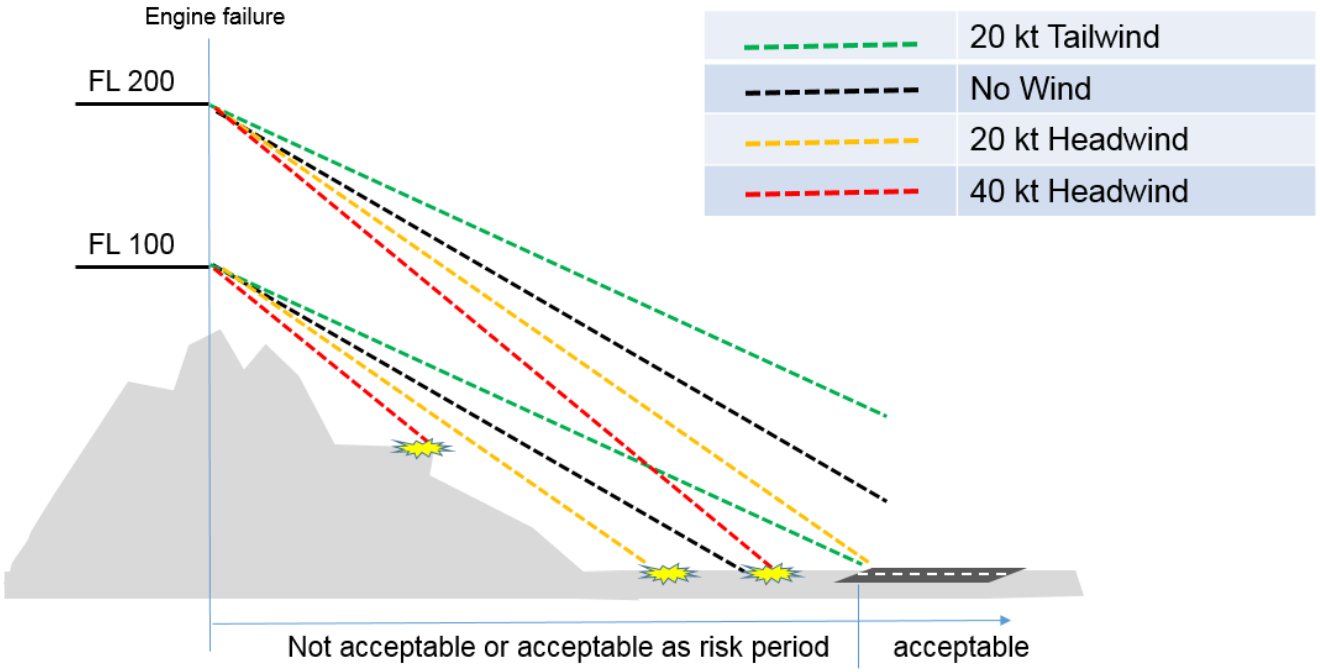

Figure 5: Sample diagram indicating the influence of wind on the descent path and glide range

Route selection

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC2 SPA.SET-IMC.105(d)(2) 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		❑ ok ❑ not ok

	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.		

2.4 Setup of Normal Procedures

Ch. 2.4 ISS 1 / REV 0 / 01.12.2017

Operating procedures have to 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 operations in accordance with Part-CAT may be commenced

2.5 Setup of Contingency and Non-Normal Procedures

Ch. 2.5 ISS 1 / REV 0 / 01.12.2017

The operator shall develop or take over from the manufacturer 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 following conditions when defining non-normal procedures:

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

2.6 The Safety Risk Assessment for a Specific Route

Ch. 2.6 ISS 1 / REV 2 / 07.01.2021

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 to extend the duration of the risk period beyond the maximum allowed duration if no landing site is available within gliding range. The FOCA will evaluate and have to approve operations before the pilot may plan cumulative risk periods beyond 15 minutes from take-off to landing.

b) The safety target

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 by 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 1.3×10^{-6}**.

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 being 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 airfield and runway, by splitting the proposed flight into appropriate segments (based on the flight phase or the landing site 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:

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

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

For sample calculations and decartelisation of individual risk elements consult GM2 SPA.SET-IMC.105(d)(2) SET-IMC operations approval guidance provided by EASA.

Find the document provided by EASA via this link: Air Ops Annex I to VIII.

Risk tolerability and mitigating measures

The operator shall evaluate all risks associated to 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, sand storms, 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 at landing sites is 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 routing

		Likelihood							
		A 99-100%	B 90-99%	C 65-90%	D 35-65%	E 10-35%	F 1-10%	G 0-1%	H 0%
Severity	1								
	2								
	3								
	4								
	5								

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

2.7 The Landing Site Assessment

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Details on the selection of an emergency landing sites

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC3 SPA.SET-IMC.105(d)(2) 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 a 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 landing site criteria:

- size,
- shape and type of surface of the emergency 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 centreline of the defined landing surface or when overrunning the defined landing stripe or RWY. Ideally, multiple approach tracks for the landing site should be possible in case of misjudgement 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.

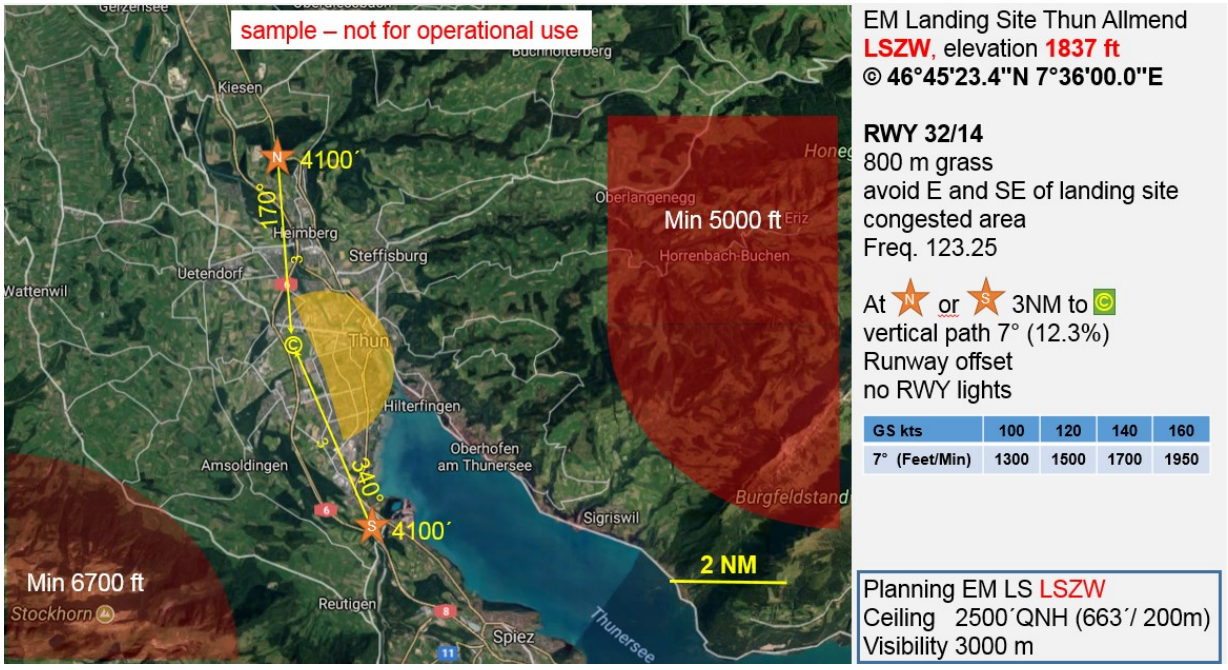


Figure 6: Sample of a landing site let down publication

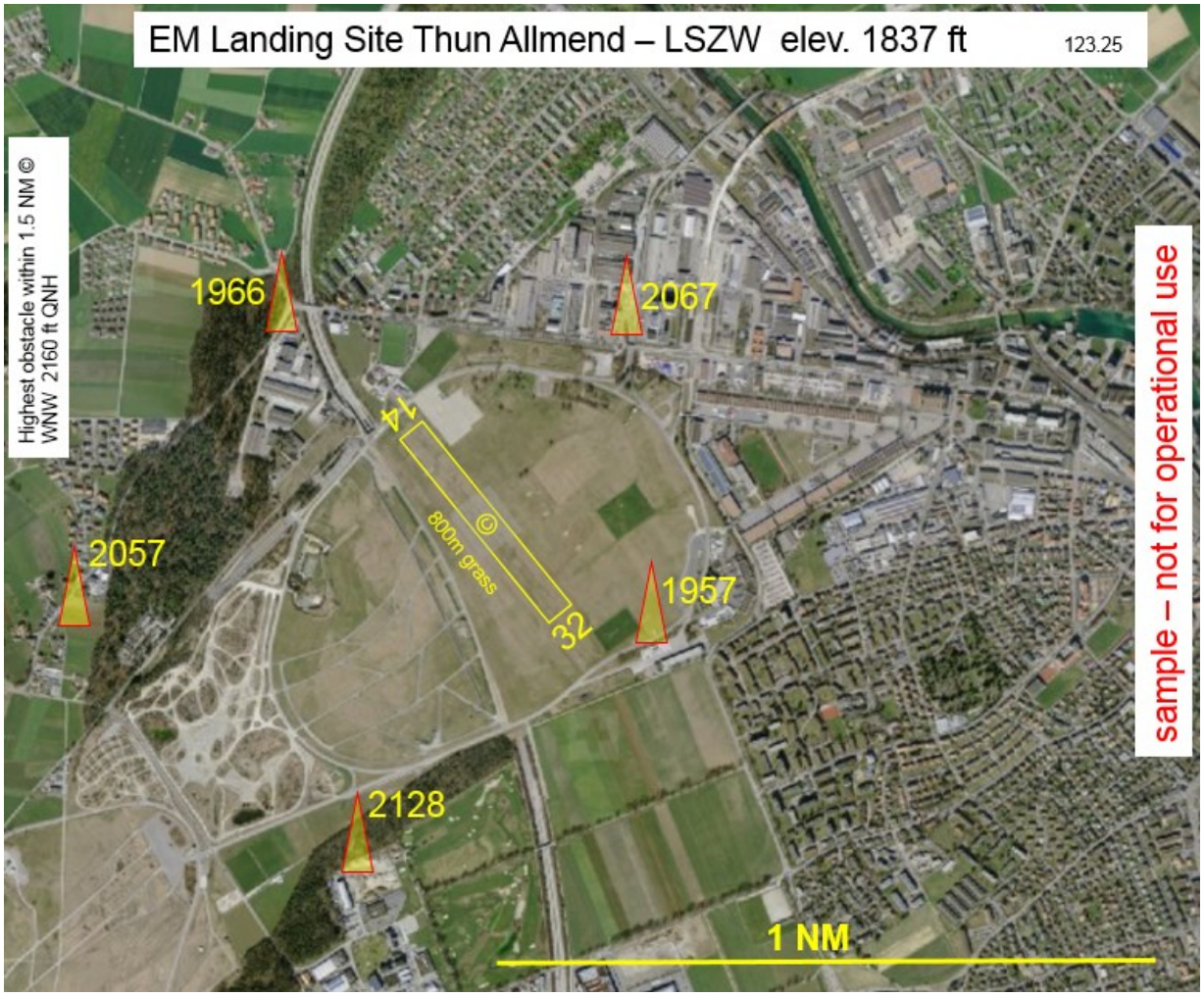


Figure 7: Sample of a landing site let down publication

Turnradius r in NM with constant bank angle 30° / zero wind				
	Altitude in feet			
IAS	20'000	15'000	10'000	5'000
80	0.11	0.09	0.08	0.07
100	0.17	0.14	0.12	0.10
120	0.24	0.21	0.17	0.15
140	0.32	0.28	0.24	0.20
160	0.42	0.37	0.31	0.26
180	0.54	0.46	0.39	0.33
200	0.66	0.57	0.49	0.41

sample – not for operational use

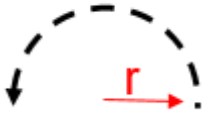
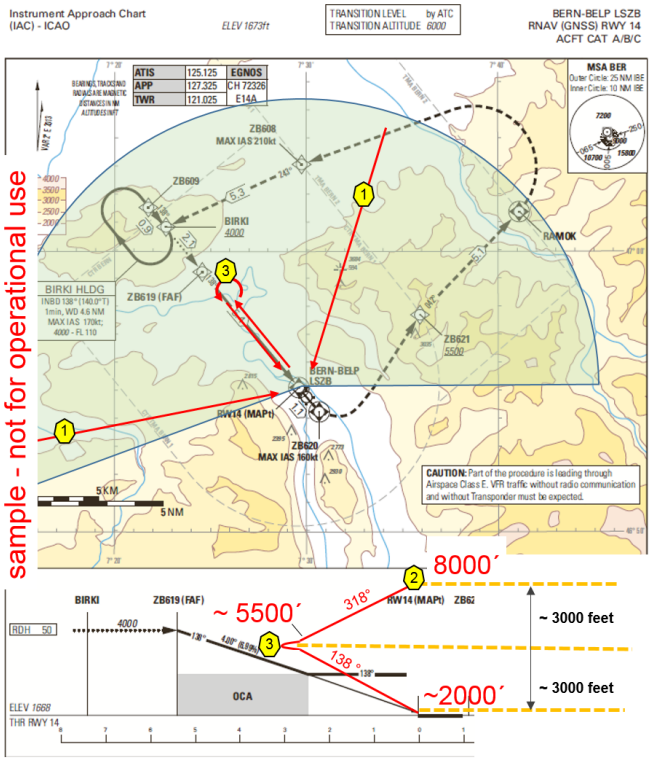


Figure 8: Sample of a publication of turn radius in NM vs. IAS and Altitude

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 hight 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/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



Sample SET-IMC let down with engine failure

1. Fly with best glide speed to overhead the RWY for line up

2. Determine target initial altitude you will reach overhead the RWY (e.g. 8000ft)

   Calculate altitude difference △ between target initial altitude and RWY elevation
   e.g. 8000´-2000´ = 6000 ft

   When reaching target initial altitude overhead the RWY, fly the outbound opposite to the IFR approach track until reaching 500`above ½ △ altitude using a 7° descent path, then start the turning maneouvre for inbound track

3. The turning maneouvre shall take place within a maximum lateral displacement of 0.6 NM to either side of the approach track. The use of the 80°/260° turn method will help achieving this goal.

Figure 9: Sample of an IMC let down procedure as overlay on an existing IFR approach

2.8 Training Programme (Training and Checking)

To obtain a SET-IMC approval by the competent authority, the operator shall provide evidence that a specific training programme covering the listed elements

Use of simulator training device (FFS or FSTD)

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105(c) (c)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
AMC1 SPA.SET-IMC.105(c) (f)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/Regulation	Standard	Operator documentation/evidence	FOCA
Training programme SPA.SET-IMC.105	A training/checking programme covering SET IMC relevant items as listed below for the flight crew members involved must be implemented.		❑ ok ❑ not ok
AMC1 SPA.SET-IMC.105(c) (a)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
AMC1 SPA.SET-IMC.105(c) (a)Conversion training(2) **Non-normal procedures**	• anti-icing and de-icing systems failures; • navigation system failures; • pressurisation system failures; • electrical system failures; • engine-out descent in simulated IMC;		❑ ok ❑ not ok
AMC1 SPA.SET-IMC.105(c) (a)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/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105(c) (b)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/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105(c) (d)Recurrent training	Recurrent training for SET-IMC operations should be included in the recurrent training required by Subpart FC (FLIGHT CREW) of Annex III (Part-ORO) to Regulation (EU) No 965/2012 for pilots carrying out SET-IMC operations. This training should include all items under conversion training (a) above.		❑ ok ❑ not ok

Recurrent checking

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105(c) (e)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

2.9 Crew Composition

Ch. 2.9 ISS 1 / REV 0 / 01.12.2017

Crew composition

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC2 SPA.SET-IMC.105(c) 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**. A lesser number of flight hours under IFR on the relevant type or class of aeroplane may be acceptable to the competent authority when the flight crew member has significant previous IFR experience.		❑ ok ❑ not ok

2.10 Implementation of SET-IMC into the Operators OM System

Ch. 2.10 ISS 1 / REV 1 / 21.06.2018

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 as proposed in AMC3 ORO.MLR.100.

Operators documentation for CAT SET-IMC operations

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC3 ORO.MLR.100 **OM A**	**Operations manual A 8.1.13** For commercial air transport operations with single-engined turbine aeroplanes in instrument meteorological conditions or at night (CAT SETIMC) approved in accordance with Subpart L (SET-IMC) of Annex V (Part-SPA) to Regulation (EU) No 965/2012: • (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
AMC3 ORO.MLR.100 **OM B**	**Operations manual B chapter 1, 2, 3** • 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		❑ ok ❑ not ok
AMC3 ORO.MLR.100 **MEL (OM-B chapter 9)**	**MEL Operations manual B chapter 9** • In addition to the normal requirements applicable to Part-CAT operators, the MEL shall consider the requirements as outlined in chapter 1.1 of this guide. All equipment as listed in 1.1 shall be operative before takeoff.		❑ ok ❑ not ok
AMC3 ORO.MLR.100 **OM C**	**Operations manual C** • (2) Information related to landing sites available for operations approved in accordance with Subpart L (SET-IMC) of Annex V (Part-SPA) to Regulation (EU) No 965/2012, including: • (a) a description of the landing site (position, surface, slope, elevation, etc.); • (b) the preferred landing direction; and • (c) obstacles in the area.		❑ ok ❑ not ok
AMC3 ORO.MLR.100 **OM D**	**Operations manual D** • Specific elements as described in chapter 2.8 of this guide have to be implemented into the OM D.		❑ ok ❑ not ok

2.11 Minimum Equipment List

Ch. 2.11 ISS 1 / REV 0 / 01.12.2017

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

The MEL is normally part of the OM B and shall be submittet to FOCA for approval together with the application package for obtaining a formal approval for CAT SET-IMC operations.

Subject/Regulation	Standard	Evidence	FOCA
AMC4 ARO.OPS.200 Eligibility	• the operator has submitted a MEL which is based on the MMEL and OSD data for formal approval.	FOCA	❑ ok ❑ not ok

3 CAT SET-IMC Certification Process

Ch. 3 ISS 1 / REV 0 / 01.12.2017

Upon receiving an application for the issue of a specific approval or changes thereof, FOCA will assess the application in accordance with the relevant requirements of Annex V (Part-SPA) and conduct, where relevant, an appropriate inspection of the SET-IMC operations.

3.1 Evaluation of Application

Ch. 3.1 ISS 1 / REV 1 / 21.06.2018

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), FOCA will verify compliance with the applicable requirements of Subpart L (SET-IMC) of Annex V (Part-SPA) to Regulation (EU) No 965/2012.

Following elements will be checked by FOCA in good detail:

Subject/Regulation	Standard	Evidence	FOCA
AMC4 ARO.OPS.200 Eligibility	• the aeroplane shall be eligible for SET-IMC ops. • 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	FOCA	❑ ok ❑ not ok

In particular, FOCA will 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 regard to the operator's specific SET-IMC flight crew training, FOCA will ensure that it complies with the applicable requirements of Subpart FC (FLIGHT CREW) of Annex III (Part-ORO) and Subpart L (SET-IMC) of Annex V (Part-SPA) to Regulation (EU) No 965/2012, and that it is appropriate to the operations envisaged.

Further FOCA will 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 Annex I (Part-M).

Note: FOCA may impose temporary restrictions to the operations (e.g. limitation to specific routes) until the operator is able to demonstrate that he is capable to operate safely in compliance with all the applicable requirements.

Following elements will be specified by FOCA within the issued formal approval:

Subject/Regulation	Standard	Evidence	FOCA
AMC4 ARO.OPS.200(c) Eligibility	When issuing the approval, the FOCA 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.	FOCA	❑ ok ❑ not ok

3.2 Evaluation of the Operational Capability – Validation Flight

Ch. 3.2 ISS 1 / REV 1 / 21.06.2018

FOCA will conduct a validation flight for observation where the operator has to demonstrate meeting the applicable requirements listed herin with the planned aeroplane before any CAT SET-IMC approval will be granted. The validation will cover flight planning and any preflight procedures, as well as a demonstration of the following simulated emergency procedures in simulated IMC/night:

Following elements will be evaluated by FOCA during a validation flight:

Subject/Regulation	Standard	Evidence	FOCA
AMC4 ARO.OPS.200(c) Flight validation	• 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 of planned single-pilot operations, 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.	FOCA	❑ ok ❑ not ok

4 CAT SET-IMC in Daily Operations

Ch. 4 ISS 1 / REV 0 / 01.12.2017

4.1 Annual Reports to the FOCA

Ch. 4.1 ISS 1 / REV 0 / 01.12.2017

The competent authorithy shall track reliability of CAT SET-IMC operators.

Subject/Regulation	Standard	Operator documentation/evidence	FOCA
AMC1 SPA.SET-IMC.105 Annual report	After obtaining the initial approval, the operator should implement a process to ensure making available to its competent authority on an 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

ANNUAL REPORT to the FOCA

After obtaining the initial approval, the operator should make available to the FOCA on an 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 occurences which may indicate the achieved safety level including an annual review of the engine-trend-monitoring and the propulsion reliability programme.