CAE Oxford Aviation Academy

OPERATIONAL PROCEDURES

ATPL GROUND TRAINING SERIES

This text book has been written and published as a reference work to assist students enrolled on an approved EASA Air Transport Pilot Licence (ATPL) course to prepare themselves for the EASA ATPL theoretical knowledge examinations. Nothing in the content of this book is to be interpreted as constituting instruction or advice relating to practical flying.

Whilst every effort has been made to ensure the accuracy of the information contained within this book, neither CAE Oxford Aviation Academy nor the distributor gives any warranty as to its accuracy or otherwise. Students preparing for the EASA ATPL (A) theoretical knowledge examinations should not regard this book as a substitute for the EASA ATPL (A) theoretical knowledge training syllabus published in the current edition of 'Part-FCL 1' (the Syllabus). The Syllabus constitutes the sole authoritative definition of the subject matter to be studied in an EASA ATPL (A) theoretical knowledge training programme. No student should prepare for, or is currently entitled to enter himself/herself for the EASA ATPL (A) theoretical knowledge examinations without first being enrolled in a training school which has been granted approval by an EASA authorised national aviation authority to deliver EASA ATPL (A) training.

CAE Oxford Aviation Academy excludes all liability for any loss or damage incurred or suffered as a result of any reliance on all or part of this book except for any liability for death or personal injury resulting from CAE Oxford Aviation Academy's negligence or any other liability which may not legally be excluded.

Printed in Singapore by KHL Printing Co. Pte Ltd

Textbook Series

Book	Title	Subject
1	010 Air Law	
2	020 Aircraft General Knowledge 1	Airframes & Systems
		Fuselage, Wings & Stabilising Surfaces
		Landing Gear
		Flight Controls
		Hydraulics
		Air Systems & Air Conditioning
		Anti-icing & De-icing
		Fuel Systems
		Emergency Equipment
3	020 Aircraft General Knowledge 2	Electrics – Electronics
		Direct Current
		Alternating Current
4	020 Aircraft General Knowledge 3	Powerplant
		Piston Engines
		Gas Turbines
5	020 Aircraft General Knowledge 4	Instrumentation
		Flight Instruments
		Warning & Recording
		Automatic Flight Control
		Power Plant & System Monitoring Instruments
6	030 Flight Performance & Planning 1	Mass & Balance
		Performance
7	030 Flight Performance & Planning 2	Flight Planning & Monitoring
8	040 Human Performance & Limitations	
9	050 Meteorology	
10	060 Navigation 1	General Navigation
11	060 Navigation 2	Radio Navigation
12	070 Operational Procedures	
13	080 Principles of Flight	
14	090 Communications	VFR Communications
		IFR Communications

Introduction

Contents

ATPL Book 12 Operational Procedures

Introduction

The subject 'Operational Procedures' is concerned with the operation of aircraft in the commercial air transport role by airlines (Operators) having their primary place of business in an EASA member state. The EASA document, which details the applicable procedures, is CS-OPS, which is based on the ICAO, published Annex 6 (Operation of Aircraft) to the Chicago Convention.

Operational Procedures covers part of the Air Law syllabus but in much greater depth and with specific reference to the JAA requirements whereas Air Law is primarily concerned with ICAO rules and regulations (Standards and Recommended Practices). The main references for Operational Procedures (Annex 6 and CS-OPS) are both documents which are amended at regular intervals and reflect modern technology and commercial practices in the aviation world. It is inevitable that any other document based on these references will not be able to be amended and therefore, these notes, which meet the requirements of the ATPL Theoretical Knowledge syllabus of the ATPL(A) must not be used for any regulatory purpose.

In compiling these notes, reference has been made to the following documents:

CS-OPS 1	
EASA CS 25	
ICAO Annex 2	Rules of the Air
ICAO Annex 6	Operation of Aircraft
ICAO Annex 8	Airworthiness of Aircraft
ICAO Annex 9	Facilitation
ICAO Annex 11	Air Traffic Services
ICAO Annex 14	Aerodromes
ICAO Annex 15	Aeronautical Information Services
ICAO Annex 17	Security
ICAO Annex 18	Transport of Dangerous Goods by Air
ICAO Doc 7030	Regional Supplementary Procedures
ICAO Doc 4444	PANS Air Traffic Management
ICAO NAT MNPS	Ops Manual

Supporting information for cross-reference and clarification has been taken from:

Aerad En Route Supplement
Aircrew Manual Boeing 747-400
CAP 168 - Licensing of Aerodromes
CAP 493 - Manual of Air Traffic Services
Pilot Notes and Checklists - PA28
UK AIP (including AICs)

Chapter

1

ICAO Annex 6

Introduction

The International Civil Aviation Organization (ICAO) publication Annex 6, titled Operation of Aircraft, contains the international Standards and Recommended Practices (SARPs) applicable to the issuing of an air operator's certificate (AOC) to conduct international commercial air transport. It has a JAA counterpart, EU-OPS, which is based on Annex 6. The ICAO document is published in three parts covering:

Part 1 Aeroplanes used in International Commercial Air Transport
Part 2 Aeroplanes used in General Aviation
Part 3 Helicopters used in International Commercial Air Transport

For this course, the syllabus references concern only Annex 6 Part 1. The SARPs relate to the responsibilities of the Operator; the responsibilities of the Commander (ICAO still uses the definition - Pilot in Command (PIC)); and the responsibilities of the Operations staff within a certified Operation. As the main syllabus reference is EU-OPS, the learning objectives for Annex 6 are limited to specific definitions and internationally agreed laws, regulations and procedures upon which the legal (and regulatory) framework of EU-OPS is based. Annex 6 is also covered to a limited extent in 010 Air Law.

Compliance with the Law

Because Annex 6 contains the international standards which must be embodied in national law (see the definition of national law in the Air Law notes), operators of aeroplanes engaged in international operations will be subject to the laws of foreign states as well as the laws of the State of the Operator (and the State of Registration of the aeroplane if different). It is incumbent upon the Operator to ensure that all employees, wherever they are around the world, comply with the laws of the state in which they are operating or based. Specifically, pilots are to be conversant with the rules of the air and ATS regulations for the airspace in which they will be flying.

Operational Control

The Operator or a designated representative will have responsibility for operational control (exercising authority over the initiation, continuation, diversion or termination of a flight). The responsibility may only be delegated to the commander (PIC), and exceptionally to the flight operations officer or dispatcher if the approved method of supervision of flight operations requires the use of flight operations/dispatch personnel.

Safety

The stated aim of ICAO is to encourage safe and efficient development and growth of international commercial aviation. To this end the certification of Operators is one area where regulation and application of auditable standards can help achieve the aim. Before an Operator is granted an air operator's certificate (AOC), the necessary approval to conduct commercial (revenue earning) operations, the Operator must demonstrate that the operation is not only commercially (financially) viable, but also safe. To this end, the Operator is to ensure that not only the destination aerodromes planned to be used are of an acceptable safety standard, but that alternate (diversion) aerodromes are specified which meet the same standards. It is a general principle of acceptance of the ICAO Standards and Recommended Practices (SARPs) by an ICAO contracting state that other states can rely on that acceptance without further verification. For instance, should an airline registered in a contracting state, say the USA, wish to operate into London Heathrow, the fact that the UK is a contracting state of ICAO and thus is compliant with the SARPs is sufficient evidence for the US operator to plan to use Heathrow either as the destination or as a nominated alternate.

Alternate Aerodromes

An alternate aerodrome is defined as an aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to, or to land at, the aerodrome of intended landing. Alternate aerodromes include the following:

- **Take-off alternate.** This is an aerodrome at which an aircraft can land should this become necessary shortly after take-off and conditions are such that it is not possible to use the aerodrome of departure. The choice of take-off alternate will be made during the planning of the flight on the day.

- **En route alternate.** This is an aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition whilst en route. The choice of en route alternate aerodromes will depend upon the type of aeroplane and the areas over which the operation is taking place. It is normal to select ‘operationally acceptable’ aerodromes for this purpose, however, in an emergency; any ‘suitable’ aerodrome could be used.

- **ETOPS en route alternate.** This is a suitable and appropriate aerodrome at which an aeroplane would be able to land after experiencing an engine shut down or other abnormal or emergency condition whilst en route in an ETOPS (Extended Twin-engine OPerationS) operation. An ETOPS aeroplane must always be flying within ‘range’ of a suitable alternate aerodrome.

- **Destination alternate.** This is an aerodrome to which an aircraft may proceed, should it become either impossible or inadvisable to land at the aerodrome of intended landing. The choice of destination alternate will be part of the pre-flight planning process.

Flight time

Safety considerations not only apply to the operation of aircraft but also to the utilization of crew. It is a requirement for the granting of an AOC that operators have a flight time limitation scheme. Also in regard of the application of regulations, flight time must be legally defined. The definition below is the Annex 6 definition and is examinable.

Flight time - aeroplanes. This is defined as the total time from the moment an aeroplane first moves for the purpose of taking off until the moment it finally comes to rest at the end of the flight.

The above definition is synonymous with the term ‘block to block’ time, or ‘chock to chock’ time in general usage, which is measured from the time the aeroplane first moves under its own power (after the push-back or tow out) for the purpose of taking off (taxiing to the runway, not to another parking stand or de-icing bay), until it finally stops (at the parking stand, not an intermediate stop after turning off the landing runway) at the end of the flight.

Flight Safety and Accident Prevention

The State of the Operator is required to establish a safety programme which sets an acceptable level of safety to be achieved by all certified operators. The Operator is required to establish a Safety Management System (SMS) throughout the operation. The required safety level is defined by the State. The programme must:

- Identify safety hazards.
- Ensure that remedial action is implemented to maintain the standard.
- Provide continuous monitoring and assessment of the level achieved.
- Make continuous improvement of the overall level of safety.

As part of the SMS, a flight safety document system is to be established by the Operator relating to the documents used by operations personnel. The system will specify the applicable documents, and the means by which amendment and changes are notified to those staff. As far as is practicable, the documents should be published to a standard format using standardized phraseology and language.

If the Operator uses aeroplanes with maximum certificated take-off mass (MTOM) greater than 27 000 kg, a flight data analysis programme is required to be established, as part of the safety programme.

Maintenance Release

The Operator is required to determine that any aircraft used in Commercial Air Transport (CAT) is airworthy. The Commander (PIC) is required to check the necessary forms and documentation to confirm the airworthiness. One of the forms checked is the maintenance release. This certifies that the maintenance work performed has been completed satisfactorily and in accordance with approved data and the procedures described in the maintenance organization's procedures manual. The certificate contains:

- Basic details of the maintenance carried out including detailed references to the approved data used.
- The date the maintenance was completed.
- The identity of the approved maintenance organization.
- The identity of the person signing the release.

Lighting of Aircraft

The Rules of the Air (010 Air Law) cover the instances where aircraft are required to show lights. These may be lights which indicate the course of the aircraft (navigation lights) and anti-collision lights. Other lights (landing lights, ice detection lights, instrument panel lights and cabin lighting) are not subject to statutory use and not covered in this section.

Navigation Lights

The navigation lights are positioned on the aeroplane to indicate to another air user the direction that the aeroplane is heading. They consist of port (left) red, starboard (right) green, and tail white lights. The port and starboard lights show horizontally through an angle of 110° either side of dead ahead, and the tail light shows through an angle of 70° either side of the plane of symmetry (140°) of the aeroplane (fore and aft axis).

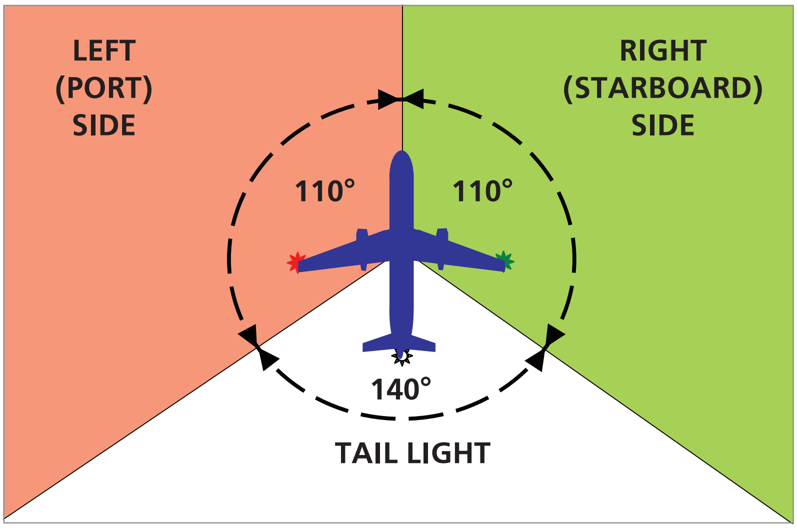


Figure 1.1 Aircraft horizontal navigation lighting

Vertically, the port and starboard lights show through 180°, the arc being in the direction of indication. The tail light is visible through 360°.

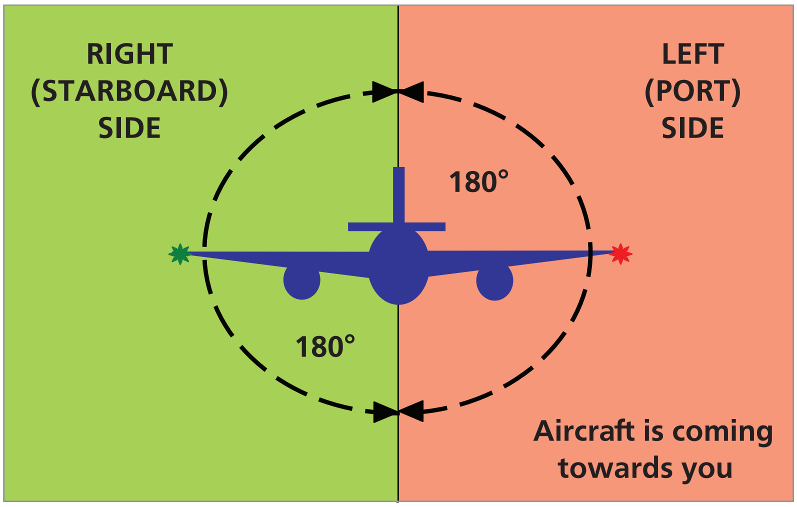


Figure 1.2 Aircraft vertical navigation lighting

Lighting Scheme

The majority of aeroplanes now flying, have navigation lights that show a steady light at all times. Older aircraft may have lights which alternate on/off together; others alternate on/off independently. Anti-collision lights may be of the rotating beacon type or the high intensity strobe discharge type (Flacon beacon).

Questions

1. Which ICAO document concerns international Commercial Air Transport (CAT) for fixed wing aeroplanes?

a. Annex 8 part 3
b. Annex 8 part 1
c. Annex 6 part 1
d. Annex 6 part 3

2. What does SARPs stand for?

a. Suitable Aeroplane Reporting Points
b. Standards And Recommended Practices
c. Standard Aircraft Reporting Procedures
d. Survival And Rescue Procedures

3. Does a take-off alternate always need to be nominated?

a. Yes for commercial air transport
b. Yes for all flights
c. No, only if the weather at destination is below limits for landing.
d. No, only if the weather at the departure airport is below limits for landing.

4. For purposes of recording, when does flight time start?

a. Take-off
b. Taxi with the intention of take-off
c. Taxi from the parking stand
d. Push-back

5. What colour, and through what angle can the port wing-tip navigation light be seen?

a. Red-70°
b. Red-110°
c. Green-70°
d. Green-110°

6. Are SARPs legally binding?

a. Yes
b. Yes if a country is a signatory to the ICAO conventions
c. No but signatory states must agree to incorporate them into national regulations
d. No, only in EASA member states

Answers

1	2	3	4	5	6
c	b	d	b	b	c

Chapter

2

EU-OPS General Requirements

Applicability

EU-OPS Part 1 contains and defines the requirements for the operation of civil aircraft in Commercial Air Transport (CAT) by any Operator whose principal place of business is in an EASA Member State. It **does not** apply to:

- Aeroplanes used in military, police or customs and excise operations, nor

- Parachute dropping and fire fighting flights including positioning flights for that purpose even though persons are carried on board for that purpose; nor

- Flights for the purpose of aerial work providing not more than 6 persons engaged in the aerial work (excluding the crew) are carried in the aeroplane.

Where the use of a Synthetic Training Device (STD) such as a flight simulator is used to replace an aeroplane for training purposes, such STDs are to be approved in accordance with CS-STD and users approved by the authority.

Common Language

Operators are required to ensure that all crew members (flight crew and cabin crew) are able to communicate (with each other) in a common language, and that they are able to understand the language in which those parts of the Operations Manual containing the crew members' duty, is written.

Quality System

The Operator is required to establish a Quality System to ensure safe operational practices and airworthy aeroplanes. A Quality Manager is to be appointed to ensure compliance with the quality system. Compliance monitoring must include a feed-back system to the Accountable Manager (see Chapter 3) who has responsibility to the Authority for compliance with the requirements of the AOC.

Accident Prevention and Flight Safety Programme

Each Operator is required to establish and maintain an Accident Prevention and Flight Safety programme, which may be integrated with the Quality System. The programme is to be administered by a person appointed by the Operator. Such a programme is to include:

- Risk awareness.
- Occurrence reporting.
- Incident and Accident evaluation.
- Flight data monitoring.

The programme manager is responsible for the implementation of proposals resulting from the programme and for monitoring the effectiveness of such proposals.

Additional Crew Members

Where additional crew members (e.g. personnel engaged in checking; non-operating crew or where animals are carried, veterinarian personnel) are carried on operational flights, the Operator is to ensure that such personnel are properly trained and proficient in the execution of their duty. Passengers must be able to distinguish between cabin crew and additional crew.

Ditching

Ditching, or the deliberate alighting of an aeroplane on the surface of the sea, is a possibility where aircraft are operated over the sea at a distance where in the event of engine failure the aircraft cannot reach land suitable for an emergency landing. To minimize the risk from ditching, operators are not to operate aeroplanes with a passenger seating capacity more than 30 at a distance from land greater than 120 minutes flying time at cruising speed, or 400 NM whichever is less, unless the aeroplane complies with the requirements of the applicable airworthiness code.

Carriage of Persons

Operators are to ensure that persons (crew and passengers) are only carried in parts of aeroplanes, which are designed for the accommodation of persons. The Commander may grant temporary access to other parts of the aeroplane for the purpose of taking action for the safety of the aeroplane, or persons, animals or goods which are in such areas providing the area is that to which designed access is possible.

Crew Responsibilities

Crew members are responsible for the discharge of their duties in respect of the safety of the aeroplane and its occupants. The discharge of such duties is to be in accordance with the procedures laid down in the Operations Manual (OM) including where necessary, use of the Operator’s occurrence reporting system. Specifically:

- Any fault or malfunction including an emergency situation, which could affect the airworthiness or safe operation of the aeroplane, is to be reported to the Commander.
- Any incident that endangered or could have endangered the safety of operations is to be reported to the Commander.

Crews must make use of the Operator’s occurrence reporting schemes. (A copy of which must be made available to the Commander)

Clearly, if the occurrence mentioned above has already been reported to the Commander, duplication of the report is not necessary.

A crew member is not to present him or herself for duty on an aeroplane:

- If under the influence of any drug that may affect his/her faculties in a manner contrary to safety.
- Until a reasonable period of time has elapsed after deep water diving.
- Until a reasonable period of time has elapsed after blood donation.
- If he or she is in any doubt as to his or her ability to accomplish the assigned duty.
- If he or she knows or suspects that he or she is suffering from fatigue to the extent where safety may be endangered.

A crew member must not:

- Consume alcohol less than 8 hours prior to reporting for duty or the commencement of standby duty.
- Report for duty with a blood alcohol level exceeding 0.2 promille.
- Consume alcohol during flight time or when on standby.

Responsibilities of the Commander

The Commander is responsible for the safety of all crew members, passengers and cargo on board as soon as he/she arrives on board, until he/she leaves the aeroplane at the end of the flight. Additionally he/she:

- Is responsible for the operation and safety of the aeroplane from the moment the aeroplane is first ready to move for taxiing for take-off until it finally comes to rest at the end of the flight and the primary propulsion units (engines excluding APU) are shut down.
- Has the authority to give all commands deemed necessary for the purpose of ensuring the safety of the aeroplane and the persons and property carried.
- Has the authority to disembark (off load) any person, or part of cargo, which in his/her opinion presents a potential hazard to the safety of the aeroplane.
- Will not allow any person to be carried in the aeroplane whom appears to be under the influence of alcohol or drugs, and may endanger the safety of the aeroplane of the occupants.
- May refuse to carry any inadmissible passenger, deportee or person in custody (potentially disruptive passenger) if the carriage poses a safety risk to the aeroplane or its occupants.
- Is to ensure that all passengers are briefed as to the location of emergency exits, and the location and the operation of safety equipment.
- Is to ensure that all operational procedures and checklists are complied with in accordance with the requirements of the OM.
- Is to ensure that no crew member performs any duty during take-off, initial climb, final approach and landing except those duties required for the safe operation of the aeroplane.
- Is to ensure that neither the Flight Data Recorder (FDR) nor the Cockpit Voice Recorder (CVR) is switched off in flight. Under certain circumstances, the CVR may be switched off after an incident or accident to ensure that the previously recorded information is retained (not ‘over written’).
- Is to decide whether or not to accept an aeroplane with unserviceabilities allowed by the Minimum Equipment List (MEL) or the Configuration Deviation List (CDL).
- Is to ensure that the pre-flight inspection has been carried out.

Authority of the Commander

The Commander is the representative of the State of Registration/State of the Operator from the time he/she enters the aeroplane until the time he/she leaves the aeroplane. The Operator is required to take all reasonable measures to ensure that all persons carried on board the aeroplane obey the lawful commands of the Commander given for the purpose of securing the safety of the aeroplane and all the persons on board.

Admission to the Flight Deck

The only personnel permitted to enter the flight deck are:

- The Operating Crew.
- A representative of the Authority in the performance of his/her official duty.
- Persons permitted to do so in accordance with instruction in the OM.

Note: *The final decision concerning admittance to the flight deck rests with the Commander.*

Unauthorized Carriage

The Operator is to ensure that no persons hides him or herself (stowaways), or hides any cargo on board an aeroplane.

Portable Electronic Devices

The Operator is to take all reasonable measures to prevent the use of any portable electronic device on board an aeroplane that could adversely affect the performance of the aeroplane's systems and equipment.

Drugs and Alcohol

Where the safety of the aeroplane or persons on board would be affected, the Operator is to ensure that no person is permitted to enter an aeroplane if it is obvious that the person is under the influence of drugs or alcohol.

Endangering Safety

The Operator is to take all reasonable measures to ensure that no person acts negligently or in such a manner that endangers the aeroplane or persons aboard, or causes an aeroplane to endanger any person or property.

Documents to Be Carried

The following documents are required to be carried on board each flight:

- The Certificate of Registration (original).
- The certificate of airworthiness (original).
- The Noise Certificate (original).
- The air operators certificate (copy will suffice).

- The Aircraft radio licence (original).
- Third party insurance certificate (copy will suffice).

Each flight crew member is to carry the valid flight crew licence plus any necessary ratings.

Manuals to Be Carried

The Operator is to ensure that the following manuals are carried on all flights:

- Parts of the OM relating to flight crew duty.
- Parts of the OM required for the conduct of the flight.
- The current Aeroplane Flight Manual (AFM) (unless the Authority has approved the OM as containing the necessary information).

Additional Information and Forms to Be Carried

The Operator is to ensure that, where relevant, the following are to be carried on all flights:

- The Operational Flight Plan (OFP).
- The required parts of the Aeroplane Technical Log.
- The ATS flight plan.
- Appropriate NOTAM/AIS briefing material.
- Appropriate meteorological information.
- Mass and Balance documentation.
- Details of special categories of passengers (i.e. security personnel if not considered as crew; persons of reduced mobility (PRMs); inadmissible passengers; deportees; persons in custody).
- Special load notification (including dangerous cargo).
- Current maps and charts.
- Any other documentation that may be required by a state (including cargo manifests; passenger manifests; etc.).
- Forms to comply with the reporting requirements of the Authority and the Operator.

The Authority may permit the information (or parts of it) above to be carried in a form other than as printed material. An acceptable standard of accessibility, usability and reliability must be assured.

Information to Be Retained on the Ground

The Operator is to ensure that:

For at least the duration of each flight (or series of flights):

- Information relevant to the flight and appropriate to the type of operation is preserved on the ground; and
- The information is retained until it can be duplicated and stored in accordance with the relevant regulations, or if this is not practicable,
- The information is carried in a fireproof container in the aeroplane.

Such information is to include:

- A copy of the OFP.
- Copies of relevant parts of the aeroplane technical log.
- Route specific NOTAM documents if specially edited by the Operator.
- Mass and Balance documentation.
- Special load documentation.

Power to Inspect

Any person authorized by the Authority is permitted to board and fly in an aeroplane operated in accordance with the AOC (and enter and remain on the flight deck - Commander's discretion applies).

Production and Preservation of Documents and Recordings

Persons authorized by the Authority are permitted access to any documents and records relating to flight operations. The Operator is required to produce all such documents and records within a reasonable time when requested to do so by the Authority. Likewise, the Commander is required to produce any of the documents required to be carried on board an aeroplane when requested to do so by an authorized person.

Original documentation is to be kept for the required retention period by the operator, even if during that period, he ceases to be the Operator of the aeroplane.

Documentation relating to a crew member is to be made available to a new operator if the crew member ceases to work for the original operator.

Following an incident, all FDR and CVR recordings are to be retained for a period of 60 days unless a longer period is requested by the Authority.

Note: *EU-OPS 1.160 (c) (1) states that the CVR recordings may not be used for any purpose other than for the investigation of an accident or incident subject to mandatory reporting* ***except*** *with the consent of all the crew members concerned.*

Leasing of Aeroplanes

Leasing, in aviation law, is the situation whereby an aeroplane is used by one operator, whilst the ownership title remains with another operator. The operator using the aeroplane pays the owner an agreed sum for the use of the aeroplane over a specified period. The types of leases are described below. They can range from an arrangement whereby an airline "borrows" an aeroplane to use whilst one of its own is unusable, to the situation where an airline does not own any aeroplanes but operates a fleet of leased aeroplanes painted in the company livery, on a long term basis.

The following terminology is generally used with regard to leasing of aeroplanes:

Dry Lease
This is when the leased aeroplane is operated under the AOC of the lessee (the operator borrowing the aeroplane).

Wet Lease
This is when the leased aeroplane is operated under the AOC of the lessor (the operator lending the aeroplane to the lessee).

The following terminology has the meaning stated in the context of EASA operations:

Wet Lease-out
This is the situation in which an EASA operator providing an aeroplane and complete crew to another EASA operator remains the operator of the aeroplane. (The aeroplane is operated under the AOC of the lessor)

Other Leasing
An EASA operator utilizing an aeroplane from, or providing it to another EASA operator, must obtain prior approval from his respective authority. Any conditions, which are part of this approval, must be included in the lease agreement. Those elements of lease agreements which are approved by the authority, other than lease agreements in which an aeroplane and complete crew are involved and no transfer of functions and responsibility is intended, are all to be regarded, with respect to the leased aeroplane, as variations of the AOC under which the flights will be operated.

The following terminology and rules apply to leasing between an EASA operator and a non-EASA organisation.

Dry Lease-in
Before an EASA operator is permitted to dry lease-in an aeroplane from a non-EASA source, the approval of the Authority is required. Any conditions of this approval are to form part of the leasing agreement. Where an aeroplane is dry leased-in, the EASA operator is to notify the authority of any differences to the requirements of EU-OPS 1 with regard to Instruments and Communications equipment fitted to the aeroplane, and receive confirmation from the Authority that the differences are acceptable.

Wet Lease-in
No EASA operator shall wet lease-in an aeroplane from a non-EASA source without the approval of the authority. Concerning wet leased-in aeroplanes, the EASA operator is to ensure the safety standards of the lessor with respect to maintenance are equivalent to current

regulations; the lessor is an operator holding an AOC issued by a state which is a signatory of the Chicago Convention; the aeroplane has a standard CofA issued in accordance with ICAO Annex 8 (A C of A issued by an EASA member state other than the state responsible for issuing the AOC, will be accepted without further showing when issued in accordance with CS-21); and any EASA requirement made applicable by the lessee's Authority is complied with.

Dry Lease-out

An EASA operator may dry lease-out an aeroplane for any purpose of commercial air transport to any operator of a state which is a signatory of the Chicago Convention providing that the Authority has exempted the EASA operator from the relevant provisions of EU-OPS Part 1 and, after the foreign regulatory Authority has accepted responsibility in writing for surveillance of the maintenance and operation of the aeroplane(s), has removed the aeroplane from its AOC; and the aeroplane is maintained in accordance with an approved maintenance programme.

Wet Lease-out

An EASA operator providing an aeroplane and complete crew and retaining all the functions and responsibilities described in EU-OPS 1 Sub Part C (Operator Certification and Supervision), shall remain the operator of the aeroplane.

Questions

1. What are the language requirements for crew?

a. Flight Crew must be able to speak the language in common use in all countries through which they operate
b. Cabin crew must be able to speak English
c. Cabin crew must learn the language of the flight crew
d. Flight crew must be able to communicate with cabin crew in a common language

2. What must the Flight Safety Programme of all Operators include?

a. Risk awareness and accident evaluation.
b. Instances of AUM exceedance.
c. Details of flight hours for Flight crew
d. Occasions when aeroplanes land with minimum fuel.

3. What must the Operator ensure with regard to additional crew?

a. They must be allocated seats in business class
b. They must be type rated and current on type
c. They must not occupy seats by emergency exits
d. They must be easily distinguishable from cabin crew

4. What are the rules for aircraft to comply with ditching requirements?

a. 400 minutes or 120 NM from an aerodrome
b. 400 NM or 120 minutes from an aerodrome
c. 400 NM or 120 minutes from land
d. 400 minutes or 120 NM from land

5. Which of the following are not required to be carried on each flight?

a. CofA
b. NOTAMS and AIS briefing material
c. European Health Insurance Card (EHIC) for all crew
d. Third party insurance certificate

6. If EU Operator A wet leases an aeroplane from EU operator B, who is responsible for the airworthiness of the aircraft?

a. A
b. B
c. Both are equally responsible
d. It depends on the year the aircraft was first registered.

Answers

1	2	3	4	5	6
d	a	d	c	c	b

Chapter

3

Operator Supervision and Certification

Rules for the Certification of an Air Operator

Commercial Air Transportation (CAT) can only be undertaken by an approved air operator and in accordance with the certificate issued by the Authority of the state. This certificate is known as an Air Operator Certificate (AOC). The AOC will be issued by the Authority of the state in which the operation has its principal place of business. In the case of British Airways, this would the CAA of the UK as the principal place of business of BA is London.

Applicant Requirements

An applicant for an AOC:

- Must not already hold an AOC issued by another Authority unless specifically approved by the Authorities concerned.
- Must register the aeroplanes to be used in the operation in the state where the AOC will be issued. Under certain circumstances (with mutual agreement of the Authorities concerned) aeroplanes registered in another state may be used. The aeroplanes used by SAS are registered variously in Norway, Sweden or Denmark.
- Must satisfy the Authority of the state issuing the AOC that the operator is able to conduct safe operations.

The applicant operator must also satisfy the Authority that the organization of the operation and the management structure of the company are both suitable and properly matched to the scale (size) and scope (types of operations) of the undertaking. The operator is also required to show the approving Authority that procedures for the supervision of operations have been defined.

Aeroplane Maintenance

The operator must ensure that the aeroplanes used in the operation are airworthy and are maintained in accordance with the manufacturers (approved) maintenance programme. If the operator elects to carry out the maintenance ‘in-house’, the operator must be approved in accordance with EASA part 145 for the approval of maintenance operations. The operator may, however, elect to have the aeroplanes maintained by a third party organization in which case, the operator is required to ensure that the maintenance organization employed is EASA part 145 approved. Where the organization carries out maintenance, the operator is required to ensure that access to the aeroplanes and the maintenance organization is granted as required, and that access is also granted to any third party maintenance organization employed by the operator.

Variation, Revocation or Suspension of an AOC

At the discretion of the Authority, an AOC may be varied, revoked or suspended if the Authority ceases to be satisfied that the operator can continue to operate safe operations. In order to be satisfied, the Authority carries out periodic audits of the operation which will include inspection and assessment of the operator’s own internal audit system, and inspection of the financial records of the operation. For continuation of the approval, the primary responsibility of the operator is to ensure that the conditions of issue of the AOC are complied with, and any limitations or restrictions imposed by the Authority (which must be stated on the certificate) are also respected.

Key Post Holders within the Operation

With regard to the issue and maintenance of the AOC the most important person in the operation is the 'Accountable Manager.' Effectively, this person, nominated by the operator and acceptable to the Authority, is responsible to the Authority for compliance with all the requirements of the Authority for the AOC. Specifically, the Accountable Manager is responsible for ensuring that all the operations and maintenance activities can be financed and carried out to the standard required by the Authority.

Other post holders appointed by the operator, required and acceptable to the Authority are:

- Flight Operations manager.
- Maintenance System manager.
- Crew Training manager.
- Ground Operations manager.

A single person may hold one or more of the above posts (if acceptable to the Authority), however, for operators with 21 or more full time employees a minimum of two persons are required to fill the four positions. For operators with less than 20 full time employees one or more of the above posts may be filled by the Accountable Manager, if this arrangement is acceptable to the Authority.

Main Operating Base

The Authority will require full operational support facilities to be established and maintained at the main operating base, appropriate to the area and type of operations conducted. For example, the main operating base of British Airways is London Heathrow but due to the extensive nature of the operation, many company/operation activities are by necessity, duplicated at other aerodromes around the world.

Aeroplanes

The aeroplanes used by an operator must have a standard certificate of airworthiness (CofA) issued in accordance with ICAO Annex 8 by a JAA member state. A CofA issued by a JAA member state other than the state of the operator will be accepted if issued in accordance with CS-21 (Certification).

Other Considerations

In addition to the above, before the granting or variation of an AOC the operator will be required to satisfy the Authority that:

- The organization/operation can be established and maintained to an acceptable (to the Authority) standard.

- A quality system (as defined in CS-OPS 1.035) is established and maintained.

- The defined training programme(s) are complied with.

- The aircraft maintenance requirements are complied with.

The operator is required to notify the Authority of any changes to any of the required information or procedures once the application for the AOC has been submitted. If, for any reason, the Authority is not satisfied that the above requirements have been complied with, the Authority may ask for one or more demonstration flights to be carried out (as if the flights were full CAT flights).

Contents and Conditions of an AOC

The air operators certificate will specify:

- The name and location (principal place of business) of the operator.
- Date of issue and the period of validity.
- A description of the type of operation(s) authorized.
- The types (and marks or variant types) of aeroplanes authorized for use in the operation.
- The registration markings of the authorized aeroplanes.
- The authorized areas of operation.
- Any special limitations imposed by the Authority.
- The special authorizations and approvals (if any) granted by the Authority such as:
  - CATII/III operations (including the approved minima).
  - Operations in MNPS airspace.
  - Extended Twin-engine Operations (ETOPS).
  - Area Navigation Operations (RNAV).
  - Operations in accordance with Reduced Vertical Separation Minima (RVSM).
  - Operations involving the transportation of dangerous goods by air.
  - Authorization to provide cabin crew initial safety training.

Terminology

The terms which are listed below are for use within the context of this regulation.

(a) **Adequate aerodrome.** An aerodrome which the operator considers to be satisfactory, taking account of the applicable performance requirements and runway characteristics; at the expected time of use, the aerodrome will be available and equipped with necessary ancillary services such as ATS, sufficient lighting, communications, weather reporting, navaids and emergency services.

(b) **ETOPS** (Extended range operations for two-engine aeroplanes). ETOPS operations are those with two-engine aeroplanes approved by the Authority (ETOPS approval), to operate beyond the threshold distance determined in accordance with EU-OPS from an adequate aerodrome.

(c) **Adequate ETOPS en route alternate aerodrome**. An adequate aerodrome, which additionally, at the expected time of use, has an ATS facility and at least one instrument approach procedure.

(d) **En route alternate (ERA) aerodrome**. An adequate aerodrome along the route, which may be required at the planning stage.

(e) **3% ERA**. An en route alternate aerodrome selected for the purposes of reducing contingency fuel to 3%.

(f) **Isolated aerodrome**. If acceptable to the Authority, the destination aerodrome can be considered as an isolated aerodrome, if the fuel required (diversion plus final) to the nearest adequate destination alternate aerodrome is more than:

For aeroplanes with reciprocating engines, fuel to fly for 45 minutes plus 15 % of the flight time planned to be spent at cruising level or two hours, whichever is less; or

For aeroplanes with turbine engines, fuel to fly for two hours at normal cruise consumption above the destination aerodrome, including final reserve fuel.

(g) **Equivalent position**. A position that can be established by means of a DME distance, a suitably located NDB or VOR, SRE or PAR fix or any other suitable fix between three and five miles from threshold that independently establishes the position of the aeroplane.

(h) **Critical phases of flight**. Critical phases of flight are the take-off run, the take-off flight path, the final approach, the landing, including the landing roll, and any other phases of flight at the discretion of the commander.

(i) **Contingency fuel**. The fuel required to compensate for unforeseen factors which could have an influence on the fuel consumption to the destination aerodrome such as deviations of an individual aeroplane from the expected fuel consumption data, deviations from forecast meteorological conditions and deviations from planned routings and/or cruising levels/altitudes.

(j) **Separate runways**. Runways at the same aerodrome that are separate landing surfaces. These runways may overlay or cross in such a way that if one of the runways is blocked, it will not prevent the planned type of operations on the other runway. Each runway shall have a separate approach procedure based on a separate navigation aid.

(k) **Approved one-engine-inoperative cruise speed**. For ETOPS, the approved one-engine-inoperative cruise speed for the intended area of operation shall be a speed, within the certified limits of the aeroplane, selected by the operator and approved by the regulatory Authority.

(l) **ETOPS area**. An ETOPS area is an area containing airspace within which an ETOPS approved aeroplane remains in excess of the specified flying time in still air (in standard conditions) at the approved one-engine-inoperative cruise speed from an adequate ETOPS route alternate aerodrome.

(m) **Dispatch**. ETOPS planning minima applies until dispatch. Dispatch is when the aircraft first moves under its own power for the purpose of taking off.

Operations Manual (OM)

Subpart P of EU-OPS contains the content requirements for the OM. The OM is provided for the guidance of personnel engaged in the operation. It consists of 4 parts:

Part A - General and Basic Information. This part includes procedures and information relating to:

- Administration and Control of OM.
- Organization and Responsibilities.
- Operational Control and Supervision.
- Quality System.
- Crew Composition.
- Qualification Requirements.
- Crew Health Precautions.
- Flight Time Limitations.
- Operating Procedures.
- Dangerous Goods and Weapons.
- Security.
- Handling, Notifying and Reporting of Occurrences.
- Rules of the Air.
- Leasing.

Part B - Aeroplane Operating Matters. This part includes procedures and information relating to:

- General Information and Units of Measurement.
- Limitations.
- Normal Procedures.
- Abnormal and Emergency Procedures.
- Performance.
- Flight Planning.
- Mass and Balance.
- Loading.
- Configuration Deviation List (CDL).
- Minimum Equipment List (MEL).
- Survival and Emergency Equipment including Oxygen.
- Emergency Evacuation Procedures.
- Aeroplane Systems.

Part C - Route and Aerodrome Instructions and Information. This is the section in which staff will find aerodrome operating minima and any special instruction for the calculation of minima and special data relating to aerodromes used as part of the operation.

Part D - Training. All personnel are required to be competent to carry out their duties. This section details the training method and requirements to ensure that all personnel are competent.

General Rules for Operations Manuals

The operator is responsible for ensuring that the OM:

- Contains all instructions and information necessary for operations personnel to conduct their duty.
- Contents, including all amendments or revisions, do not contravene any part of the AOC or any applicable regulation.
- Must be approved by the Authority.
- Must be prepared in the English language, unless otherwise approved by the Authority or as prescribed by national law. It may be translated and used in full, or part, into another language.
- Can be issued in separate volumes.
- Is available for all operations personnel who must have easy access to a copy of each part applicable to their duties. Crew members must be supplied with a personal copy, or sections from, Parts A and B.
- Must be amended and kept up to date and all personnel must be informed of the revision relevant to their duties.
- Is up to date and all copies are amended with the revisions supplied by the operator.

Ops Manual Amendments

The regulations concerning amendment to the OM are as follows:

- The Authority must be supplied with any proposed amendment in advance of the effective date.
- If the amendment must be approved in accordance with EU-OPS, the approval shall be obtained before the amendment becomes effective.
- If the amendment is required to be immediate, in the interest of safety, the amendment may be published immediately if permission is granted by the Authority.
- All amendments required by the Authority must be included.
- The contents are presented in a form which can be used without difficulty and the design must observe Human Factors principles.
- The OM may be presented in a form other than on printed paper but if so the format must be accessible, usable and reliable to the user.

Competence of Operations Personnel

An operator shall ensure that all personnel assigned to, or directly involved in, ground and flight operations are properly instructed, have demonstrated their abilities in their particular duties and are aware of their responsibilities and the relationship of such duties to the operation as a whole.

Aeroplane Maintenance

All aeroplanes used in the operation are to be maintained and released to service by an appropriate 'EC regulation part-145' approved/accepted organization. Pre-flight inspections (see definition) need not necessarily be carried out by the part-145 organization. Continuing airworthiness requirements are laid down in 'EC regulation part-M'.

Questions

1. **What are the general rules regarding the issue of an AOC?**

   a. Operators must own enough aeroplanes to conduct safe operations
   b. Aeroplanes should be registered in the state where the AOC is issued
   c. Operators must be certified in accordance with EASA part 145
   d. The Accountable Manager must be the holder of a full ATPL

2. **What must be stated on the AOC?**

   a. Name of the Accountable Manager
   b. Registration markings of all aeroplanes
   c. Aerodrome operating minima for all aerodromes cleared for use
   d. Date of expiry of the AOC

3. **Where would a pilot find the MEL for his aeroplane?**

   a. AFM
   b. Ops Manual part C
   c. Ops Manual part B
   d. Company Procedures Manual

4. **Can the Ops Manual be stored electronically?**

   a. Yes but not on the aircraft
   b. No
   c. Yes
   d. Yes but only on the aircraft

5. **What language must the Ops Manual normally be produced in?**

   a. English
   b. French
   c. Spanish
   d. All major languages used in the EU

6. **If, during the pre-flight inspection, the pilot notices an aerial missing from the airframe;**

   a. he must refer to the CDL, and if it is listed he can continue
   b. he must refer to the MEL and if it is listed he can continue
   c. he must report it after flight
   d. he must report it before flight

Answers

1	2	3	4	5	6
b	b	c	c	a	d

Chapter

4

Operational Procedures

Continued Overleaf

4 Operational Procedures

Establishment of Procedures

The operator is required to establish and define procedures for all ground and flight operations relating to the duties of ground staff and crew members specific to each type of aeroplane used in the operation.

Checklists are to be formulated and used by crew members for all phases of the operation of the aeroplane under normal, abnormal and emergency conditions and the checklists are to be applicable to OM Part B ensuring the procedures detailed in Part B are followed. The aircraft manufacturer's checklists contained in the AFM will be the basis for the company-specific checklists.

The operator is to ensure that no procedures other than those required for the safe operation of the aeroplane are required during critical phases of the flight.

Use of Air Traffic Control

Whenever it is available (it will always be available in controlled airspace (CAS) and at controlled aerodromes) an ATC service is to be requested and the ATC instructions complied with. Inevitably, this will require the filing of an IFR flight plan (FPL) in classes A, C, D and E airspace or a VFR/IFR FPL in class B airspace. This implies that all commercial operations will take place inside CAS. As a controlled flight inside CAS ATC will apply the required separation standards to all flights thus maximizing safety.

Authorization and Selection of Aerodromes by the Operator

Only authorized aerodromes are to be used as destinations or destination alternates. All the aerodromes used for flight operations in the context of the operation, are to be approved by the operator. Such consideration must take into account the types of aeroplane used and the nature of the operation concerned.

Take-off Alternate

The Operational Flight Plan (OFP) will specify a take-off alternate to be used in the event that it would not be possible to return to the departure aerodrome for meteorological or performance reasons.

Take-off Alternate - Planning Minima for IFR Flights

For an aerodrome to be selected as a take-off alternate, the weather reports/forecasts must indicate that during the period 1 hour before until 1 hour after the ETA at the (alternate) aerodrome the met conditions will be at or above the applicable aerodrome operating minima defined at *Figure 4.1*. In this respect, the ceiling must be taken into account when non-precision or circling approaches are the only available instrument approach option. Additionally, any limitations related to one engine inoperative must also be considered.

Two Engine Aeroplane

The take-off alternate must be located within either one hour flight time at the one-engine-inoperative cruise speed or, where approved, the operator's ETOPS diversion time, subject to any MEL restriction, up to a maximum of 2 hours at the one-engine-inoperative cruise speed.

Three or More Engines
Two hours flight time at the one-engine-inoperative cruise speed specified in the AFM in still air standard conditions based on the actual take-off mass for three- and four-engine aeroplanes.

Note: *The one-engine-inoperative cruise speed is to be the speed specified in the AFM in still air standard conditions based on the actual take-off mass. If the AFM does not specify a speed, the speed to be used for calculation is that which can be achieved with the remaining engines set at maximum continuous power.*

Destination (Except for Isolated Destination Aerodromes)
For an aerodrome to be selected as a destination, the weather reports/forecasts must indicate that during the period 1 hour before until 1 hour after the ETA at the aerodrome, the met conditions will be at or above the following:

- The RVR/visibility must be as required for the aerodrome operating minima.
- For a non-precision or circling approach the ceiling must be at or above MDH.

or

Two destination alternates must be selected.

Alternate
The planning minima defined in the table below are applicable to destination alternate, isolated destination and 3% ERA.

Type of Approach	Planning Minima
CAT II and CAT III	CAT I RVR
CAT I	Non-precision RVR and the ceiling must be above MDH (See note)
Non-precision	Non-precision RVR and the ceiling must be above MDH (See note) plus 200 ft and 1000 m
Circling	Circling (Vis/RVR/MDH(VM(C))

Note. *Non-precision means the next highest minimum that is available at the aerodrome. So, for CAT I ILS this could be ILS no GP or, for example, a VOR/DME. The same is applicable to non-precision approaches.*

Figure 4.1

Destination Alternate(s)
The selected destination alternate (diversion) aerodromes are to be detailed in the OFP.

At least one destination alternate (diversion) aerodrome must be selected for each IFR flight unless:

- Both, the duration of the planned flight from take-off to landing (or in the event of a re-plan, the remaining flight time) does not exceed 6 hours, and two separate runways are available and useable at the destination aerodrome and the met reports/forecasts indicate that from 1 hour before until 1 hour after ETA at the destination, the ceiling will be at least 2000 ft or circling height +500 ft (whichever is greater) and the visibility will be not less than 5 km.

- The destination is so isolated that no useable diversion aerodrome exists.

Planning Minima - ETOPS En Route Alternate

An operator shall only select an aerodrome as an ETOPS en route alternate aerodrome when the appropriate weather reports or forecasts, or any combination thereof, indicate that, between the anticipated time of landing until one hour after the latest possible time of landing, conditions calculated by adding the additional limits of *Figure 4.2* will exist. An operator shall include in the OM the method for determining the operating minima at the planned ETOPS en route alternate aerodrome.

Approach facility	Alternate airfield ceiling	Weather minima Visibility/RVR
Precision approach procedure.	Authorized DH/DA plus an increment of 200 ft	Authorized visibility plus an increment of 800 metres
Non-precision approach or circling approach	Authorized MDH/MDA plus an increment of 400 ft	Authorized visibility plus an increment of 1500 metres

Figure 4.2

Meteorological Conditions

For an IFR flight, the commander shall only commence take-off or continue beyond the point from which a revised flight plan applies in the event of in-flight re-planning, when information is available indicating that the expected weather conditions at ETA at the destination and/or required alternate aerodromes, are at or above the planning minima.

On an IFR flight, the commander shall only continue towards the planned destination aerodrome when the latest information available indicates that at ETA the weather conditions at the destination or at least one destination alternate are at or above the applicable aerodrome operating minima.

For a VFR flight, the commander will only commence the flight when the weather reports or forecasts indicate that the meteorological conditions along the route (or the part of the route to be flown under VFR) will permit flight under VFR.

Approach and Landing Conditions

Before commencing any approach to land, the commander is to be satisfied that according to the information available, the weather at the aerodrome and the condition of the runway to be used will not prevent a safe approach, landing or missed approach being made in accordance with the performance information in the OM.

Aerodrome Operating Minima (AOM)

For all aerodromes (departure, destination or alternate), and for instrument approaches and runways used within the context of the operation and approved for use by the operator, the operator is required to define the applicable aerodrome operating minima (AOM). This will be:

- For take-off, the minimum acceptable met visibility or, where available, the minimum acceptable RVR or IRVR.
- For instrument approaches, the AOM consists of DA/H or MDA/H and the minimum applicable met visibility or RVR/IRVR.
- Additionally for non-precision approaches, ICAO Annex 6 also mentions 'cloud consideration'.

Commencement and Continuation of Approach

(a) The commander or the pilot to whom conduct of the flight has been delegated may commence an instrument approach regardless of the reported RVR/visibility but the approach shall not be continued beyond the outer marker (or equivalent position) on a precision approach, or below 1000 ft on a non-precision approach, if the reported RVR/visibility is less than the applicable minima.

(b) Where RVR is not available, RVR values may be derived by converting the reported visibility in accordance with *Figure 4.3* (this table will be reproduced in the OM).

(c) If, after passing the outer marker or equivalent position in accordance with (a) above, the reported RVR/visibility falls below the applicable minimum, the approach may be continued to DA/H or MDA/H.

(d) Where no outer marker or equivalent position exists, the commander or the pilot to whom conduct of the flight has been delegated shall make the decision to continue or abandon the approach before descending below 1000 ft above the aerodrome on the final approach segment. If the MDA/H is at or above 1000 ft above the aerodrome, the operator shall establish a height, for each approach procedure, below which the approach shall not be continued if RVR/visibility is less than applicable minima.

(e) The approach may be continued below DA/H or MDA/H and the landing may be completed provided that the required visual reference is established at the DA/H or MDA/H and is maintained.

(f) The touch-down zone RVR is always controlling. If reported and relevant, the midpoint and stop-end RVR are also controlling. The minimum RVR value for the midpoint is 125 m or the RVR required for the touch-down zone if less, and 75 m for the stop-end. For aeroplanes equipped with a roll-out guidance or control system, the minimum RVR value for the midpoint is 75 m.

Note: *"Relevant", in this context, means that part of the runway used during the high speed phase of the landing down to a speed of approximately 60 knots.*

Lighting elements in operation	RVR = Reported Met Vis x	
	Day	Night
High intensity (HI) approach and runway lighting	1.5	2.0
Any type of lighting installed other than above	1.0	1.5
No lighting	1.0	Not applicable

Figure 4.3: Conversion of Met into RVR

The AOM for a specific type of approach and landing procedure are considered to be applicable if the ground equipment necessary for the procedure and the aeroplane systems required are serviceable, the required performance criteria are met and the crew is appropriately qualified.

Instrument Departure and Approach Procedures

Where Standard Instrument Departures (SIDs) and Standard Arrival Procedures (STARs) have been established by the state for aerodromes used in the operation, the defined procedures are to be used. Any procedure published may be modified by specific ATC instruction and the commander may accept alternative instructions with the provision that the appropriate obstacle clearance criteria are met. The final approach must be flown visually or in accordance with the established instrument procedure.

The operator may specify different procedures to those established by the state provided that the operator's procedures are approved by the state in which the procedure is to be used and further approved by the Authority of the operator.

Noise Abatement Procedures

Noise abatement is a major consideration of all instrument departures and arrivals. Modern aircraft are much more quiet than older aeroplanes but the legacy of noise reduction through procedures is incorporated in the design of SIDs and approach procedures. Noise abatement and the basic procedures, is covered in detail in Chapter 10. The responsibility for the establishment of the specific procedures rests with the operator. The procedure defined by the operator for a specific aeroplane should be the same for each aerodrome used. A critical factor to be considered in Noise Abatement Procedures is the actual take-off mass of the aircraft.

Routes and Areas of Operation

The operator is to make sure that any restrictions or limitations imposed by the Authority with regard to routes and areas of operation are complied with. For the routes and areas of operation, the operator is to ensure that:

- Ground facilities and services (including meteorological services) are provided and are adequate for the planned operation.
- The performance of the aeroplanes used (or intended to be used) must ensure compliance with the minimum flight altitude requirements.

- The equipment fitted to the aeroplanes to be used meets the minimum requirements for the planned operations.

- Appropriate maps and charts (including the relevant FMS database) are available.

- Where twin-engine aeroplanes are used, adequate aerodromes (for diversion in the event of an emergency) are available within the defined time/distance limitations.

- If single-engine aeroplanes are used, surfaces are available which permit a safe forced landing

RVSM Operations

RVSM (reduced vertical separation minima) is now the generally accepted method of applying vertical separation between aircraft operating between FL290 and FL410. The subject is covered fully in 010 Air Law. It is also covered in our study of the North Atlantic in Chapter 9 of these notes. Before an operator can operate over routes at flight levels where RVSM is applied, approval must be granted by the Authority and such approval noted in the AOC. Basically, the crew must be trained in RVSM and the aircraft equipped with A/TCAS, an altitude reporting SSR system, and have an autopilot 'height lock' with an altitude deviation alerting system (audio or visual).

Operations in MNPS Airspace

Certain specified areas of airspace are designated as MNPS (minimum navigational performance specification) areas where special navigational requirements exist. An example is the North Atlantic which is covered in depth in Chapter 9 of these notes. Due to the lack of ground based radio navigation aids and the high level of traffic density, standards for determination of position and track need to be specified and all aircraft operating in these areas must comply. The Authority will give approval (in the AOC) for operators to conduct operations in MNPS airspace (MNSPA). For operations in MNPSA the operator must ensure that contingency procedures specified by the Authority are included in the OM.

Maximum Distance from an Adequate Aerodrome for Two-engine Aeroplanes without an ETOPS Approval

(a) Without ETOPS approval, an operator shall not operate a two-engine aeroplane over a route which contains a point further from an adequate aerodrome (under standard conditions in still air) than, in the case of:

1. Performance Class A aeroplanes with either:
   (i) a maximum approved passenger seating configuration of 20 or more; or
   (ii) a maximum take-off mass of 45 360 kg or more,

the distance flown in 60 minutes at the one-engine-inoperative cruise speed determined in accordance with subparagraph (b) below;

2. Performance Class A aeroplanes with:
   (i) a maximum approved passenger seating configuration of 19 or less; and
   (ii) a maximum take-off mass less than 45 360 kg,

the distance flown in 120 minutes or, if approved by the Authority, up to 180 minutes for turbojet aeroplanes, at the one-engine-inoperative cruise speed determined in accordance with subparagraph (b) below;

3. Performance Class B or C aeroplanes:
   (i) The distance flown in 120 minutes at the one-engine-inoperative cruise speed determined in accordance with subparagraph (b) below; or
   (ii) 300 nautical miles, whichever is less.

(b) An operator shall determine a speed for the calculation of the maximum distance to an adequate aerodrome for each two-engine aeroplane type or variant operated, not exceeding V_{MO}, based upon the true airspeed that the aeroplane can maintain with one-engine-inoperative.

(c) An operator must ensure that the following data, specific to each type or variant, is included in the OM:

1. The one-engine-inoperative cruise speed determined in accordance with subparagraph (b) above; and

2. The maximum distance from an adequate aerodrome determined in accordance with subparagraphs (a) and (b) above.

Extended Range Operations with Twin-engine Aeroplanes (ETOPS)

Before an operator can conduct flights beyond the threshold distances stated for non-ETOPS operations, approval must be obtained from the Authority. This will be annotated on the AOC. It is also a requirement that the operator must maintain a reliability programme to monitor the equipment fitted to the aeroplane that is critical for ETOPS operations.

Before each ETOPS flight is conducted, the operator is to ensure that a suitable en route alternate aerodrome is available within either the approved diversion time, or a diversion time based on the MEL generated serviceability status of the aeroplane, whichever is shorter.

Establishment of Minimum Flight Altitudes

The operator is required to establish minimum flight altitudes for all route segments to be flown which require terrain clearance. The altitudes and the method of calculating must take into account the performance requirements of EU-OPS parts F - I.

The method of calculating the altitudes is to be approved by the Authority.

If the minimum altitude specified by a state is higher than that specified by the operator, the higher altitude is to be used.

When establishing the minimum flight altitude, the operator is to take into account:

- The position accuracy of the aeroplane.
- Inaccuracies in the operation of altimeters.
- The characteristics of the underlying terrain.
- The probability of encountering adverse weather (e.g. severe turbulence and descending air currents); and
- Inaccuracies in aeronautical charts.

When taking into account the points above, consideration is to be given to:

- Corrections for temperature and pressure variations from standard values.
- ATC requirements; and
- Any foreseeable contingencies along the planned route.

Fuel Policy

The operator is required to establish a fuel policy for flight planning and re-planning purposes to ensure that every flight carries sufficient fuel for the planned operation and reserves to cover deviations from the planned operation. The planning is to be based on procedures contained in the OM and the operating conditions under which the flight is to be conducted. This will use data provided by the aeroplane manufacturer, or current aeroplane specific data resulting from a fuel consumption monitoring system. Operating conditions will include realistic aeroplane fuel consumption, anticipated masses, expected meteorological conditions and airspace restrictions.

A commander shall only commence a flight or continue a flight in the event of in-flight re-planning, if satisfied that the aeroplane carries at least the planned amount of useable fuel (and oil) to complete the flight safely.

The pre-flight calculation of fuel required is to include taxi fuel, trip fuel, and reserve fuel consisting of:

- Contingency fuel.
- Alternate fuel.
- Final reserve fuel.
- Additional fuel if required by the type of operation (i.e. ETOPS) and,

Any extra fuel required by the commander.

In flight re-planning fuel calculation is to consider trip fuel for the remainder of the flight, reserve fuel consisting of:

- Contingency fuel.
- Alternate fuel.
- Final reserve fuel.

Any additional fuel reserve required by the commander.

Carriage of Persons with Reduced Mobility (PRMs)

PRMs are defined as those people whose mobility is restricted because of sensory or locomotory incapacity, intellectual deficiency, age, illness or any other reason resulting in the need for special attention and adaptation of the services normally provided to passengers. Operators are required to establish procedures for the carriage of PRMs such that they are not allocated or occupy seats where their presence would:

- Impede the crew in their duties.
- Obstruct access to emergency equipment.
- Impeded the emergency evacuation of the aeroplane.

The commander is to be notified when PRMs are to be carried on board. Generally, PRMs should not occupy seats adjacent to emergency exits and the number of PRMs should not exceed the number of able bodied persons capable of assisting with an emergency evacuation.

Carriage of Inadmissible Passengers, Deportees or Persons in Custody

Definitions:

- **Inadmissible Passenger.** A passenger carried in an aeroplane from a destination state to which the passenger did not have right of access (i.e. no visa, excluded from a visa waiver scheme, or no right of residence).

- **Deportee.** A person subject to judicial deportation (legally expelled) from a state to a state to which that person has right of access/residence.

- **Person In custody.** A person in the charge of a law enforcement officer being escorted from one state to another for judicial reasons.

Operators are required to establish procedures for the carriage of inadmissible passengers, deportees or persons in custody to ensure that the safety of the aeroplane and its occupants. The commander is to be notified when such persons are carried on board.

Where a passenger is found to be inadmissible, the operator will be required to return the person to the state of departure or to another state to which that person has right of access. Initially the operator will be required to bear the cost of transportation, but recover the cost from the person through a civil legal action. In practice, operators require passengers without visas or passengers who are not citizens of the state of departure or state of destination, to purchase return tickets. In some cases, the operator may decline to sell a ticket to a person who is potentially inadmissible.

Stowage of Baggage and Cargo and Galley Equipment

Operators are required to establish procedures for the stowage of baggage and cargo. The procedures are to ensure that hand baggage and cargo is adequately stowed and must take into account that:

- Each item carried in a cabin must be stowed in a location capable of retaining it.

- Mass limitation for stowages must not be exceeded.

- Under seat stowages must not be used unless the seat is equipped with a retaining bar and the baggage is of the correct size.

- Items must not be stowed in toilets or against bulkheads that are incapable of restraining articles moving forward, sideways or upwards. Where permitted, max mass must be adjacently placarded (stated on a notice).

- Baggage lockers must not be loaded so that the latched doors cannot be closed securely.

- Baggage and cargo must not be placed where it would impede an emergency evacuation.

Before take-off and landing, and whenever the “fasten seat belt” signs are illuminated, the commander is to ensure that baggage is stowed where it will not impede evacuation or cause injury by falling, and galley equipment is properly secured.

Passenger Seating

An operator shall establish procedures to ensure that passengers are seated where, in the event that an emergency evacuation is required, they may best assist and not hinder evacuation from the aeroplane.

Passenger Briefing

A briefing is to be given to all passengers before the flight commences. This can be delivered either verbally or by audio-visual means. A briefing card is also to be provided giving instructions for the use of emergency exits and emergency equipment. Additionally, the briefing before take-off is to cover:

- Smoking regulations.
- Seat position and tray stowage.
- Location of emergency exits.
- Location and use of floor escape path markings.
- Stowage of hand baggage.
- Restrictions on the use of portable electronic devices.
- Location and the content of the briefing card.

Passengers are to receive a demonstration of:

- Seat belt fastening and unfastening.
- Use of oxygen equipment.
- Location and use of life jackets (if required to be fitted).

After take-off passengers are to be reminded of the smoking regulations, the use of safety belts and the recommendation to use the seat belts at all times even though the seat belt light is not illuminated.

Before landing, further reminders are to be given concerning the smoking regulations, use of seat belts, seat and tray stowage, hand bag stowage and restrictions on the use of portable electronic equipment. Also after landing further reminders are to be given concerning smoking and the use of seat belts until the aircraft finally comes to rest.

In an emergency during flight, passengers are to be briefed and instructed as may be appropriate to the circumstances.

Flight Preparation

For each flight as part of the operation, an operational flight plan (OFP) is to be formulated. From this the ATC flight plan will be produced. The OFP will be the main briefing reference for the flight and cabin crew. It is usual for the OFP to be produced by the planning department but it must be signed by (and ownership transferred to) the commander.

Before commencing the flight, the commander is to satisfy him/herself that:

- The aeroplane is airworthy.

- The aeroplane will not be operated contrary to the provisions of the Configuration Deviation List (CDL).

- The instruments and equipment required (by subpart K of EU-OPS) are available (fitted and serviceable - except as permitted by the MEL).
- The necessary parts of the OM are available on board the aeroplane.
- The documents required by EU-OPS are on board the aeroplane.
- Current maps and charts (or equivalent data - current FMS database) are available to cover the flight including any diversion which may be anticipated. The documentation should include any necessary conversion tables e.g. height in feet to height in metres.
- Ground facilities and services are available and adequate.
- OM requirements concerning fuel, oil, oxygen, minimum safe altitudes, AOM and availability of diversion aerodromes can be complied with.
- The load is properly distributed and properly secured.
- The mass of the aeroplane at the start of the take-off roll will be such that the flight can be conducted in accordance with EU-OPS; and
- Any additional limitations required by the operator or the Authority can be complied with.

ATS Flight Plan

The operator is to ensure that an ATS flight plan is submitted (filed) or adequate information is communicated to the ATS Authority to allow the alerting service to be activated, for each flight. The ATS flight plan is produced and filed after the operational flight planning process has been completed.

Refuelling and De-fuelling

The refuelling of aeroplanes is not permitted with Avgas or wide cut fuels (e.g. Jet B - a mixture of gasoline and kerosene), when passengers are on board, embarking or disembarking. If other fuels are being used (e.g. Jet A1) then procedures are to be established to ensure that the aeroplane is properly manned by qualified personnel ready to initiate an immediate evacuation by the most expeditious means.

Crew Members at Duty Stations

Each member of the flight crew is to be at the designated duty station for take-off and landing. During all other phases of flight, each crew member is to remain alert and at the duty station, unless the duty in connection with the operation requires absence, or for physiological needs. At least one suitably qualified pilot is to be at the controls at all times.

If unexpected fatigue is experienced, the commander may authorize a rest period if workload permits (not to be included in flight time limitation considerations).

All cabin crew are to be seated at their assigned stations during critical phases of flight.

Seats, Safety Belts and Harnesses

Crew Members
Each crew member is to be properly secured by all safety belts and harnesses for take-off and landing and at any other time the commander deems necessary. During other phases of flight, each flight crew member is to keep the safety belt fastened when seated at the duty station.

Passengers
Each passenger is to occupy a seat and the seat belt (or harness) is to be properly fastened before take-off and landing, during taxiing and whenever deemed necessary in the interest of safety by the commander. Designated seats may be occupied by one adult and an infant if the infant is properly secured by a supplemental loop belt or other restraint.

Smoking

The commander is to prohibit smoking:

- Whenever deemed necessary in the interest of safety.
- While the aeroplane is on the ground (unless permitted in accordance with OM).
- Outside designated smoking areas, in the aisles and in the toilets.
- In cargo compartments or other areas where cargo is carried not stored in flame resistant containers; and
- In cabin areas where oxygen is being supplied.

Ice and Other Contaminants

The commander is not permitted to commence the take-off run unless all the surfaces of the aeroplane are clear of all deposits which might adversely affect the performance of the aeroplane. The operator is to establish procedures for the de-icing and anti-icing of aeroplanes.

Use of Supplemental Oxygen

The Commander is to ensure that all flight crew members performing essential duties use supplemental oxygen continuously whenever the cabin altitude exceeds 10 000 ft for a period in excess of 30 minutes, and at all times whenever the cabin altitude exceeds 13 000 ft.

Ground Proximity Detection

When undue proximity to the ground is detected by any flight crew member or warning system, the commander or pilot at the controls of the aeroplane is to take corrective action to establish a safe flight condition.

Occurrence Reporting

Accident and Serious Incident Reporting
An operator shall establish procedures for reporting accidents and serious incidents taking into account responsibilities described as follows.

1. A commander shall notify the operator of any accident or serious incident occurring while he/she was responsible for the flight. In the event that the commander is incapable of providing such notification, this task shall be undertaken by any other member of the crew if they are able to do so, note being taken of the succession of command specified by the operator.

2. An operator shall ensure that the Authority in the state of the operator, the nearest appropriate Authority (if not the Authority in the state of the operator), and any other organization required by the state of the operator to be informed, are notified by the quickest means available of any accident or serious incident and — in the case of accidents only — at least before the aeroplane is moved unless exceptional circumstances prevent this.

3. The commander or the operator of an aeroplane shall submit a report to the Authority in the state of the operator within 72 hours of the time when the accident or serious incident occurred.

Specific Reports.

Occurrences for which specific notification and reporting methods must be used are described below:

1. Air traffic incidents. A commander shall without delay notify the air traffic service unit concerned of the incident and shall inform them of his/her intention to submit an air traffic incident report after the flight has ended whenever an aircraft in flight has been endangered by:

   (i) a near collision with any other flying device;

   (ii) faulty air traffic procedures or lack of compliance with applicable procedures by air traffic services or by the flight crew;

   (iii) failure of air traffic services facilities.

In addition, the commander shall notify the Authority of the incident.

2. Airborne collision avoidance system (ACAS) resolution advisory (RA). A commander shall notify the air traffic service unit concerned and submit an ACAS report to the Authority whenever an aircraft in flight has manoeuvred in response to an ACAS RA.

3. Bird hazards and strikes

   (i) A commander shall immediately inform the local air traffic service unit whenever a potential bird hazard is observed.

   (ii) If he/she is aware that a bird strike has occurred, a commander shall submit a written bird strike report after landing to the Authority whenever an aircraft for which he/she is responsible suffers a bird strike that results in significant damage to the aircraft or the loss or malfunction of any essential service. If the bird strike is discovered when the commander is not available, the operator is responsible for submitting the report.

4. Dangerous goods incidents and accidents. An operator shall report dangerous goods incidents and accidents to the Authority and the appropriate Authority in the state where the accident or incident occurred. The first report shall be dispatched within 72 hours of the event unless exceptional circumstances prevent this and include the details that are known at that time. If necessary, a subsequent report must be made as soon as possible giving whatever additional information has been established.

5. Unlawful interference. Following an act of unlawful interference on board an aircraft, the commander or, in his/her absence, the operator shall submit a report, as soon as practicable to the local Authority and to the Authority in the state of the operator.

6. Encountering potential hazardous conditions. A commander shall notify the appropriate air traffic services unit as soon as practicable whenever a potentially hazardous condition such as an irregularity in a ground or navigational facility, a meteorological phenomenon or a volcanic ash cloud is encountered during flight.

Questions

1. How far from the aerodrome of departure can a take-off alternate be?

a. 2 hour flight time at the 1 engine cruise speed for a 4-engine aeroplane
b. 2 hours 40 for an ETOPS aircraft if its ETOPS limit is 2 hours 40
c. 1 hour flight time at the all engine cruise speed for a 2-engine aircraft
d. 2 hours flight time at the 1 engine inop cruise speed for a 3-engine aircraft

2. At time of departure what are the rules regarding aerodromes?

a. The destination aerodrome must be within limits for landing
b. ETOPS en route aerodromes must be VMC
c. Destination and destination alternate aerodromes must be forecast to be at or above minima at ETA
d. Departure aerodrome must be forecast to be in limits from 1 hour before to 1 hour after ETA

3. Is the commander of a commercial air transport aeroplane required to use ATC?

a. Only in class A airspace
b. Yes wherever it is available
c. Only if flying IFR
d. Only at aerodromes

4. When can a pilot deviate from a SID?

a. If in VMC
b. Once below MDH
c. Once above transition altitude
d. When cleared by Air Traffic

5. What are the requirements concerning special categories of passengers?

a. PRMs cannot sit next to emergency exits.
b. Inadmissible passengers cannot be carried on commercial air transport aircraft
c. The captain is to be informed when deportees are carried
d. Persons in custody are to be seated on the flight deck

6. What are the rules regarding the stowage of baggage and cargo?

a. The captain must physically check all baggage and cargo is secure before take-off
b. The senior cabin crew is responsible for ensuring it is secure
c. The flight despatcher must sign to say it is secure
d. The captain is responsible for ensuring it is secure

Answers

1	2	3	4	5	6
d	c	b	d	c	d

Chapter

5

All Weather Operations

Continued Overleaf

5 All Weather Operations

Introduction

In order to meet the requirements of the travelling public and freight operations, modern aeroplanes are required to be capable of operating in weather conditions that 25 years ago would not have been possible. The ability to accurately assess and forecast the weather conditions for the aerodromes to be used and the availability of high precision electronic systems capable of providing extremely accurate guidance in both azimuth and elevation, make present day commercial aviation virtually oblivious to the weather.

Whilst it would appear to be technically possible to carry out a completely blind take-off and landing, other considerations need to be taken into account. For instance, it is no good being able to land an aeroplane with zero visibility if the pilot then cannot safely manoeuvre the aeroplane off the runway to the parking stand! Also, not all aerodromes have the same high degree of sophistication with respect to facilities as say London Heathrow. In order to create a framework within which operations specifically in poor visibility can safely be conducted, EU-OPS 1 specifies criteria for Low Visibility Operations with respect to take-off and landing. The criteria is explained and detailed in this chapter.

Aerodrome Operating Minima: Operator's Responsibility

An operator shall establish, for each aerodrome planned to be used, aerodrome operating minima that are not lower than the values given in EU-OPS 1. These are reproduced in this chapter and are required learning. The method of determination of the minima must be acceptable to the Authority. The minima shall not be lower than any that may be established for aerodromes by the State in which the aerodrome is located, except when specifically approved by that State. The use of head-up display (HUD), head-up display landing system (HUDLS) or enhanced vision system (EVS) may allow operations with lower visibilities than normally associated with the aerodrome operating minima (AOM).

Note: *The above paragraph does not prohibit in-flight calculation of minima for a non-planned alternate aerodrome if carried out in accordance with an accepted method.*

In establishing the aerodrome operating minima which will apply to any particular operation, an operator must take full account of:

- The type, performance and handling characteristics of the aeroplane.
- The composition of the flight crew, their competence and experience.
- The dimensions and characteristics of the runways which may be selected for use.
- The adequacy and performance of the available visual and non-visual ground aids.
- The equipment available on the aeroplane for the purpose of navigation and/or control of the flight path, as appropriate, during the take-off, the approach, the flare, the landing, roll-out and the missed approach.
- The obstacles in the approach, missed approach and the climb-out areas required for the execution of contingency procedures and necessary clearance.
- The obstacle clearance altitude/height for the instrument approach procedures.
- The means to determine and report meteorological conditions; and
- The flight technique to be used during the final approach.

In categorizing aeroplanes for the determination of operating minima, the indicated airspeed at threshold (V_{AT}) is calculated as below. All approaches shall be flown as stabilized approaches (SAp) unless otherwise approved by the Authority for a particular approach to a particular runway. All non-precision approaches shall be flown using the continuous descent final approach (CDFA) technique unless otherwise approved by the Authority for a particular approach to a particular runway.

Classification of Aeroplanes

The criteria taken into consideration for the classification of aeroplanes by categories is the indicated airspeed at threshold (V_{AT}), which is equal to the stalling speed in the landing configuration (V_{SO}) multiplied by 1.3, or the 1g stall speed (V_{S1g}) multiplied by 1.23, at the maximum certified landing mass. If V_{SO} and V_{S1g} are available, the higher resulting V_{AT} shall be used. The aeroplane categories corresponding to V_{AT} values are in the *Figure 5.1*:

Aeroplane Category	V_{AT}
A	Less than 91 kt
B	From 91 to 120 kt
C	From 121 to 140 kt
D	From 141 to 165 kt
E	From 166 to 210 kt

Figure 5.1 Aircraft category

Low Visibility Operations - General Operating Rules

Low visibility operations consist of:

- Manual take-off (with or without electronic guidance or HUDLS/Hybrid HUD/HUDLS).
- Autocoupled approach to below DH, with manual flare, landing and roll-out.
- Autocoupled approach followed by autoflare, autolanding and manual roll-out.
- Autocoupled approach followed by autoflare, autolanding and auto roll-out when the applicable RVR is less than 400 m.
- Approach flown with the use of a HUDLS/Hybrid HUD/HUDLS and/or EVS.

The precise nature and scope of procedures and instructions given depend upon the airborne equipment used and the flight deck procedures followed. An operator must clearly define flight crew member duties during take-off, approach, flare, roll-out and missed approach in the OM. Particular emphasis must be placed on flight crew responsibilities during transition from non-visual conditions to visual conditions, and on the procedures to be used in deteriorating visibility or when failures occur. Special attention must be paid to the distribution of flight deck duties so as to ensure that the workload of the pilot making the decision to land or execute a missed approach enables him to devote himself to supervision and the decision making process.

The detailed operating procedures and instructions must be specified in the OM. The instructions must be compatible with the limitations and mandatory procedures contained in the AFM and cover the following:

- Checks for the satisfactory functioning of equipment both before departure and in flight.
- Effects on minima caused by changes in the status of the ground installations and airborne equipment.
- Procedures for the take-off, approach, flare, landing, roll-out and missed approach.
- Procedures to be followed in the event of failures, warnings to include HUD/HUDLS/EVS and other non-normal situations.
- The minimum visual reference required.
- The importance of correct seating and eye position.
- Action that may be necessary from the deterioration of visual reference.
- The requirement for all height calls below 200 ft to be based on rad alt and for one pilot to continue to monitor the aeroplane instruments until the landing is complete.
- The requirements for the ILS localizer sensitive area to be protected.
- The information used relating to wind velocity; windshear; turbulence; runway contamination and the use of multiple RVR assessments.
- Procedures to be used for

  (A) lower than Standard Category I;
  (B) other than Standard Category II;
  (C) approaches utilizing EVS; and
  (D) practice approaches and landing on runways at which the full Category II or Category III aerodrome procedures are not in force.

- Operating limitations resulting from airworthiness certification.
- Information on the maximum deviation allowed from the ILS glide path or localizer; and
- Allocation of crew duties in the carrying out of the procedures above, to allow the Commander to devote himself/herself mainly to supervision and decision making;

An operator shall not conduct Category II and III operations unless:

- Each aeroplane is certificated for operations with DH below 200 ft, or no DH, and equipped in accordance with CS-AWO or an equivalent accepted by the Authority.
- A suitable system for recording approach and/or automatic landing success and failure is established and maintained to monitor the overall safety of the operation.
- The operations are approved by the Authority.
- The flight crew consists of at least two pilots; and
- DH is determined by a radio altimeter.

An operator shall not conduct low visibility take-offs in less than 150 m RVR (Category A B and C aeroplanes) or 200 m (category D) unless approved by the Authority.

Terminology

The following terms used in this chapter are defined as follows:

- **Circling**: The visual phase of an instrument approach to bring an aeroplane into a position for landing on a runway which is not suitably located for a straight-in approach.

- **Low Visibility Procedures (LVP).** Procedures applied at an aerodrome for the purpose of ensuring safe operations during Lower than Standard Category I, Other than Standard Category II, Category II and III approaches and low visibility take-offs.

- **Low Visibility Take-off (LVTO)**: A take-off where the RVR is less than 400 m.

- **Flight Control System**: A system which includes an automatic landing system and/or a hybrid landing system.

- **Fail-passive Flight Control System**: A flight control system is fail-passive if, in the event of a failure, there is no significant out-of-trim condition or deviation of flight path or attitude but the landing is not completed automatically. For a fail-passive flight control system, the pilot assumes control of the aeroplane after a failure.

- **Fail-operational Flight Control System**: A flight control system is fail-operational if, in the event of a failure below alert height, the approach, flare and landing, can be completed automatically. In the event of a failure, the automatic landing system will operate as a fail-passive system.

- **Fail-operational Hybrid landing system**: A system which consists of primary fail-passive automatic landing system and a secondary independent guidance system enabling the pilot to complete a landing manually after a primary system failure.

- **Visual Approach**: An approach when either part or all of an instrument approach procedure is not completed and the approach is executed with visual reference to the terrain.

- **Continuous Descent Final Approach (CDFA).** A specific technique for flying the final-approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the Final Approach Fix altitude / height to a point approximately 15 m (50 feet) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aeroplane flown.

- **Stabilized Approach (SAp).** An approach which is flown in a controlled and appropriate manner in terms of configuration, energy and control of the flight path from a pre-determined point or altitude/height down to a point 50 feet above the threshold or the point where the flare manoeuvre is initiated if higher.

- **Head-up Display (HUD).** A display system which presents flight information into the pilot's forward external field of view and which does not significantly restrict the external view.

- **Head-up Display Landing System (HUDLS).** The total airborne system which provides head-up guidance to the pilot during the approach and landing and/or go-around. It includes all sensors, computers, power supplies, indications and controls. A HUDLS is typically used for primary approach guidance to decision heights of 50 ft.

- **Hybrid Head-up Display Landing System (hybrid HUDLS)**. A system which consists of a primary fail-passive automatic landing system and a secondary independent HUD/HUDLS enabling the pilot to complete a landing manually after failure of the primary system.

  Note: *Typically, the secondary independent HUD/HUDLS provides guidance which normally takes the form of command information, but it may alternatively be situation (or deviation) information.*

- **Enhanced Vision System (EVS)**. An electronic means of displaying a real time image of the external scene through the use of imaging sensors.

Take-off Minima

The following general considerations are to be complied with:

- The take-off minima established by the operator must be expressed as visibility or RVR limits, taking into account all relevant factors for each aerodrome planned to be used and the aeroplane 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) must be specified.
- The Commander shall not commence take-off unless the weather conditions at the aerodrome of departure are equal to or better than applicable minima for landing at that aerodrome unless a suitable take-off alternate aerodrome is available.
- When the reported meteorological visibility is below that required for take-off and RVR is not reported, a take-off may only be commenced if the Commander can determine that the RVR/visibility along the take- off runway is equal to or better than the required minimum.
- When no reported meteorological visibility or RVR is available, a take-off may only be commenced if the Commander can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.

Visual Reference

The take-off minima must be selected to ensure sufficient guidance to control the aeroplane in the event of both a discontinued take-off in adverse circumstances and a continued take-off after failure of the critical power unit.

Required RVR/Visibility

For multi-engine aeroplanes, whose performance is such that, in the event of a critical power unit failure at any point during take-off, the aeroplane can either stop or continue the take-off to a height of 1500 ft above the aerodrome while clearing obstacles by the required margins, the take-off minima established by an operator must be expressed as RVR/visibility values not lower that those given in the *Figure 5.2*:

Take-off RVR/Visibility	
Facilities	**RVR/Visibility (note 3)**
Nil (day only)	500 m
Runway edge lighting and/or centre line marking	250/300 m (notes 1 and 2)
Runway edge and centre line lighting	200/250 m (note 1)
Runway edge and centre line lighting and multiple RVR information	150/200 m (notes 1 and 4)

Figure 5.2 Take-off RVR/visibility requirements

Notes:

1. *The higher values apply to category D aeroplanes*
2. *For night operations at least runway edge and runway end lights are required*
3. *The reported RVR/visibility value representative of the initial part of the take-off run can be replaced by pilot assessment.*
4. *The required RVR value must be achieved for all of the relevant RVR reporting points except as note 3 above.*

For multi-engine aeroplanes whose performance is such that they cannot comply with the above performance conditions in the event of a critical power unit failure, there may be a need to re-land immediately and to see and avoid obstacles in the take-off area. Such aeroplanes may be operated to the following take-off minima provided they are able to comply with the applicable obstacle clearance criteria, assuming engine failure at the height specified. The take-off minima established by an operator must be based upon the height from which the one engine inoperative net take-off flight path can be constructed. The RVR minima used may not be lower than either of the values given in the *Figures 5.2 or 5.3*.

When reported RVR or met visibility is not available, the Commander shall not commence the take-off run unless it can be determined that the actual conditions satisfy the applicable take-off minima.

Take-off RVR/Visibility - flight path	
Assumed engine failure height above the runway	**RVR/Visibility (note 2)**
< 50 ft	200 m
51 - 100 ft	300 m
101 - 150 ft	400 m
151 - 200 ft	500 m
201 - 300 ft	1000 m
> 300 ft	1500 m (note 1)

Figure 5.3 Take-off RVR/visibility - flight path.

Notes:
1. 1500 m is also applicable if no positive take-off flight path can be constructed
2. The reported RVR/visibility value representative of the initial part of the take-off run can be replaced by pilot assessment

Figure 5.2 Exceptions

When approved by the Authority, an operator may reduce the take-off minima to **125 m** RVR for Cat A, B and C aeroplanes, or **150 m** for cat D providing the conditions specified below are complied with:

- Low visibility procedures are in force.
- High intensity runway centre line lights spaced at 15 m or less, and high intensity edge lights spaced at 60 m or less are in operation.
- Flight crew members have satisfactorily completed training in a flight simulator.
- A 90 m visual segment is available from the flight deck at the start of the take-off run.

  and
- The required RVR value has been achieved for all the relevant reporting points.

Additionally, subject to approval by the Authority, an operator of an aeroplane using an approved lateral guidance system or an approved HUD/HUDLS for take-off may reduce the take-off minima to an RVR less than **125 m** for Cat A, B and C, or **150 m** for Cat D but not lower than **75 m**, provided runway protection and facilities equivalent to Category III landing operations are available.

Low Visibility Ops - Aerodrome Considerations

An operator shall not use an aerodrome for Category II and III operations unless the aerodrome is approved for such operations by the State in which the aerodrome is situated. An operator shall verify that Low Visibility Procedures (LVP) have been established and will be enforced at those aerodromes where LV ops are to be conducted.

Low Visibility Ops - Training and Qualifications

An operator shall ensure that prior to conducting LV take-off, Category II and III operations or approaches utilizing EVS:

- Each flight crew member completes training and checking prescribed including flight simulator training in operating to the limiting values of RVR and DH appropriate to the operator's CAT II/III approval; and is qualified to the prescribed standard.
- The training and checking is to be conducted in accordance with a detailed syllabus approved by the Authority and included in the OM. This training is in addition to all other prescribed training.
- The flight crew qualification is to be specific for the type of aeroplane and the operation.
- Training, checking and qualification requirements are as prescribed in EU-OPS 1.

Low Visibility Ops - Operating Procedures

An operator must establish procedures and instructions to be used for low visibility take-off, approaches utilizing EVS, Lower than Standard Category I, Other than Standard Category II, Category II and III operations. These procedures must be included in the OM and contain the duties of the crew members during taxiing, take-off, approach, flare, landing, roll-out and missed approach as appropriate. The Commander must be satisfied that:

- The status of the visual and non-visual facilities is sufficient prior to commencing a LV take-off or Cat II/III approach.
- Appropriate LV procedures are in force according to information received from ATC before commencing a LV take-off or Cat II/III approach.
- The flight crew members are properly qualified prior to commencing a LV take-off in RVR of less than 150 m (Cat A, B and C aeroplanes) or 200 m (Cat D) or Cat II/III approaches.

Low Visibility Ops - Minimum Equipment

An operator must ensure that the OM contains the minimum equipment that has to be serviceable before low vis procedures can be commenced. The Commander is to be satisfied that the status of the aeroplane and the airborne systems is appropriate for the specific operation to be conducted.

System Minima

Definition: Height derived for the lowest permitted DH or MDH taking into account the characteristics of the ground and airborne equipment. System minima are related to the type of approach and are standard figures for precision and non-precision approaches.

Non-precision Approach

An operator must ensure that system minima for non-precision approach procedures, which are based upon the use of ILS without glidepath (LLZ only), VOR, NDB, SRA, and VDF are not lower than the MDH values given in *Figure 5.4*.

System minima	
Facility	**Lowest MDH**
Localiser with or without DME	250 ft
SRA terminating at 0.5 NM	250 ft
SRA terminating at 1 NM	300 ft
SRA terminating at 2 NM	350 ft
VOR	300 ft
VOR/DME	250 ft
NDB	350 ft
VDF (QDM and QGH)	350 ft
NDB/DME	300 ft
RNAV/LNAV	300 ft

Figure 5.4 Non-precision system minima

Minimum Descent Height

An operator must ensure that the minimum descent height for a non-precision approach is not lower than either the OCH/OCL for the category of aeroplane; or the system minimum. MDH (and OCH) are based on the aerodrome elevation, which is a specified point on the aerodrome, often just in front of the tower. Since runways often have a slight gradient (slope) the elevation of the thresholds of runways could be considerably higher, or lower than the stated elevation of the airfield. If the threshold elevation is 2 metres or more BELOW the threshold of the airfield, MDH is measured from the threshold rather than the airfield.

Visual Reference

A pilot may not continue an approach below MDA/MDH unless at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

- Elements of the approach light system.
- The threshold.
- The threshold markings.
- The threshold lights.
- The threshold identification lights.
- The visual glide slope indicator.
- The touchdown zone or touchdown zone markings.
- The touchdown zone lights.
- Runway edge lights, or
- Other visual references accepted by the Authority.

Required RVR

A non-precision approach (NPA) operation is an instrument approach using any of the facilities described in *Figure 5.4* (System minima), with an MDH or DH not lower than 250 ft and an RVR/CMV of not less than 750 m, unless accepted by the Authority. An APV operation is an instrument approach which utilizes lateral and vertical guidance, but does not meet the requirements established for precision approach and landing operations, with a DH not lower than 250 ft and a runway visual range of not less than 600 m unless approved by the Authority. RVR for approaches must be greater than minima at the threshold. (For take-off, all 3 RVR must be within limits)

Precision Approach - Category I Operations

A Category I operation is a precision instrument approach and landing using ILS, MLS, GLS (GNSS/GBAS) or PAR and with an RVR not less than 550 m unless accepted by the Authority. An operator must ensure that the decision height to be used for a Category I precision approach is not lower than:

- The minimum decision height specified in the AFM if stated.
- The minimum height at which the precision approach aid can be used without the required visual reference.
- The OCH/OCL for the category of aeroplane; or
- 200 ft.

A pilot may not continue an approach below the Category I decision height, unless at least one of the visual references listed above is visible.

Minimum RVR /CMV/visibility for Category I, APV and non-precision approaches can be derived from the following formula;

Required RVR/visibility (m) = [(DH/MDH (ft) × 0.3048)/tan α] – length of approach lights (m)

Note 1*: α is the calculation angle, being a default value of 3° increasing in steps.*

This means that RVR is dependent upon the actual DH/MDH, and the lighting facilities available at the aerodrome. However, unless authorized by the Authority, the lowest RVR for a Cat I Approach is 550 m. When authorized (Lower than Standard Cat I) the absolute minimum RVR, depending on the class of lighting facility, can be 400 m

For single-pilot operations, an operator must calculate the minimum RVR for all approaches in accordance with the appropriate tables found in EU-OPS. (These tables are not required knowledge for students.) However, for single pilot operations, the minimum RVR is 800 m, except when using a suitable autopilot coupled to an ILS or MLS, or an approved HUDLS (including EVS), in which case normal minima apply.

Precision Approach - Category II Operations

A Category II operation is a precision instrument approach and landing using ILS or MLS with:

- Decision height below 200 ft but not lower than 100 ft; and
- Runway visual range of not less than 300 m.

An operator must ensure that the decision height for a Category II operation is not lower than:

- The minimum decision height specified in the AFM, if stated.
- The minimum height to which the precision approach aid can be used without the required visual reference.
- The OCH/OCL for the category of aeroplane.
- The decision height to which the flight crew is authorized to operate, or
- 100 ft.

A pilot may not continue an approach below the Category II decision height unless visual reference containing a segment of at least 3 consecutive lights being the centre line of the approach lights, or touchdown zone lights, or runway centre line lights, or runway edge lights, or combination of these is attained and can be maintained. This visual reference must include a lateral element of the ground pattern, i.e. an approach lighting crossbar or the landing threshold or a barette of the touchdown zone lighting unless the operation is conducted utilising an approved HUDLS to touchdown.

The lowest minima to be used by an operator for Category II operations are:

Category II minima		
Decision Height	**Autocoupled/Approved HUDLS to below DH (note 1)**	
	RVR (Category A, B, C)	**RVR Category D**
100 - 120 ft	300 m	300 m (note 2) / 350 m
121 - 140 ft	400 m	400 m
141 ft and above	450 m	450 m

Figure 5.5: RVR for Cat II approach vs DH.

Notes:

1. *This reference to 'autocoupled to below DH/Approved HUDLS' in this table means continued use of the automatic flight control system down to a height which is not greater than 80% of the applicable DH. Thus airworthiness requirements may, through minimum engagement height for the automatic flight control system, affect the DH to be applied.*
2. *300 m may be used for a Category D aeroplane conducting an autoland.*

Precision Approach - Category III Operations

Category III operations are subdivided as follows:

- Category III A operations: A precision instrument approach and landing using ILS or MLS with decision height lower than 100 ft; and runway visual range not less than 200 m.
- Category III B operations: A precision instrument approach and landing using ILS or MLS with decision height lower than 50 ft, or no decision height; and runway visual range lower than 200 m but not less than 75 m.
- Category III C operations: A precision instrument approach and landing using ILS or MLS with no decision height and no runway visual range requirements.

Note: *Where the DH and the RVR do not fall within the same Category, the RVR will determine in which Category the operation is to be considered.*

For operations in which decision height is used, an operator must ensure that the decision height is not lower than:

- The minimum decision height specified in the AFM, if stated.
- The minimum height to which the precision approach aid can be used without the required visual reference; or
- The decision height to which the flight crew is authorized to operate.

No Decision Height Operations

Operations with no decision height may only be conducted if:

- The operation with no decision height is authorized in the AFM.
- The approach aid and the aerodrome facilities can support operations with no decision height; and
- The operator has an approval for CAT III operations with no decision height.

Note: *In the case of a CAT III runway it may be assumed that operations with no decision height can be supported unless specifically restricted as published in the AIP or NOTAM.*

Visual Reference

For Category IIIA and Category IIIB operations conducted either with fail passive flight control systems, or with the use of an approved HUDLS, a pilot may not continue an approach below decision height unless a visual reference containing a segment of at least 3 consecutive lights being the centre line of the approach lights, or touchdown zone lights, or runway centre line lights or runway edge lights, or a combination of these is attained and can be maintained.

For Category IIIB operations with fail-operational flight control systems using a decision height, a pilot may not continue an approach below decision height, unless a visual reference containing at least one centre line light is attained and can be maintained.

For Category III operations with no decision height there is no requirement for visual contact with the runway prior to touchdown.

Category III RVR Requirements

The lowest minima to be used by an operator for Category III operations are:

Category III minima			
Approach Category	**Decision Height (ft)**	**Roll-out Control/ Guidance System**	**RVR (m)**
IIIA	Less than 100 ft	Not required	200 m
IIIB	Less than 100 ft	Fail-passive	150 m
IIIB	Less than 50 ft	Fail-passive	125 m
IIIB	Less than 50 ft or no DH	Fail-operational	75 m

Figure 5.6: RVR for Cat III approach vs DH & roll-out

Circling

An option will always be available to make an instrument approach to one runway and then carry out a circling manoeuvre to land on another runway more suitably into wind or to meet ATC requirements. This is called Visual Manoeuvring Circling (VM(C)) and is covered in detail in Air Law (010). The instrument approach will terminate at the defined MDH for (VM(C)) and this will be maintained throughout the circling manoeuvre until established on visual final for the landing runway. EU-OPS 1 defines visibility for (VM(C)) as defined in *Figure 5.7*. These figures are different from the requirements of Annex 6.

	Aeroplane Category			
	A	**B**	**C**	**D**
MDH	400 ft	500 ft	600 ft	700 ft
Minimum Met Visibility	1500 m	1600 m	2400 m	3600 m

Figure 5.7: Visibility & MDH for circling vs aeroplane category

Visual Approach

A visual approach is defined as an IFR approach completed with visual reference to terrain. There is no requirement for the pilot to see the aerodrome of the landing runway at the commencement of the approach, however, the pilot must be capable of navigating the aeroplane with reference to the underlying terrain. EU-OPS 1 states that an operator is not to conduct visual approaches when the RVR is less than 800 m.

VFR Operating Minima

An operator is to ensure that VFR flights are conducted in accordance with the visual flight rules and in meteorological conditions shown below.

Airspace Class	A B C D E (Note 1)	F G	
		Above 900 m (3000 ft) AMSL or above 300 m (1000 ft) AGL whichever is the higher	At and below 900 m (3000 ft) AMSL or 300 m (1000 ft) AGL whichever is the higher
Distance from cloud	1500 m horizontally 300 m (1000 ft) vertically		Clear of cloud and in sight of the surface (CCISG)
Flight visibility	8 km at and above 3050 m (10 000 ft) AMSL (note 2) 5 km below 3050 m (10 000 ft) AMSL		5 km (note 3)

Figure 5.8: VMC criteria

Notes:

Note 1: *VMC minima for Class A airspace are included for guidance but do not imply acceptance of VFR Flights in Class A airspace*

Note 2: *When the height of the transition altitude is lower than 3050 m (10 000 ft) AMSL, FL100 should be used in lieu of 10 000 ft.*

Note 3: *Cat A and B aeroplanes may be operated in flight visibilities down to 3000 m, provided the appropriate ATS Authority permits use of a flight visibility less than 5 km, and the circumstances are such, that the probability of encounters with other traffic is low, and the IAS is 140 kt or less.*

Special VFR

Special VFR flights are not to be commenced when the visibility (flight or ground) is less than 3 km and not otherwise conducted when the flight visibility is less than 1.5 km.

Note: *The criteria defined in ICAO Annex 6 is slightly different*

Questions

1. **What is the speed range for a category C aeroplane?**

   a. Up to 90 kt
   b. 91-120 kt
   c. 121-140 kt
   d. 141-165 kt

2. **What constitutes Low Vis Procedures?**

   a. RVR less than 400 m
   b. Precision approaches
   c. Low Vis Take-off and Cat II/III approaches
   d. Low Vis Take-off and precision approaches

3. **What is the minimum RVR for a Cat D aircraft taking off from an aerodrome with full facilities and multiple RVR information?**

   a. 200 m
   b. 150 m
   c. 125 m
   d. 400 m

4. **What is the system minima for an SRA approach terminating at 2 miles?**

   a. 250 ft
   b. 300 ft
   c. 350 ft
   d. 400 ft

5. **Unless otherwise cleared, what is the minimum RVR for a non-precision approach?**

   a. 700 m
   b. 750 m
   c. 800 m
   d. 850 m

6. **What is the system minima for a Cat I approach manually flown by a single pilot?**

   a. 200 ft/550 m
   b. 200 ft/800 m
   c. 100 ft/350 m
   d. 100 ft/550 m

7. **What is the minimum met vis for a cat B aircraft on a circling approach where the aerodrome stipulates a minimum circling height of 900 ft?**

   a. 1500 m
   b. 1600 m
   c. 2400 m
   d. 3600 m

8. For VFR flight (in a cat C aircraft) what is the minimum horizontal visibility below 10 000 ft?

a. 8 km
b. 5 km
c. 1500 m
d. 300 m

Answers

1	2	3	4	5	6	7	8
c	c	a	c	b	b	b	b

Chapter

6

Aeroplane Equipment and Instruments

Continued Overleaf

1 Aeroplane Equipment and Instruments

Introduction

In addition to the minimum equipment necessary for the issue of a CofA, the instruments, equipment and flight documents fitted to or carried in the aeroplane have to be adequate for the operation. As we have already seen, the operator includes the MEL, in the OM which allows the Commander to decide if a flight may be commenced or continued from any intermediate stop if any instrument, item of equipment or system becomes unserviceable. Additionally, the operator provides operations staff and flight crew with an aircraft operating manual, for each aircraft type operated, which contains the normal, abnormal and emergency procedures relating to the operation of the aircraft. The manual also includes details of the aircraft systems and of the checklists to be used.

Basic Requirements

An aeroplane has to be equipped with instruments to allow the flight crew to control the flight path of the aeroplane, carry out any required procedural manoeuvres, and comply with the operating limitations of the aeroplane in the expected operating conditions. Other equipment carried in the aeroplane is required for either safety, navigation or regulatory reasons.

Internal Doors and Curtains

The requirements for the security of the flight deck have already been discussed, but EU-OPS has additional requirements concerning doors and curtains. All aeroplanes with more than 19 passenger seats are required to have a lockable door between the passenger compartment and the flight deck. The door is to have a notice on it stating that entry is only permitted to crew members. Where a compartment not usually occupied by passengers has an emergency exit, the door leading from the passenger compartment to that area is to have an openable door. If passage through a doorway is required in the event of an emergency, the door (or curtain) is to have a means of securing it in the open position. Such doors (or curtains) are to have signs attached indicating that the doorway must be secured open for take-off and landing. The crew must have means of unlocking any door that can be locked by passengers (toilet doors).

First Aid Kits

EU-OPS requires an aeroplane to be equipped with accessible and adequate medical supplies (first aid kits) commensurate with the number of passengers the aeroplane is authorized to carry. The kits are required to be inspected regularly and replenished as necessary. Additionally, Annex 6 and EU-OPS require the carriage of an emergency medical kit, for the use of doctors or other qualified persons, for treating in-flight medical emergencies in aeroplanes authorized to carry more than 30 passengers, if the flight is 60 minutes or more from qualified medical assistance. The emergency medical kit must be dust and moisture proof and must be carried under security conditions, preferably on the flight deck.

Passengers	First Aid Kits
0 - 99	1
100 - 199	2
200 - 299	3
300 or more	4

Figure 1.1: First aid kit requirement

First Aid Oxygen

(a) An operator shall not operate a pressurized aeroplane at altitudes above 25 000 ft, when a cabin crew member is required to be carried, unless it is equipped with a supply of **undiluted** oxygen for passengers who, for physiological reasons, might require oxygen following a cabin depressurization. The amount of oxygen shall be calculated using an average flow rate of at least three litres standard temperature pressure dry(STPD)/minute/person and shall be sufficient for the remainder of the flight after cabin depressurization when the cabin altitude exceeds 8000 ft but does not exceed 15 000 ft, for at least 2% of the passengers carried, but in no case for less than one person. There shall be a sufficient number of dispensing units, but in no case less than two, with a means for cabin crew to use the supply. The dispensing units may be of a portable type.

(b) The amount of first aid oxygen required for a particular operation shall be determined on the basis of cabin pressure altitudes and flight duration, consistent with the operating procedures established for each operation and route.

(c) The oxygen equipment provided shall be capable of generating a mass flow to each user of at least four litres per minute, STPD. Means may be provided to decrease the flow to not less than two litres per minute, STPD, at any altitude.

Break-in Markings

Areas of the fuselage suitable for break-in by rescue crews in an emergency are to be marked by red or yellow lines, and if necessary they are outlined in white to contrast with the background. If the corner markings are more than 2 m apart, intermediate lines 9 cm × 3 cm are inserted so that there is no more than 2 m between adjacent markings.

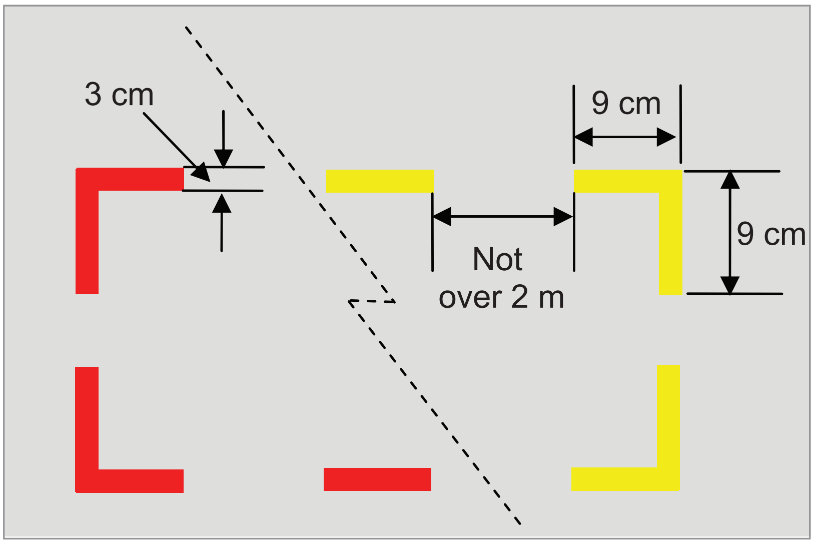


Figure 1.2 Break-in markings

Means of Emergency Evacuation

Where the sill height of an emergency exit is more than 1.83 m (6 ft) above the ground with the landing gear extended, or 1.83 m above the ground after an undercarriage collapse, the exit is to be fitted with a means to enable passengers and crew to reach the ground safely in an emergency. The device need not be fitted to over wing exits if the exit route terminates at a point less than 1.83 m above the ground. If required, a separate flight crew emergency exit is to be equipped with a similar device if the exit is more than 1.83 m above the ground.

Cockpit Voice Recorders (CVRs)

There are many instances when the transcript of communications to and from the aeroplane or between crew members offers vital evidence to what happened during an incident or before an accident. In order to assist investigations CVRs are required to be carried and operated at all times in aircraft involved in CAT. EU-OPS requires the carriage of a CVR in specific aeroplanes.

There are 3 cases:

Case 1: Multi-engine turbine aircraft issued with a CofA on or after 1 April 1998 and a max passenger seating capacity of more than 9, the CVR must record at least the last 30 minutes. For any aircraft (turbine or piston) registered after this date with MTOM in excess of 5700 kg, the recording limit is extended to 2 hours.

Case 2: Multi-engine turbine aircraft with a CofA issued between 1 Jan 1990 and 31 Mar 1998 and a max passenger seating capacity of more than 9. The recorder must record at least the last 30 minutes.

Case 3: Any aircraft with a CofA issued before 1 April 1998 with a MTOM greater than 5700 kg, the recorder must record for at least the last 30 minutes.

Summary

All aeroplanes > 5700 kg MTOM. (Case 3)

From 1 Jan 1990 rule expanded to include multi-engine turbine powered aeroplanes, < 5700 kg MTOM but > 9 passenger seats. (Case 2)

From 1 April 1998 recording time increase to 2 hours for aeroplanes over 5700 kg MTOM.

CVRs – Operation, Construction and Installation

CVRs have to be constructed, located and installed so as to provide maximum practical protection for the recordings in order that the recorded information can be preserved, recovered and transcribed. Flight recorders must meet the prescribed crashworthiness and fire protection specifications, and are required to have a device fitted to assist underwater location. CVRs are required to switch on automatically prior to the aeroplane first moving under its own power, and continue to record until the termination of the flight.

Flight Data Recorders (FDRs)

FDRs are more commonly referred to as the 'black box' although they are usually painted a Day-Glo colour (either red or yellow) and have underwater location devices fitted. They are required to be capable of recording data pertaining to the operation of the aeroplane systems, control positions, and performance parameters. As with CVRs they are required to assist in the investigation of accidents and incidents.

For Classification

Flight Data Recorders - 1

a. An operator shall not operate any aeroplane first issued with an individual CofA on or after 1 April 1998 which:

1. Is multi-engine turbine powered and has a maximum approved passenger seating configuration of more than 9,

   or

2. Has a maximum certificated take-off mass over 5700 kg, unless it is equipped with a flight data recorder that uses a digital method of recording and storing data and a method of readily retrieving that data from the storage medium is available.

b. The flight data recorder shall be capable of retaining the data recorded during at least the last 25 hours of its operation except that, for those aeroplanes with a maximum certificated take-off mass of 5700 kg or less, this period may be reduced to 10 hours.

Flight Data Recorders - 2

a. An operator shall not operate any aeroplane first issued with an individual CofA on or after 1 June 1990 up to 31 March 1998 with a maximum certificated take-off mass over 5700 kg unless it is equipped with a flight data recorder that uses a digital method of recording and storing data and a method of readily retrieving that data from the storage medium is available.

b. The flight data recorder shall be capable of retaining the data recorded during at least the last 25 hours of its operation.

Flight Data Recorders - 3

a. An operator shall not operate any turbine-engined aeroplane first issued with an individual CofA, before 1 June 1990 which has a maximum certificated take-off mass over 5700 kg unless it is equipped with a flight data recorder that uses a digital method of recording and storing data and a method of readily retrieving that data from the storage medium is available.

b. The flight data recorder shall be capable of retaining the data recorded during at least the last 25 hours of operation.

Summary

Turbine powered aeroplanes >5700 kg MTOM (Case 3)

After 1 June 1990 this was expanded to include all aeroplanes >5700 kg MTOM (Case 2)

After 1 April 1998 rule was further extended to include turbine powered aeroplanes MTOM less than 5700 kg, but with more than 9 passenger seats. However on these aircraft the recording time can be reduced to 10 hours.

Equipment for Compliance with Flight Rules

When an aircraft is operated under VFR it is assumed that the aeroplane can be navigated visually. Flight under IFR on the other hand, requires the use of radio navigation aids and more sophisticated instrumentation. All aeroplanes operated under VFR during the day are to be equipped with:

(a) A magnetic compass;

(b) An accurate timepiece showing the time in hours, minutes, and seconds;

(c) A sensitive pressure altimeter calibrated in feet with a subscale setting, calibrated in hectopascals/millibars, adjustable for any barometric pressure likely to be set during flight;

(d) An airspeed indicator calibrated in knots;

(e) A vertical speed indicator;

(f) A turn and slip indicator, or a turn coordinator incorporating a slip indicator;

(g) An attitude indicator;

(h) A stabilized direction indicator; and

(i) A means of indicating in the flight crew compartment the outside air temperature calibrated in degrees Celsius.

(j) For flights which do not exceed 60 minutes duration, which take off and land at the same aerodrome, and which remain within 50 NM of that aerodrome, the instruments prescribed in subparagraphs (f), (g) and (h) above, and subparagraphs (k)4., (k)5. and (k)6. below, may all be replaced by either a turn and slip indicator, or a turn coordinator incorporating a slip indicator, or both an attitude indicator and a slip indicator.

(k) Whenever two pilots are required the second pilot's station shall have separate instruments as follows:

1. A sensitive pressure altimeter calibrated in feet with a subscale setting calibrated in hectopascals/millibars, adjustable for any barometric pressure likely to be set during flight;
2. An airspeed indicator calibrated in knots;
3. A vertical speed indicator;
4. A turn and slip indicator, or a turn coordinator incorporating a slip indicator;
5. An attitude indicator; and
6. A stabilized direction indicator.

(l) Each airspeed indicating system must be equipped with a heated pitot tube or equivalent means for preventing malfunction due to either condensation or icing for:

1. Aeroplanes with a maximum certificated take-off mass in excess of 5700 kg or having a maximum approved passenger seating configuration of more than 9;

2. Aeroplanes first issued with an individual CofA on or after 1 April 1999.

(m) Whenever duplicate instruments are required, the requirement embraces separate displays for each pilot and separate selectors or other associated equipment where appropriate.

(n) All aeroplanes must be equipped with means for indicating when power is not adequately supplied to the required flight instruments; and

(o) All aeroplanes with compressibility limitations not otherwise indicated by the required airspeed indicators shall be equipped with a Mach number indicator at each pilot's station.

(p) An operator shall not conduct day VFR operations unless the aeroplane is equipped with a headset with boom microphone or equivalent for each flight crew member on flight deck duty.

Compliance with IFR, or VFR at Night

An operator shall not operate an aeroplane in accordance with instrument flight rules (IFR) or by night in accordance with visual flight rules (VFR) unless it is equipped with the flight and navigational instruments and associated equipment and, where applicable, under the conditions stated in the following subparagraphs:

The items required for VFR flight during the day, plus the following;

(a) A standby altimeter.

(b) An airspeed indicating system with heated pitot tube or equivalent means for preventing malfunctioning due to either condensation or icing including, for aeroplanes > 5700 kg MTOM or > 9 passenger seats certified since 1st April 1998, a warning indication of pitot heater failure.

(c) Two independent static pressure systems, except that for propeller driven aeroplanes with maximum certificated take-off mass of 5700 kg or less, one static pressure system and one alternate source of static pressure is allowed.

(d) A chart holder in an easily readable position which can be illuminated for night operations.

Single-pilot IFR Operations

Aeroplanes operated under IFR with a single-pilot crew are required to have an autopilot with at least an altitude hold and heading mode.

Altitude Alerting System

An operator shall not operate a turbine propeller powered aeroplane with a maximum certificated take-off mass in excess of 5700 kg or having a maximum approved passenger seating configuration of more than 9 seats or a turbojet powered aeroplane unless it is equipped with an altitude alerting system capable of:

- Alerting the flight crew upon approaching a preselected altitude.

- Alerting the flight crew by at least an aural signal, when deviating from a preselected altitude.

Standby Horizon

Those aeroplanes with a maximum certificated take-off mass in excess of 5700 kg or having a maximum approved passenger seating configuration of more than nine seats must be equipped with an additional, standby, attitude indicator (artificial horizon), capable of being used from either pilot's station, that:

1. Is powered continuously during normal operation and, after a total failure of the normal electrical generating system is powered from a source independent of the normal electrical generating system, including an indicator to show that it is on its own power;

2. Provides reliable operation for a minimum of 30 minutes after total failure of the normal electrical generating system, taking into account other loads on the emergency power supply and operational procedures;

3. Operates independently of any other attitude indicating system;

4. Is operative automatically after total failure of the normal electrical generating system; and

5. Is appropriately illuminated during all phases of operation, except for aeroplanes with a maximum certificated take-off mass of 5700 kg or less, already registered in a Member State on 1 April 1995, equipped with a standby attitude indicator in the left-hand instrument panel.

Aeroplane Lighting

For flights by day, an aeroplane is not to be operated unless it is equipped with:

- Functioning anti-collision light system.
- Adequate lighting for all the aeroplane instruments and equipment essential to the safe operation of the aeroplane.
- Lighting to illuminate the passenger compartment; and
- A torch readily accessible for each crew member station.

All aeroplanes, when operated at night, require additional lighting to that above including navigation/position lights and two landing lights.

Flights over Water

Regulations apply to flights over water when aircraft are considered to be vulnerable to ditching. This is considered to be more than 93 km (50 NM) from shore, or when take-off or approach path is over water. The latter case results from the crash of the Lockheed Electra into the Potomac River after take-off from Washington Domestic (now Ronald Reagan) Airport, when many passengers drowned because there was no requirement then for life preservers to be carried on flights not flying over the sea. When required, aeroplanes flying over water are required to be fitted with one life jacket or equivalent individual floatation device for each person on board, stowed in a position easily accessible from the seat of the person for whose use it is provided. Each life jacket and equivalent individual floatation device is to be equipped with a location light.

Long Range Flights

On overwater flights, an operator shall not operate an aeroplane at a distance away from land, which is suitable for making an emergency landing, greater than that corresponding to:

- 120 minutes at cruising speed or 400 NM, whichever is the lesser, for aeroplanes capable of continuing the flight to an aerodrome with the critical power unit(s) becoming inoperative at any point along the route or planned diversions; or
- 30 minutes at cruising speed or 100 NM, whichever is the lesser, for all other aeroplanes,

unless the equipment specified in subparagraphs (a) and (b) below is carried.

(a) Sufficient life-rafts to carry all persons on board. Unless excess rafts of enough capacity are provided, the buoyancy and seating capacity beyond the rated capacity of the rafts must accommodate all occupants of the aeroplane in the event of a loss of one raft of the largest rated capacity. The life-rafts shall be equipped with:

- a survivor locator light; and
- life saving equipment including means of sustaining life as appropriate to the flight to be undertaken; and

(b) At least two survival emergency locator transmitters (ELT) capable of transmitting on 121.5 MHz and 406 kHz

Weather Radar

When carrying passengers in pressurized aircraft, the aeroplane is to be fitted with serviceable weather radar whenever the aeroplane is being operated in areas where thunderstorms or other potentially hazardous weather conditions, which can be detected with airborne weather radar, are expected to exist along the route. EU-OPS expands the requirement to include un-pressurized aeroplanes with MTOM greater than 5700 kg; and any un-pressurized aeroplane with more than 9 passenger seats. For propeller driven pressurized aeroplanes, with MTOM not exceeding 5700 kg and not more than 9 passenger seats, a suitable system for detecting thunderstorms and other potentially hazardous conditions may be used instead of radar.

Equipment for Operations in Icing Conditions

Aeroplanes are not to be operated in expected or actual icing conditions unless certified and equipped for flight in icing conditions. When operated at night, such aeroplanes are to be equipped with an ice detection device or a method of illumination to detect ice formation.

Machmeter

All aeroplanes with speed limitations expressed in terms of Mach number (limiting Mach) are to be equipped with a Mach number indicator (Machmeter). This does not stop the use of the airspeed indicator to derive Mach number for ATS purposes.

Ground Proximity Warning System (GPWS)

Terrain Awareness Warning System (TAWS)

Too many aircraft have been lost and crew and passengers killed by inadvertent controlled flight into terrain (CFIT). The ATC Authority will not accept responsibility for terrain clearance (except during radar vectoring) and the responsibility rests firmly with the pilots to ensure safe clearance from the ground is maintained. Misreading of altimeters; misunderstanding procedures (the Kuala Lumpur 747 crash); poor navigation and misidentification by ATC radar units all conspire to make inadvertent controlled flight into terrain a continuing danger and hazard. A GPWS fitted to an aeroplane can give warning to the pilots that the aeroplane is getting too close to the ground. An Enhanced GPWS (EGPWS or TAWS) includes a predictive terrain hazard warning function, and is required to be fitted to all turbine powered CAT aeroplanes with MTOM greater than 5700 kg or approved passenger seating of more than 9. The GPWS is required to provide automatic warnings by aural and visual indications of the following circumstances:

- Sink rate.
- Ground proximity.
- Altitude loss after take-off or go-around.
- Incorrect landing configuration; and
- Downward glide slope deviation.

The terrain awareness and warning system must automatically provide the flight crew, by means of visual and aural signals and a terrain awareness display, with sufficient alerting time to prevent controlled flight into terrain events, and provided a forward looking capability and terrain clearance floor.

ACAS

All turbine powered aeroplanes > 5700 kg MTOM or having more than 19 passenger seats must be equipped with ACAS II. Pilots are to ensure that ACAS RA are smoothly and immediately responded to, even if this conflicts with ATC instructions.

Communications Equipment

An aeroplane used for CAT must be fitted with radio communication equipment capable of conducting two-way communication with ATC for aerodrome control purposes and receiving meteorological information at any time during flight. Provision must be made for unserviceabilities, therefore at least 2 transceivers must be carried. Additionally it must be capable of conducting 2 way communications on the aeronautical emergency frequency 121.5 MHz. Practically, this means 2 VHF transceivers for domestic airspace, and at least 1 VHF and 1 HF for Oceanic flight.

Internal Communications

Aeroplanes with more than 19 passenger seats must be fitted with a Public Address system (PA) and (for aircraft registered after 1965) crew interphone. The requirement for an interphone is also for aircraft with 19 passenger seats or less, if its MTOM is greater than 15 000 kg. The PA is used to talk to passengers, the interphone is for the flight deck to communicate with cabin crew. In addition, if there are more than 1 flight crew members, they must have a flight crew interphone, utilizing headsets and boom microphones.

Audio Selector Panel (ASP)

An operator shall not operate an aeroplane under IFR unless it is equipped with an audio selector panel accessible to each required flight crew member.

Navigation Equipment

The aeroplane is to be fitted with navigation equipment which will enable it to fly in accordance with its operational flight plan; within the limits specified for Required Navigation Performance (RNP) types, and as required by ATC. It is assumed that flights under VFR are flown by visual reference to landmarks. For flights in areas where minimum navigation performance specifications (MNPS) are specified, an aeroplane is to be fitted with navigation equipment which continuously provides indications of adherence to, or departure from, track, to the required degree of accuracy at any point along that track. The MNPS and the procedures governing their application are published in Regional Supplementary Procedures (Doc 7030). For flights where RVSM of 300 m (1000 ft) is applied between FL290 and FL410, an aeroplane is to be fitted with equipment which is capable of indicating the flight level being flown; automatically maintaining a selected flight level; providing an alert to the flight crew when a deviation occurs from the selected flight level (the threshold for the alert shall not exceed ± 90 m (300 ft)), and for automatically reporting pressure-altitude (Mode C).

Instrument Procedures

When an aeroplane is to be operated under IFR, or VFR at night, it is to be fitted with at least;

- VOR
- ADF
- DME

Additionally, if flying in airspace which requires it;

- Area Navigation System
- Altitude alerting SSR

and, if required for the intended approach

- ILS
- MLS
- Marker receiver

The requirement for VOR/DME/ADF is to be doubled where navigation is based on that aid alone.

Installation

The equipment installation is such that the failure of any single unit required for either communications or navigation purposes, or both, does not result in the failure of another unit required for communications or navigation purposes.

Electrical Circuit Fusing

Most circuit protection systems fitted to aeroplanes use circuit breakers rather than fuses. However, where fuses are fitted to aeroplanes there must be a supply of replacement fuses for use in flight (for fuses which can be replaced in flight). There must be at least 10% of each type and fuse rating with the proviso that there are not less than 3 of each.

Windshield Wipers

Windshield wipers (or an equivalent means of clearing precipitation) are required to be fitted at each pilot station if the MTOM is greater than 5700 kg.

Items not Requiring Approval

The following items do not require an equipment approval:

- Fuses.
- Torches.
- Time pieces.
- Chart holders.
- First aid kits and emergency medical kits.
- Megaphones.
- Survival and pyrotechnic signalling equipment.
- Child restraint devices.

Seats and Harnesses

A seat or a berth is to be provided for all persons on board over the age of two. Each passenger seat is to be equipped with a safety belt with or without a diagonal strap, or a safety harness. Acceptable child restraint devices may be used for each infant.

Each flight crew member seat (including seats alongside pilots' seats) is to be fitted with a safety belt and shoulder harness together with a device to automatically restrain the occupant in the event of sudden deceleration. Cabin crew seats are to have safety belts with shoulder harnesses (additional cabin crew may use passenger seats).

All safety belts with shoulder harnesses must have a single point of release.

For aeroplanes with a MTOM of 5700 kg or less, rather than belt with shoulder harness, the crew seats can be fitted with belts with diagonal shoulder strap.

For aeroplanes with a MTOM of 2730 kg or less, the diagonal shoulder strap is not needed.

'Fasten Seat Belts' and 'No Smoking' Signs

Aeroplanes in which the passenger seating is not visible from the flight deck are to be fitted with signs to alert the passengers and cabin crew when seat belts are to be fastened or when smoking is not permitted.

Carriage and Use of Supplemental Oxygen

The requirements for the carriage of supplemental oxygen (an oxygen supply that supplements the natural oxygen in the atmosphere) is summarized in the two tables below.

The minimum requirements for supplemental oxygen to be carried in pressurized aeroplanes (Note 1), are as follows:

	Supply For:	Duration and Cabin Pressure Altitude
1.	All occupants of flight deck seats on duty	Entire flight time when the cabin pressure exceeds 13 000 ft and entire flight time when cabin pressure exceeds 10 000 ft but does not exceed 13 000 ft after the first 30 minutes at those altitudes, but in no case less than: (i) 30 minutes for aeroplanes certificated to fly at altitudes not exceeding 25 000 ft (note 2) (ii) 2 hours for aeroplanes certificated to fly at altitudes more than 25 000 ft (note 3) The masks fitted to these aircraft must be "quick-don" style
2.	All required cabin crew members	Entire flight time when cabin pressure altitude exceeds 13 000 ft but not less than 30 minutes (note 2), and entire flight time when cabin pressure altitude is greater than 10 000 ft but does not exceed 13 000 ft after the first 30 minutes at these altitudes
3.	100% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 15 000 ft but in no case less than 10 minutes (note 4).
4.	30% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 14 000 ft but does not exceed 15 000 ft
5.	10% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 10 000 ft but does not exceed 14 000 ft after the first 30 minutes at these altitudes.

Notes:

1. *The supply provided must take account of the cabin pressure altitude descent profile for the routes concerned.*
2. *The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 10 000 ft in10 minutes followed by 20 minutes at 10 000 ft.*
3. *The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 10 000 ft in 10 minutes followed by 110 minutes at 10 000 ft.*
4. *The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 15 000 ft in 10 minutes.*
5. *For the purpose of this table 'passengers' means passengers actually carried and includes infants.*

The minimum requirements for supplemental oxygen to be carried in un-pressurized aeroplanes are as follows:

	Supply For:	Duration and Pressure Altitude
1.	All occupants of flight deck seats on duty	Entire flight time at pressure altitudes above 10 000 ft
2.	All required cabin crew members	Entire flight time at pressure altitudes above 13 000 ft and for any period exceeding 30 minutes at pressure altitudes above 10 000 ft but not exceeding 13 000 ft
3.	100% of passengers (see note)	Entire flight time at pressure altitudes above 13 000 ft
4.	10% of passengers (see note)	Entire flight time after 30 minutes at pressure altitudes greater than 10 000 ft but not exceeding 13 000 ft

Note: *For the purpose of this table 'passengers' means passengers actually carried and includes infants under the age of 2.*

Crew Protective Breathing Equipment (PBE)

All aeroplanes with certificated MTOM > 5700 kg or having maximum seating configuration of more than 19 is requires to have:

- **Flight Crew:** PBE for each flight crew member to protect eyes, nose and mouth ('quick don') and to provide oxygen for a period of not less than 15 minutes. The oxygen supply for this can be from the main supplemental oxygen supply. The 'quick don' is to be located such that it is easily accessible for immediate use by each required flight crew member. If the flight crew is more than one and no cabin crew is carried, portable PBE for one crew member meeting the above standard is to be carried.

- **Cabin crew:** Sufficient PBE for all cabin crew for a period of not less than 15 minutes. The PBE must be installed adjacent to each cabin crew member duty station.

- **Additional PBE:** Easily accessible portable PBE is to be located at or adjacent to the required hand-held fire extinguishers in galleys not located on the main passenger deck, or Class A or B cargo compartment. For the cargo compartment the PBE must be stowed outside the compartment but adjacent to the entrance to the compartment.

Crash Axes and Crowbars

Aeroplanes with a maximum take-off mass exceeding 5700 kg or having a passenger seating configuration of more than nine are to be equipped with a crash axe or crowbar located on the flight deck. Aeroplanes with a passenger seating configuration of more than 200 are required to carry an additional crash axe or crowbar stowed in the rearmost galley area. Axes or crowbars stowed in the passenger cabin are not to be visible to the passengers.

Megaphones

An operator shall not operate an aeroplane with a maximum approved passenger seating configuration of more than 60 and carrying one or more passengers unless it is equipped with portable battery-powered megaphones ('bull horn') readily accessible for use by crew members during an emergency evacuation, to the following scale for each passenger deck:

Passenger Seating Configuration	Number of Megaphones Required
61 - 99	1
100 or more	2

For aeroplanes with more than one passenger deck, in all cases when the total passenger seating configuration is more than 60, at least 1 megaphone is required.

Emergency Lighting

The rules for emergency lighting are complex and vary according to dates of certification and the approved passenger seating configuration. Generally, emergency lighting is required to be provided for evacuation of the aeroplane, which has an independent power source that provides power after the aircraft batteries have been switched off. The lighting can be provided from:

- Sources of general cabin illumination.
- Internal lighting in floor level emergency exit areas.
- Illuminated emergency exit markings and location signs.
- Exterior emergency lighting at all overwing exits and exits where descent assistance devices are provided.

Emergency Locator Transmitter (ELT)

Aeroplanes with more than 19 passenger seats must have;

1. one automatic emergency locator transmitter (ELT) or two ELTs of any type; or
2. two ELTs, one of which shall be automatic for aeroplanes first issued with an individual CofA after 1 July 2008.

Aeroplanes with up to 19 passenger seats must have;

1. one ELT of any type; or
2. one automatic ELT for aeroplanes first issued with an individual CofA after 1 July 2008.

All ELTs carried to satisfy the above requirements transmit on 121.5 MHz (international distress frequency, used for homing) and 406 MHz (SARSAT data uplink).

Survival Equipment

Aeroplanes operating over areas where SAR would be particularly difficult are to be equipped with:

- Signalling equipment to make the pyrotechnic distress signals as described in ICAO Annex 2.
- At least one ELT.
- Additional equipment for the route to be flown except when:
    - The provision of SAR is not particularly difficult and the aeroplane remains within a distance corresponding to:
    - 120 minutes at the one engine out cruising speed for aeroplane capable of continuing the flight to an aerodrome with the critical power unit inoperative, or
    - 30 minutes at cruising speed for all other aeroplanes, or
    - For aeroplanes certificated to EASA CS Part 25 or equivalent, no greater distance than that corresponding to 90 minutes at cruising speed from an area suitable for making an emergency landing.

Questions

1. **Where should the emergency medical kit normally be stowed?**

   a. In the rearmost galley
   b. Near any passenger qualified to administer drugs
   c. On the flight deck
   d. In the cargo hold

2. **On which aircraft do CVRs need to record for 2 hours?**

   a. All aircraft > 5700 kg
   b. All aircraft > 9 passenger seats
   c. Aircraft > 5700 kg registered after 01/04/1998
   d. Aircraft > 9 passenger seats registered after 01/04/1998

3. **On which aircraft can the FDR recording time be reduced to 10 hours?**

   a. All aircraft < 5700 kg
   b. All aircraft < 9 passenger seats
   c. Aircraft < 5700 kg registered after 01/04/1998
   d. Aircraft < 9 passenger seats registered after 01/04/1998

4. **Which aircraft must be fitted with ACAS II?**

   a. >5700 kg or > 19 passenger seats
   b. >5700 kg and > 19 passenger seats
   c. >5700 kg or > 9 passenger seats
   d. >5700 kg and > 9 passenger seats

5. **When must flight deck operating crew be on oxygen in a pressurized aircraft?**

   a. The entire flight time when the aircraft is above 13 000 ft
   b. The entire flight time when the cabin is above 10 000 ft
   c. The entire flight time when the cabin is above 13 000 ft
   d. Flight deck crew do not need oxygen in a pressurized aircraft

6. **When deciding on how much oxygen is required for a particular flight, what must the crew allow for?**

   a. Oxygen for 100% of the passenger seat fit for cabin alt above 15 000 ft
   b. Oxygen for 100% of the passengers for the entire time the cabin is between 10-13 000 ft
   c. Oxygen for 30% of the passengers for the entire time the cabin of a pressurized aircraft is above 14 000 ft
   d. Oxygen for all passengers and all crew for the entire flight above 12 000 ft

7. **How many ELTs must be fitted to an aircraft with 19 passenger seats?**

   a. 1 automatic, or 2 of any type
   b. 2, one of which must be automatic if registered after July 2008
   c. 1, which must be automatic if registered after July 2008
   d. ELTs are for life rafts only, not aircraft

Answers

1	2	3	4	5	6	7
c	c	c	a	c	c	c

Chapter

7

Crew, Logs and Records

Continued Overleaf

1 Crew, Logs and Records

Crew Composition

The minimum flight crew is specified in the AFM and the operational flight crew is to be no less than this. Additional crew members may be required when the OM specifies. Each member of the flight crew is to hold the appropriate licence that is acceptable to the Authority and are to be suitably qualified to carry out the assigned duty. The operator is to ensure that inexperienced flight crew members are not crewed together.

Commander

One of the pilots who is qualified as Pilot in Command (PIC) as defined in the requirements for flight crew licences, is to be appointed as the Commander.

Qualifications Required for Command

When suitably qualified (as defined below) the holder of an ATPL(A) may be appointed Commander of a multi-pilot crew on aeroplanes which require a multi-pilot crew. The holder of a CPL(A) may be appointed Commander of a single-pilot operation aeroplane to:

- Conduct passenger flights under VFR more than 50 NM radius from the aerodrome of departure providing the pilot has a minimum of 500 hours total flight time on aeroplanes or holds a valid instrument rating.

- Operate multi-engine aeroplanes under IFR providing the pilot has a minimum of 700 hours total flight time on aeroplanes which includes 400 hours as PIC of which 100 hours are under IFR including 40 hours multi-engine operation. The 400 hours as PIC may be substituted by hours operating as co-pilot within a multi-pilot crew system (as defined in the OM) on the basis of 2 hours co-pilot = 1 hour PIC.

Nomination as Commander

To upgrade from co-pilot to Commander (or for pilots joining an operation as a Commander) the pilot must have a minimum level of experience acceptable to the Authority as specified in the OM. For multi-pilot operations, the pilot must complete an appropriate command course as defined in the OM. This is to include:

- Training in an STD (including line oriented flying training) and/or flying training.

- An Operator Proficiency Check as Commander.

- Commander's responsibilities.

- Line training in command under supervision. A minimum of 10 sectors is required for pilots already qualified on the aeroplane type.

- Completion of a Commander's line check and route and aerodrome competence qualification, and

- Elements of Crew Resource Management.

Relief of the Commander

The Commander may delegate the conduct of the flight to another suitably qualified pilot. For operations above FL200, the Commander may be relieved by a pilot (cruise relief pilot) with the minimum qualifications as follows:

- The holder of a valid ATPL(A).
- Converted and Type Rated on type.
- Recurrently trained and checked, and
- Route competent.

Relief of the Co-pilot

The co-pilot may only be relieved by another suitably qualified pilot or a cruise relief co-pilot qualified to operate in the role of co-pilot in the cruise only not below FL200, as follows:

- Holder of valid CPL(A) with IR(A).
- Converted and Type Rated on type excluding the requirement for take-off and landing, and
- Recurrently trained and checked without the requirements for take-off and landing.

Recent experience is not required however, the pilot is to carry out Flight Simulator recency and refresher flying skills training at intervals not exceeding 90 days. This training may be combined with other pilot recurrent training and checking required.

System Panel Operator

Where a system panel operator (previously called a Flight Engineer) is required by the AFM the flight crew is to include one crew member who holds a Flight Engineer licence or is a suitably qualified flight crew member and acceptable to the Authority.

Relief of System Panel Operator

A system panel operator may be relieved in flight by a crew member who holds a Flight Engineer's licence or by another suitably qualified flight crew member with a qualification acceptable to the Authority.

Minimum Flight Crew for Operations under IFR or at Night

For operations under IFR or at night, the operator is to ensure that the minimum flight crew for a turboprop aeroplane with a maximum approved passenger seating configuration of more than 9 and all turbojet aeroplanes, is two pilots. Other aeroplanes may be operated as single-pilot aeroplanes under the following conditions:

- The Operations Manual must contain a pilot conversion course and recurrent training programme to meet the needs for the additional requirements for single-pilot operations. The requirements are to include:

    - Engine management and emergency handling.
    - Use of normal, abnormal and emergency checklists.
    - ATC Communications.
    - SIDs and STARs.
    - Autopilot management, and
    - Use of simplified in-flight documentation.
- The recurrent checks are to be performed in the single-pilot role on the type or class of aeroplane in the environment representative of the operation.
- The pilot is to have a minimum of 50 hours flight time on the specific type or class of aeroplane under IFR, of which 10 hours is as Commander, and
- The minimum required recent experience is to be 5 IFR flights including 3 instrument approaches carried out during the preceding 90 days on the type or class or aeroplane in the single-pilot role. This requirement may be replaced by an IFR instrument approach check on the type or class of aeroplane.

Conversion, Training and Checking

Operators are responsible for ensuring that all flight crew are correctly qualified for the role and duty they are employed for.

Type Rating

Each flight crew member is required to complete a type rating course (approved by the Authority and in accordance with Part-FCL) when changing from one type of aeroplane to another for which a type or class rating is required. Successful completion of the course will involve passing a skill test which will have a period of validity of 12 months.

Conversion Training

Flight crew members are required to complete a conversion course of training before commencing unsupervised line flying when changing to an aeroplane for which a new type or class rating is required or when changing operator. Conversion training is to be conducted by suitably qualified personnel and the syllabus of training is to be specified in the OM. The personnel integrating CRM into conversion training are to be appropriately qualified. The amount of training required by an operator’s conversion course will be determined by the flight crew member’s previous training as recorded in the training records required to be kept by the operator. The minimum standard of qualification and experience required prior to commencing conversion training are specified in the OM.

Difference and Familiarization Training

If a pilot is required to operate a variant of a type of aeroplane or another type of the same class currently operated, or when procedures or equipment is changed for types or variants currently operated, difference training focussing on additional knowledge and training on an approved training device or the aeroplane, is to be carried out. Familiarization training involves the acquisition of additional knowledge when operating another type or variant, or when procedures or equipment is changed.

Recurrent Training and Checking

Operators are to ensure that all flight crew members undergo recurrent training and checking relevant to the type and variant of the aeroplane operated. The training and checking is specified in the OM. The training and checking specified is to include:

- Operator Proficiency Checks.
- Line Checks.
- Emergency and Safety Equipment training and checking.
- CRM training.
- Ground and Refresher training, and
- Aeroplane/STD training.

Operator Proficiency Check

Each crew member is required to undergo the Operator Proficiency Check in accordance with EU-OPS. This requires a pilot to demonstrate proficiency and competence in carrying out normal, abnormal and emergency procedures. The check is to be conducted without external reference when the pilot is required to operate under IFR.

The period of validity of an Operator Proficiency Check is 6 calendar months in addition to the remainder of the month of issue. If a subsequent check is carried out within the last 3 months of the current check, the date of expiry of the recent check will be 6 months from the expiry date of the previous check (3 month rule). For instance, the current check validity period expires on 31 December. The pilot successfully passes an Operator Proficiency Check on 1 October. The period of validity will therefore be extended to 30 June next year.

Line Checks

Each flight crew member is to undergo a line check to demonstrate competence in carrying out normal line operations as described in the OM. The period of validity of a line check is to be 12 months (dated from the last day of the month of issue). The 3 month rule applies.

Emergency and Safety Equipment Training and Checking

Each flight crew member is to undergo training and checking on the location and use of all emergency and safety equipment carried on the aeroplane. The period of the check is to be 12 months (dated from the last day of the month of issue). The 3 month rule applies. The training and checking can be combined and is to be conducted in an aeroplane or a suitable alternative training device. Every year the training programme must cover:

- Donning of a life jacket.
- Donning of protective breathing equipment.
- Handling of fire extinguishers.
- The location and use of all emergency and safety equipment on the aeroplane.
- Instruction on the location and use of all types of exits, and
- Security procedures.

Every three years the training must cover:

- Operation of all types of exits.
- Demonstration of the method of using a slide.
- Actual fire fighting on an actual or simulated fire.
- Actual handling of pyrotechnics (real or simulated).
- Demonstration of the use of a life raft.
- The effects of smoke in an enclosed environment and use of relevant equipment in a simulated smoke filled environment.

Crew Resource Management (CRM) Training

The operator is to ensure that elements of CRM are integrated into all appropriate phases of recurrent training and that each flight crew member undergoes specific modular CRM training. All major CRM topics are to be covered over a period not exceeding 3 years.

Ground and Refresher Training

The operator is to ensure that each flight crew member undergoes Ground and Refresher training at least every 12 months. The 3 month rule applies. The training which will be verified by a questionnaire or other means is to include:

- Aeroplane systems.
- Operational Procedures and requirements including ground de/anti-icing and pilot incapacitation.
- Accident and incident occurrence review.

Aeroplane/STD Training

The operator is to ensure that each flight crew member undergoes Aeroplane/STD training at least every 12 months. The 3 month rule applies. The training is to be established so that all major failures of aeroplane systems and associated procedures will have been covered in the preceding three year period. The required training may be combined with the operator proficiency check.

Pilot Qualifications to Operate in Either Pilot Seat

Before a pilot is permitted to operate in either seat, the pilot must have completed the necessary additional training and undergone the required checking. The training programme is to be included in the OM and is to be acceptable to the Authority. Commanders whose duties require them to operate in the right-hand seat and carry out the duties of co-pilot, or Commanders required to conduct training or examining from the right-hand seat are to be suitably qualified. The additional training must include the following:

- An engine failure after take-off.
- A one engine inoperative approach and missed approach; and a one engine inoperative landing.

Where the engine-out manoeuvres are carried out in an aeroplane, the engine failure must be simulated.

When operating in the right-hand seat, the pilot must be fully qualified, valid and current to operate from the left-hand seat. A pilot relieving the Commander must have demonstrated practice of drills and procedures which would not normally be the responsibility of the relieving pilot.

Recent Experience

In order to operate at the controls of an aeroplane in flight, a pilot must be in current flying practice. This means that the pilot must have flown the aeroplane (or in certain circumstances, a flight simulator) and carried out specified manoeuvres in the aeroplane on a specified number of occasions.

- A pilot is not permitted to act as pilot flying (PF) or pilot not flying (PNF) unless the pilot has carried out 3 take-offs and landings in the last 90 days in an aeroplane, or in a flight simulator, of the same type/class.
- A pilot who does not hold a valid instrument rating is not to be assigned duty as the Commander of an aeroplane at night unless the pilot has carried out at least one landing at night in the preceding 90 days as PF in an aeroplane or in a flight simulator, of the same type or class.

The 90 day period may be extended to 120 days under the supervision of a Type Rated Instructor (TRI) or Type Rated Examiner (TRE). For periods beyond 120 days the recency requirement is satisfied by a training flight or use of a flight simulator of the aeroplane type to be used.

Route and Aerodrome Qualification for Commander or PF

Before being allocated duty as Commander or PF, the operator is to ensure that the pilot has obtained adequate knowledge of the route to be flown and of the aerodromes (including alternates), facilities and procedures to be used.

The period of validity of the competence is 12 months in addition to the remainder of the month of qualification, or the month of latest operation on the route or to the aerodrome. The method of revalidating is to be by operating the route (or to the aerodrome) within the period of validity. The 3 month rule also applies.

Operations on More Than One Type or Variant

Flight crew members are only permitted to operate more than one type or variant if competent to do so. When making a decision to use more than one type or different variants of a type, operators must consider and justify the use taking account of:

- The level of technology.
- Operational Procedures.
- Handling characteristics.

Where more than one type or variants is to be used, the OM must include:

- Details of the minimum experience level of flight crew.
- The minimum experience level on one type or variant before beginning training for another type or variant.
- The training process to be employed.
- The applicable recent experience requirements for each type or variant.

Operation of Aeroplanes and Helicopters

If a flight crew member operates both aeroplanes and helicopters, the operator is to ensure that the helicopters and aeroplanes flown are limited to one type of each. The operator is also required to detail the appropriate procedures and/or operational restrictions (as approved by the Authority) in the OM.

Training Records

The operator is to maintain records of all training (courses), checking and qualifications undertaken by a flight crew member, and to make all such course records available, on request, to each flight crew member.

Cabin Crew

A cabin crew member is a person who is assigned by the operator to undertake tasks in the cabin and shall be identifiable by virtue of an operator's cabin crew uniform to passengers as a cabin crew member. EU-OPS defines a cabin crew member as a crew member, other than a flight crew member, who performs in the interest of safety of passengers, duties assigned by the operator or the Commander of the aeroplane.

Training

Each cabin crew member is to have successfully completed an approved initial course of training. After the initial course, or before converting from one aeroplane type to another, a conversion course is to be successfully completed. The crew member is also to complete the operator's CRM training and Aeroplane Type Specific CRM training as defined in EU-OPS. Before operating a different variant of the type or an aeroplane with different safety equipment fitted, difference training must be completed.

Numbers and Composition of Cabin Crew

The following is the requirement for the inclusion of cabin crew on an aeroplane:

- If the aeroplane has a maximum approved passenger seating more than 19 with at least one passenger on board, at least one cabin crew member is to be included in the crew.
- For every 50 (or fractions of 50) passenger seats installed on the same deck, one cabin crew member is to be included in the crew. Alternatively, the requirement is the number of cabin crew members required to actively participate in a demonstration evacuation of the aeroplane, with the proviso that one cabin crew member may be dispensed with for every 50 passenger seats (or multiples of 50) that the actual number of seats is reduced by.
- The Authority may specify additional cabin crew members.
- In unforeseen circumstances the required number of cabin crew members may be reduced provided that the number of passengers has been reduced in accordance with the procedures specified in the OM, and a report is submitted to the Authority after the flight.

Minimum Requirements for Appointment as Cabin Crew

To be appointed as cabin crew a person must:

- Be at least 18 years of age.
- Be medically fit (passed an initial medical assessment) and physically capable of discharging the duties specified in the OM.
- Have completed an acceptable initial training course.
- Have completed an acceptable conversion course.
- Have undergone recurrent training in accordance with procedures laid down in the OM.

The operator is to ensure that each cabin crew member is competent to perform the required duties in accordance with the procedures specified in the OM.

Senior Cabin Crew Members

In aeroplanes where more than one cabin crew member is required, one member of the cabin crew is to be appointed the Senior Cabin Crew Member. The appointed crew member is to have not less than one year's experience and have successfully completed an appropriate course of training including appropriate CRM training. The Senior Cabin Crew Member is to be responsible to the Commander for the conduct and co-ordination of normal and emergency procedures as specified in the OM. In the absence of instructions from the Commander, during turbulence the Senior Cabin Crew Member is entitled to suspend non-safety related activities and request the 'fasten seat belt' sign.

The Senior Cabin Crew Member must be specifically trained;

- To give pre-flight cabin crew briefings.
- In Crew Co-operation.
- On the operator's legal responsibilities.
- In human factors/CRM.
- On accident/incident reporting.
- On flight and duty time limitations.

Operation on More Than One Type or Variant

Usually, a cabin crew member is not permitted to operate on more than three aeroplane types. Exceptionally, the Authority may approve operation of up to four types with the proviso that for at least two of the types, non-specific normal and emergency procedures are the same and safety equipment and type specific normal and emergency procedures are similar. For the purpose of this rule, aeroplane variants are considered to be different if they have different:

- Emergency exit operation.
- Location and type of portable safety equipment, and
- Type specific emergency procedures.

Journey Log

An operator shall retain the following information for each flight in the form of a journey log:

- Aeroplane registration.
- Date.
- Name(s) of crew members(s).
- Crew member(s) duty.
- Place of departure.
- Place of arrival.
- Time of departure (off blocks).
- Time of arrival (on blocks).
- Flight hours.
- Nature of flight.
- Incidents, observations (if any), and
- Commander's signature.

A journey log can be replaced if relevant information is available in other documentation. All entries are to be made concurrently and are to be permanent in nature.

Operational Flight Plan (OFP)

An operator is to ensure that the OFP used and the entries during flight contain the following:

- Registration.
- Type and variant.
- Date of flight.
- Flight identification.
- Names of flight crew members.
- Flight crew members' duties.
- Place of departure.
- Time of departure (off blocks and take-off).
- Place of arrival (planned and actual).
- Time of arrival (actual landing and block time).
- Type of operation (ETOPS, VFR, ferry flight etc.).
- Route and route segments with checkpoints/waypoints, distances, times and tracks.
- Planned cruising speed and flying times between checkpoints/waypoints. Estimate and actual times overhead.*
- Safe altitudes and minimum levels.*
- Planned altitudes and flight levels.*
- Fuel calculations (records of in-flight fuel checks)*
- Fuel on board when starting engines.
- Alternate(s) for destination and where applicable, take-off and en route. Initial ATS flight plan clearance and re-clearance.
- In-flight re-planning calculations, and
- Relevant met information.

* The items indicated must also be included for diversion routes and alternate airfields if applicable.

Information readily available in other documentation from other sources, or irrelevant to the operation may be omitted from the operational flight plan. A description of the layout and use of the operational flight plan must be included in the OM. All entries are made concurrently and are permanent in nature.

Storage Periods

Operators are to ensure that all records and relevant operational and technical information for each individual flight are stored in an acceptable form, accessible to the Authority, for the periods detailed below.

Information used for the preparation and execution of flights	
Operational Flight Plan	3 months
Aeroplane Technical Log	36 months after the last date of entry
Route specific NOTAM briefing information if edited by the operator	3 months
Mass and balance documentation	3 months
Special load notification	3 months

Figure 1.1: Retention of flight prep documentation

Reports	
Journey Log	3 months
Flight reports for recording details of any occurrence, as prescribed in EU-OPS or any event which the Commander deems necessary to report/record	3 months
Reports on exceedances of duty and/or reducing rest periods	3 months

Figure 1.2: Retention of reports

Flight Crew Records	
Flight duty and rest time	15 months
Licence	As long as the flight crew member is exercising the privileges of the licence for the operator
Conversion training and checking	3 years
Command course (including checking)	3 years
Recurrent training and checking	3 years
Training and checking to operate in either pilot seat	3 years
Recent experience	15 months
Route and aerodrome competence	3 years
Training and qualification for specific operations (e.g. ETOPS CATII/III etc.)	3 years
Dangerous goods training	3 years

Figure 1.3: Flight crew records

Cabin Crew Records	
Flight, duty and rest time	15 months
Initial training, conversion and difference training (including checking)	As long as the cabin crew member is employed by the operator
Recurrent training and refresher (including checking)	Until 12 months after the cabin crew member has left the employ of the operator
Dangerous goods training	3 years

Figure 1.4: Cabin crew records.

Records for other Operations Personnel	
Training/qualification records of other personnel for whom an approved training programme is required by EU-OPS	Last 2 training records

Figure 1.5: Records for other operations personnel.

Other Records	
Cosmic and solar radiation dosage	Until 12 months after the cabin crew member has left the employ of the operator
Quality system records	5 years
Dangerous goods transport documentation	3 months after the completion of the flight
Dangerous goods acceptance checklist	3 months after the completion of the flight

Figure 1.6: Other records.

Flight and Duty Time Limitations

Operators are required to keep records of flight and duty times of all crew and to ensure that the defined maximum is not exceeded. In the UK the flight and duty limitations are defined in CAP 393 (the Air Navigation Order).

Definitions

For the purposes of this Regulation, the following definitions shall apply:

- **Augmented flight crew**: A flight crew which comprises more than the minimum number required for the operation of the aeroplane and in which each flight crew member can leave his/her post and be replaced by another appropriately qualified flight crew member.

- **Block time**: The time between an aeroplane first moving from its parking place for the purpose of taking off until it comes to rest on the designated parking position and all engines or propellers are stopped.

- **Break**: A period free of all duties, which counts as duty, being less than a rest period.

- **Duty**: Any task that a crew member is required to carry out associated with the business of an AOC holder. Unless where specific rules are provided for by this Regulation, the Authority shall define whether and to what extent standby is to be accounted for as duty.

- **Duty period**: A period which starts when a crew member is required by an operator to commence a duty and ends when the crew member is free from all duties.
- **Flight duty period**: A flight duty period (FDP) is any time during which a person operates in an aircraft as a member of its crew. The FDP starts when the crew member is required by an operator to report for a flight or a series of flights; it finishes at the end of the last flight on which he/she is an operating crew member.
- **Home base**: The location nominated by the operator to the crew member from where the crew member normally starts and ends a duty period or a series of duty periods and where, under normal conditions, the operator is not responsible for the accommodation of the crew member concerned.
- **Local day**: A 24 hour period commencing at 00.00 local time.
- **Local night**: A period of eight hours falling between 22.00 and 08.00 local time.
- **A single day free of duty**: A single day free of duty shall include two local nights. A rest period may be included as part of the day off.
- **Operating crew member**: A crew member who carries out his/her duties in an aircraft during a flight or during any part of a flight.
- **Positioning**: The transferring of a non-operating crew member from place to place, at the behest of the operator, excluding travelling time. Travelling time is defined as:
    - time from home to a designated reporting place and vice versa,
    - time for local transfer from a place of rest to the commencement of duty and vice versa.
- **Rest period**: An uninterrupted and defined period of time during which a crew member is free from all duties and airport standby.
- **Standby**: A defined period of time during which a crew member is required by the operator to be available to receive an assignment for a flight, positioning or other duty without an intervening rest period.
- **Window of Circadian Low (WOCL)**: The Window of Circadian Low (WOCL) is the period between 02.00 and 05.59. Within a band of three time zones the WOCL refers to home base time. Beyond these three time zones the WOCL refers to home base time for the first 48 hours after departure from home base time zone, and to local time thereafter.

Flight and Duty Limitations

Cumulative duty hours: An operator shall ensure that the total duty periods to which a crew member is assigned do not exceed:

(a) 190 duty hours in any 28 consecutive days, spread as evenly as practicable throughout this period; and

(b) 60 duty hours in any seven consecutive days.

Limit on total block times: An operator shall ensure that the total block times of the flights on which an individual crew member is assigned as an operating crew member does not exceed

(a) 900 block hours in a calendar year;

(b) 100 block hours in any 28 consecutive days.

Operators may be authorized to extend FDP by augmenting the crew. This would be done on a case by case basis.

Maximum Daily Flight Duty Period (FDP)
The maximum daily FDP is 13 hours. On a multi-sector day this is reduced to; 12.5 hours for 3 sectors, 12 hours for 4 sectors, 11.5 hours for 5 sectors, and 11 hours for 6 or more sectors.

The FDP is further reduced if the flight commences or ends in the WOCL. (By 100% of the encroachment for commencement, 50% if the flight ends during the WOCL)

The FDP can be extended by up to an hour, but no more than twice in any 7 day period, and not if the FDP encroaches on the WOCL. In exceptional circumstances the Commander can further extend the FDP by up to 2 hours (3 with augmented crew) or to allow the aircraft to continue to its destination/alternate. Minimum crew rest must be ensured after any extension. A report must be submitted to the operator, which must be copied to the Authority within 28 days.

Rest
Unless the operator has permission from the Authority, when operating from home base the minimum rest period is 12 hours, or the length of the preceding FDP whichever is greater. When operating away from home base it is 10 hours or the duration of the preceding FDP, however, operators must take into account travelling time and the effects of time zone changes. A clear 8 hours rest must be allowed for.

Standby
If a crew member is required to be on airport standby a quiet and comfortable area not open to the public must be provided. Airport standby time is included in the total duty hours limit stated above. For standby at a location other than an airport, duty hours are calculated by the operator, in a manner acceptable to the Authority, taking into account facilities for rest and other factors which may affect fitness to fly.

Flight Duty, Duty and Rest Period Records
1. An operator shall ensure that crew members' records include:

(a) block times;

(b) start, duration and end of each duty or flight duty periods;

(c) rest periods and days free of all duties;

and are maintained to ensure compliance with the requirements of this subpart; copies of these records will be made available to the crew member upon request.

Records must include all reports of extended FDP and reduced rest periods.

Questions

1. **If an Operator Proficiency Check is due on 31 July, but the crew member completes it on 12 May, when would the next one need to be completed by?**

    a. 12 November
    b. 30 November
    c. 12 January
    d. 31 January

2. **What are the rules regarding OPCs?**

    a. Can be completed in the simulator, but no passengers to be carried
    b. Can be completed in the aircraft but only if the aircraft is certified by the Authority as a suitable substitute for the simulator
    c. Can be completed in the simulator but only if the simulator is certified by the Authority
    d. Can be completed in conjunction with a line check

3. **Who could be nominated as Senior Cabin Crew?**

    a. Any flight crew
    b. Cabin crew with more than a year's experience
    c. Any cabin crew over the age of 18
    d. Cabin crew as long as they are not qualified on more than 3 types or variants

4. **What are the limits on crew duty?**

    a. 190 hours in a year, 60 duty hours in any seven consecutive days
    b. 900 block hours in a year, 60 block hours in any consecutive 7 days
    c. 900 block hours in a year, 100 block hours in any consecutive 28 days
    d. 190 block hours in any consecutive 7 days, 900 block hours in any consecutive 28 days

5. **What is the minimum crew rest period before flight?**

    a. 12 hours when operating away from home base
    b. 13 hours, reducing by 30 minutes for every sector after the 3rd sector in a day
    c. 10 hours when operating from home base
    d. 12 hours when operating from home base

6. **What is the maximum Flight Duty Period (without extension)?**

    a. 11 hours if flying 7 sectors in a day
    b. 12 hours if flying 12 sectors in a day
    c. 10.5 if flying 7 sectors in a day
    d. 13 hours under all circumstances

Answers

1	2	3	4	5	6
d	c	b	c	d	a

Chapter

8

Long Range Flight and Polar Navigation

Navigation System Degradation

Modern navigation systems based on INS and radio navigation aids (including GPS) consisting of either 2 or 3 set systems, include comparator and/or warning devices. Pure equipment failure would be indicated by the illumination of a warning light.

Course and INS Cross-checking

In an emergency course and INS can be cross-checked:

- In a 3 set system, the output of each system should be compared (a voting system) from which inaccuracy in any one system should be quickly detected.

- In a 2 set system, the failure of one system would not be readily detected unless the system captions malfunction codes in which case interpretation of the code should reveal which unit is faulty. If it is possible to obtain a fix (from the weather radar or bearings from ADF and NDB, or a fix from a VOR beacon), comparing with the system positions should reveal the inaccurate system.

If uncertainty still exists more basic methods include contacting another aeroplane in the vicinity and cross-checking spot winds, ground speed and drift. As a last resort, comparison of the outputs from the nav systems could be compared with the flight plan data for wind velocity at the DR position of the aeroplane.

Unable to Continue in Accordance with ATC Clearance

If an aeroplane is unable to continue the flight as per the ATC clearance, a revised clearance shall, whenever possible, be obtained prior to initiating any action. This shall also apply to aircraft which are unable to maintain the specified navigation accuracy. The revised clearance shall be obtained by RTF distress or urgency traffic as appropriate. The subsequent ATC action shall be based on the intention of the pilot and the overall air traffic situation.

Polar Navigation

Polar tracks defined as North/South routes involve navigation at high latitudes (above 65°N). In these areas, the lack of ground radio aids, high rates of change of magnetic variation and steep magnetic dip angles, make conventional airways navigation difficult if not impossible. For the reasons stated, magnetic compasses become unreliable and reference to magnetic north is impractical. In this situation, navigation is achieved by reference to a grid navigation process or reliance on inertial systems and satellite based global positioning (GPS).

In areas where the rate of change of magnetic variation becomes excessive (in close proximity to the North Magnetic Pole), VOR beacons are orientated to true north to assist grid navigation. VORs in the Canadian Northern Control Area are oriented to true north. Where the primary heading information is derived from an INS system, care must be taken to monitor the system (by reference to any other aid or method) for degradation or failure.

It is important to remember that there are a number of different ways in which the autopilot can become unobtrusively disconnected from the steering mode, therefore regular checks of correct engagement are to be made. Where possible it is recommended that when coupled to the autopilot the navigation system should display position co-ordinates throughout the flight; these are then plotted 10 minutes after each waypoint. The navigation system not being used to steer the aircraft should display cross-track distance being displayed on the HSI where feasible.

Training and drills should not be conducted to the extent that the flight crew is distracted such that the navigation system is mishandled. If at any point during the flight the autopilot is disconnected (e.g. because of turbulence) care must be taken when the navigation steering is re-engaged to ensure that the correct procedure is followed. Where the system sets specific limits for automatic capture, the cross-track indications should be monitored to ensure proper re-capture of the programmed flight path/profile. Where low angles of bank are used (10° for passenger comfort) it is essential to be particularly alert to possible insidious departures from cleared track.

Other factors which make polar navigation difficult are limited communications with that which is available being mainly restricted to HF, lack of en route alternate aerodromes and high rates of gyro correction (for earth rate and transport wander).

Grid Navigation

Grid navigation in conjunction with a directional gyro can be used in polar areas to resolve polar navigation problems. The procedures for the use of polar stereographic charts and grid co-ordinates are covered fully in the navigation general syllabus with reference to the associated notes. Similarly, the use and effect of INS and gyro systems is covered in the instrument syllabus including the definition and calculation of transport precession, earth rate precession and convergence factor. However it should be noted that grid navigation, gyroscopic transport precession, earth rate precession and convergence factor are examinable in the OP syllabus.

Minimum Time Routes

A minimum time route is defined as the track flown between two points which results in the shortest time adhering to all ATC and airspace restrictions. Geographically, the shortest distance between any two points is the minor arc of the great circle joining both those points. In reality, airspace restrictions (danger/restricted/prohibited areas), airway routings, and wind and meteorological considerations may make another longer track a quicker option.

Historically, minimum time routes have been ‘manually’ calculated by taking 3, 4 or 5 alternative track options from a point and taking wind into account, determining the route that achieves the greatest track distance in a given time period (usually 1 hour). The process is then repeated for the point at the end of that route and repeated as many times as is required to arrive at the destination. This is a time consuming and laborious process. Modern computers are far better at doing this than man, and today all minimum time routes are computer generated (and far more accurate in the prediction).

Questions

1. How should the accuracy of long range navigation systems be checked?

a. With 2 systems, a voting system is employed
b. With reference to a map and compass
c. A voting system if 3 systems are installed, by cross-checking with DME with only 2 systems
d. Ask ATC

2. If an aircraft is unable to continue in accordance with the clearance what should they do?

a. Attempt to obtain a revised clearance from ATC, via radio relay if required
b. Continue in accordance with the last acknowledged clearance until in sight of land
c. Follow the contrails of another aircraft
d. Land at the nearest suitable aerodrome

3. An aircraft on the ground at latitude 51°50'S is parked on a heading of 180° with ground power applied and all flight instruments powered. After 2 hours, what will the DGI indicate?

a. 156°
b. 204°
c. 168°
d. 192°

4. What is a minimum time route?

a. The shortest distance between 2 points
b. The great circle track between 2 points
c. The minimum time between 2 points taking into account wind and time zone changes
d. The minimum time between 2 points taking into account wind and ATC restrictions

Answers.

1	2	3	4
c	a	b	d

Chapter

9

Minimum Navigation Performance Specification Airspace MNPSA

Continued Overleaf

9 MNPSA

Introduction

Due to economic, geographical and geophysical considerations, the airspace over the North Atlantic Ocean between the latitudes of 35N and 70N is some of the most frequently flown airspace in the World. Typically there could be up to 300 aircraft over the Ocean at the same time. More than 425 000 commercial aircraft alone cross the airspace annually. This may seem excessive, but consider that we, flying scheduled passenger operations, share the sky with airfreight operators, the military and long range general aviation aircraft. Whilst the airspace is vast (some 6 million square miles) and the possibility of one aircraft even seeing another would appear remote, the actual situation is dramatically different. By agreement between the states bordering the North Atlantic (Canada; USA; Iceland; Greenland; Norway; the UK; Eire; France; Spain; Portugal) the ICAO North Atlantic Region (NAT region) has been established to provide a framework for the solution of problems concerned with transoceanic operations. Within the NAT region, the area over the ocean and northwards towards the North Pole is designated as airspace in which a minimum standard for air navigation has been specified. This is known as the NAT Minimum Navigation Performance Specification Airspace (MNPSA). ICAO publishes two documents concerned with the NAT region: Doc 7030 contains the NAT Regional Supplements, and the North Atlantic MNPS Airspace OM covering specific NAT procedures.

Considerations

The problems are threefold: Firstly, the economic requirement is for traffic to fly to and from North America, mainly the United States and Canada, and Europe. The majority of this traffic is scheduled passenger operations and this falls into distinct flow patterns resulting in a tidal type of situation with peaks in each direction at certain times of the day. Secondly, the meteorological situation over the Ocean 'standardizes' the polar frontal jet stream and the sub-tropical jet stream at about 55°N and 40°N respectively. The jet stream flow is always from west to east. Whilst it is not always desirable to fly in a jet stream it is always desirable to avoid a jet stream when flying in the opposite direction. Modern turbine powered aeroplanes are most efficient (fuel efficient) at the altitude where the air is coldest (densest) for engine performance, but least dense for drag reduction. The air is coldest at the tropopause but whilst the air above the tropopause is less dense, the temperature remains constant and therefore there is little advantage to be gained by climbing above the tropopause. Hence, all the traffic flying across the North Atlantic will want to cruise at or about the tropopause. At 40°N this will be about 40 000 ft whereas at 55°N this will be about 35 000 ft. This tends to concentrate all the traffic at or about these altitudes. Finally, the total absence of ground based navigation aids means that navigation accuracy will not be as good as over land and allowances in separation will need to be made by the ATC authorities.

References

1. ICAO North Atlantic Manual.
2. ICAO Regional Air Navigation (RAN) Plan for the NAT Region.
3. ICAO Regional Supplementary Procedures (Doc 7030).

Transoceanic Navigation Problems

The problems of navigating aeroplanes over vast areas of sea are really no worse than the problems of doing the same over huge tracts of uninhabited land e.g. the Sahara Desert. These are:

- No aerodromes.
- No ground based radar.
- No fixed radio navigation beacons (VOR; NDB etc.).
- Outside of VHF radio range hence reliance on HF communications.

Additionally, the North Atlantic suffers from abnormally high levels of traffic density with modern turbine engined aeroplanes wanting to fly at the same flight levels, and an economically generated tidal flow of traffic. As the NAT region encompasses latitudes higher than 70N problems are encountered with magnetic compasses due to the weak horizontal component of the Earth's magnetic field (less than 6 μTesla) and occasionally large values of magnetic variation (31°W at Resolute Bay in northern Canada). This last problem requires radio navigation beacons to be oriented to true north and at polar latitudes the use of grid navigation techniques using gyro referenced compasses.

The Airspace

The concentration of the traffic by route and altitude, together with the separation requirements and navigation system requirements, mean that all traffic flying across the North Atlantic is required to fly IFR. To this extent, all the airspace is classified as class A between FL55 and FL660. By definition, class A is controlled airspace (CAS) in which ATC is provided to IFR traffic therefore the airspace must, by definition, be a control area (CTA). Indeed this is the case but because special rules are applicable, the airspace is defined as an Oceanic Control Area (OCA). In practice, there are 5 NAT OCAs encompassing the MNPSA (Shanwick; Santa Maria; Gander; New York; Reykjavik) with 5 corresponding Oceanic Area Control Centres (OACCs) at Prestwick; Lisbon; Gander; New York and Reykjavik respectively. The OCAs are contiguous with the East/West boundary being at 30W (Shanwick and Gander) and 40W (Santa Maria and New York) and the North/South boundary being at 45N (Shanwick/Gander and Santa Maria/New York). Reykjavik extends from the northern boundaries of Shanwick and Gander to the North Pole, including the majority of Greenland. The easterly and westerly continental boundaries are defined by domestic airspace (national FIRs) although beyond the SW boundary of New York *North Atlantic* Oceanic Airspace is still New York OCA, but not part of the NAT MNPSA. This area is known as the West Atlantic Route System (WATRS) and contains routings for traffic between USA and the Caribbean. The Easterly boundary of Reykjavik is the western boundary of the Bodø (pronounced Boo der) OCA. Bodø is in Norway and the OCA is not part of the MNPSA area.

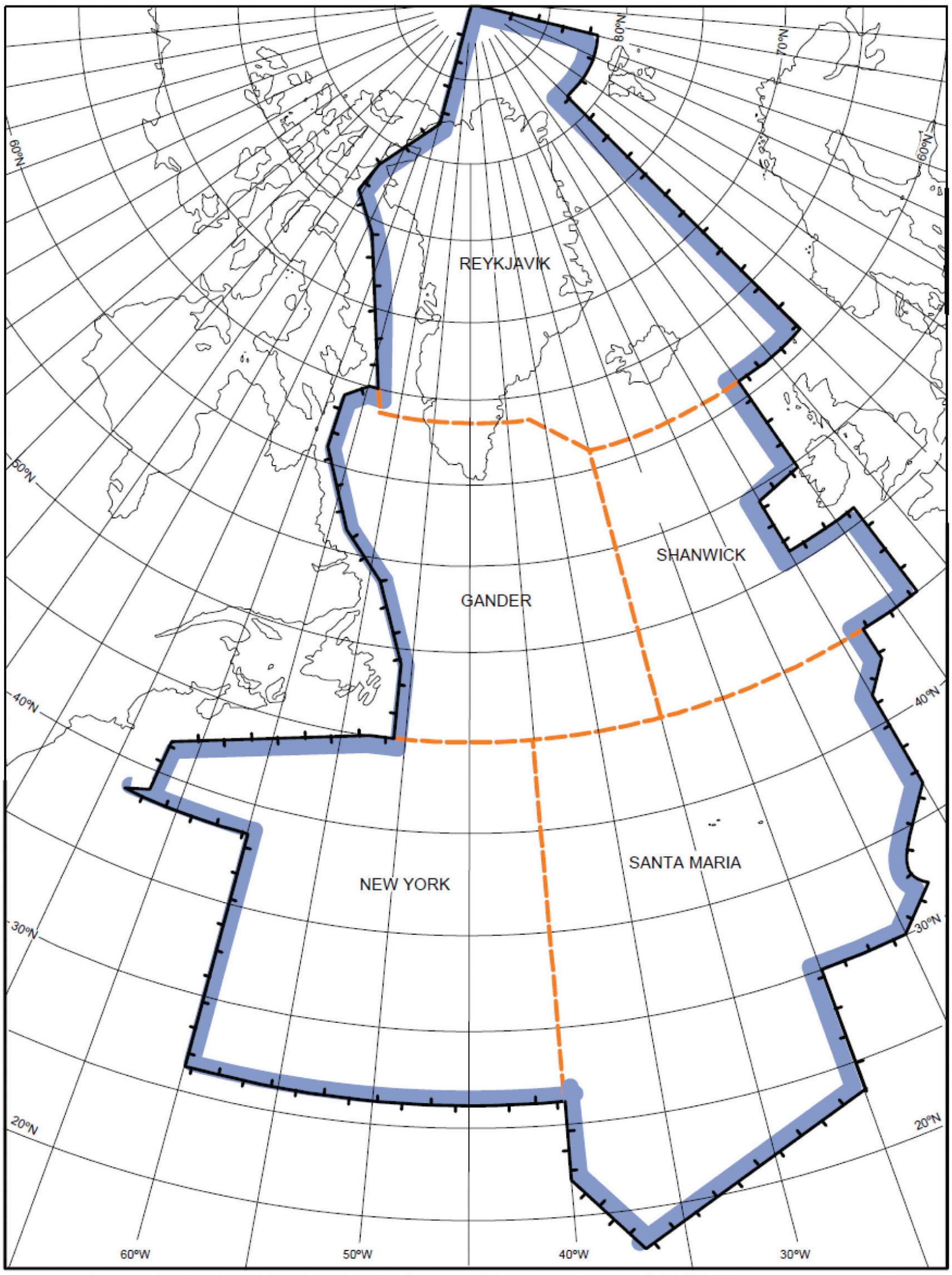
MNPS Authority

Operators of aircraft flying within the MNPSA are required to have authority approval (stated on the AOC) requiring the aircraft to be able to navigate in accordance with the relevant RNP. Approval for MNPS will be indicated to Air Traffic by inserting the letters SX in item 10 of the flight plan.

Practical experience has shown that when two or more turbojet aircraft, operating along the same route at the same flight level, maintain the same Mach number, they are more likely to maintain a constant time interval between each other than when using other methods. This is due to the fact that the aircraft concerned are normally subject to approximately the same wind and air temperature conditions, and minor variations in ground speed, which might increase and decrease the spacing between them, tend to be neutralized over long periods of flight. Requested TRUE Mach number, taking into account known errors in the flight deck indication, is to be inserted in item 15 of the flight plan. Wherever possible this requested speed will be accommodated, however occasionally ATC may need to assign a Mach number

0.01 higher than, or 0.02 lower than requested. Pilots should maintain their last assigned Mach number during step-climbs in oceanic airspace. If due to aircraft performance this is not feasible ATC should be advised at the time of the request for the step climb. After leaving oceanic airspace pilots must maintain their assigned Mach number in domestic controlled airspace unless and until the appropriate ATC unit authorizes a change.

NORTH ATLANTIC MNPS AIRSPACE OPERATIONS MANUAL



Published on behalf of the North Atlantic Systems Planning Group (NAT SPG) by the European and North Atlantic Office of ICAO

Figure 9.1: NAT airspace

RVSM

MNPS Airspace extends from Flight Level (FL) 285-420, incorporating the RVSM FLs 290-410. Aircraft flying in MNPSA must also be authorized to fly RVSM, and must comply with the altimetry Minimum Aircraft System Performance Specification (MASPS). In domestic airspace RVSM FLs are allocated according to magnetic track (i.e. flights Easterly are on odd FL, 290, 310 etc, Westerly on even FL 300, 320 etc.) Due to the tidal nature of the majority of North Atlantic traffic during the times of the Organized Track System (OTS) all FL are available in both directions. Outside the OTS standard RVSM FL apply. The minimum equipment requirement for RVSM flight is as follows;

- Two independent barometric altimeters agreeing to within +/- 200 ft
- Autopilot with height hold capability
- Altitude deviation alerting system (minimum of an aural alert if the aircraft deviates by +/- 300 ft)
- SSR with altitude alerting mode (mode C)
- The altimeters must be checked prior to entering the NAT OCA. Pilots must report when reaching any new cruising level, and if a deviation of more than 300 ft occurs it must be reported to ATS, with a subsequent written report post flight.

Navigation System Requirements

The minimum equipment for flight in MNPS Airspace is 2 independent Long Range Navigation Systems (LRNS) to cater for failure of one system. Approved systems may be:

- GNSS (GPS)
- INS
- IRS

Each system must be capable of providing continuous position, track and speed information.

In addition, all turbine powered aeroplanes with MTOM > 5700 kg, or having more than 19 passenger seats are required to carry and operate ACAS II in the NAT region. (However this equipment is required in the relevant aircraft of all EU operators anyway)

Navigation System Serviceability

The requirement for 2 LRNS covers the case of a failure in one system and each system must have a failure warning indication. Where triple INs are used as an IRS, a ‘voting’ system is employed to ensure use of the most accurate information. In a double INS system, external information (heading and drift) will be required to determine which system is inaccurate if a failure occurs. In the event of total failure, ask another aircraft for assistance or follow the contrails. In the event of total navigation system failure, declare an emergency using MAYDAY or PAN PAN procedures. Navigation system failure procedures are covered at the end of this chapter.

NAT Tracks

The most desirable routes are the minimum time tracks (MTT) from Paris, London and central Europe terminating at New York, Chicago, Atlanta, Montreal and Boston. Generally, an MTT is a great circle track with the most favourable wind, and examination of a chart of the North Atlantic will easily show that most of the routes for the destinations would follow very similar tracks. This again concentrates the traffic such that the majority of the traffic flying across the NAT region will be focused on a few FLs (adjacent to the tropopause) and virtually the same track. The situation is further complicated by the time differences that give rise to the 'tidal flow'. Generally, people wish to leave Europe in the morning to arrive in North America at about mid day local time. A 7-hour flight to New York departing from London at 9am (0900Z) would arrive at 11am local time (1600Z). (Concorde used to arrive before it had taken off!) For the return, daytime flying is wasteful. A 6-hour flight from Boston to London departing at 10am (1500Z) would land at 9pm London time (2100Z). To overcome this, the majority of flights to Europe from North America depart early in the evening to arrive first thing in the morning. The 6pm (2300Z) Virgin flight from Orlando lands at Gatwick at 7am (0700Z) the next morning. To accommodate all these flights going the same way at approximately the same time, a set of roughly parallel tracks is established with lateral separation based on the MNPS RNP. The FLs allocated to these tracks are RVSM levels and to facilitate yet further utilization of the vertical airspace, the tracks are made effectively 'one way only' and both the eastbound and the westbound semi-circular RVSM levels are allocated to the track direction. These tracks are called organized tracks and the overall concept is called the organized track system (OTS). Whilst this appears to be much formalized in concept, the use of the tracks is not mandatory, and an operator may plan any route required. A route that does not comply with the existing OTS is called a 'random route', and operators planning random routes are asked to observe certain restrictions. These will be covered later.

OTS Track Designation

To accommodate the 'tidal' nature of the transatlantic flow, two OTS are established: the daytime OTS westbound, and the night time OTS eastbound. Each track in the OTS is given an individual identifier or designator. For the daytime OTS the tracks are lettered from "A" for the most northerly at the start point and then sequentially lettered in a southerly direction. For the night time OTS, the most southerly track is "Z" with the next track to the north "Y" etc...

OTS Changeover

At some time of the day the eastbound OTS will be replaced with the westbound OTS and vice versa. Clearly, this has to be organized or chaos would result. If the eastbound OTS finished at 1000Z and the westbound started at 1001Z, it would be perfectly feasible for a flight to join the eastbound OTS at 0959Z at FL 310 and at some point in the flight, conflict with a flight joining the westbound OTS at 1001Z also at FL310 but going the opposite way. To overcome this, the OTS period is defined at 30W (approximately the midpoint for most traffic). An aircraft flying the OTS must plan to cross 30W during the period of the OTS to be able to fly the entire route as a NAT track. This, however, does not totally solve the problem: consider the case of an aircraft crossing 30W at one minute before the end of the OTS! To make it as safe as can be, a changeover (buffer) period is also established which exists from the end of one OTS until the start of the OTS in the reverse direction. This will allow an aircraft crossing 30W at the end of the OTS to complete the route before an aircraft flying the reverse direction would be permitted to join the route.

The standard OTS periods of validity are;

Daytime (Westbound) OTS 1130-1900UTC at 30W

Night-time (Eastbound) OTS 0100-0800UTC at 30W.

These times occasionally change however, any changes will be highlighted in the remarks of the Track Message.

The changeover periods are 0801Z to 1129Z and 1901Z to 0059Z. Don't forget, the OTS only exists in the NAT region and flight in the NAT region will only be part of the total journey. For example, British Airways BA289 flies from London to Phoenix where 60% of the flight is outside the NAT area.

OTS Message (Track Message - TM)

At set times each day, the airspace managers of the 5 OCAs together with Met advisers hold a conference to decide the following day's OTS. As well as considering the weather they will take into account route requests from operators, who can request specified routings by submitting a Preferred Route Message (PRM) in advance. The manager of Shanwick is then responsible for publishing the next daytime (westbound) OTS and the Gander manager publishes the night time (eastbound) OTS. The OTS is then distributed to interested parties (domestic airspace ACCs, operators etc.) in the form of an OTS message which specifies the date; period of validity; the routes (Lat/Long positions and named positions) by designator, and remarks including the track message identifier (TMI) and notices regarding airspace reservations and navigational data.

Track Message Identifier (TMI)

The TMI is a method of identifying the OTS promulgated by the OACC. It consists of the name of the OACC, the abbreviation TMI followed by the Julian date of the OTS. The Julian calendar starts at 001 for 1 January and ends at 365 for 31 December (366 for a leap year). So, the eastbound OTS for 28 February is Gander TMI 059. If any amendment is required, the whole NAT track message will be re-issued. An added note will indicate the revision with an alphabetic character, e.g. TMI059A, then B, etc.

Track Routings

After the track identifier, the first position in a NAT track is the entry point. This can be either a Lat/Long (a 5-character group giving the whole number of degrees of latitude, followed by a slash, then the whole number of degrees longitude e.g. 59/10 meaning 5900N01000W) or a named position (the ICAO standard for position names is used - 5 letters e.g. CIMAT). The rest of the route, in the 5-character lat/long form and named positions if applicable, follows. An example of a westbound route in the TM is as follows:

A 59/10 61/20 61/30 61/40 61/50 60/60 CIMAT

The route is route "A" therefore it is the most northerly of that OTS. The entry point is 59N 10W. From there the route is 61N 20W; 61N 30W; 61N 40W; 61N 50W; 60N 60W and exit at point CIMAT (which is defined in the Montreal CTA as 5930N 06300W).

Allocation of FLs

The next part of the TM for the route is the allocation of FLs. In theory, all the RVSM FLs (290 - 410 inclusive) should be available for allocation. In practice this is not always the case. For the more popular routes more FLs are usually available than for the less popular. Generally, FLs 290 and 300 are too low for normal traffic and FLs 400 and 410 just a touch too high. Also the freeing of RVSM FLs to non-OTS traffic is in keeping with the objective of making as much airspace available for non-NAT Track traffic as possible, and also offers flexibility for random routes. For the westbound OTS track A above, the allocation of FLs was as follows:

EAST LVLS NIL; WEST LVLS 310 320 330 340 350 360 390

The inclusion of EAST LVLS NIL implies that for the period of the OTS all other direction traffic along this route would be random route traffic. Indeed, it is unlikely that contra direction traffic would be accepted into the OTS now because of RVSM, whereas before the introduction of RVSM at least one level was always reserved for contra direction traffic.

Domestic Routes

The TM also includes details of specific routing from domestic airspace to the entry point for the route and also from the exit point into domestic airspace. This will allow domestic airspace managers to 'flow manage' transatlantic traffic into the domestic airways or high-level route system within the receiving FIR. For route A the TM included:

EUR RTS WEST NIL; NAR N464B N466B N468B N472B N474B

This implies that there are no specified European routes to the start point, and from CIMAT the NAR (North American routings) are N464B etc.

Random Routes

As the use of the OTS is not mandatory, operators may plan to use any other route. Such routes are called random routes. Examples of a random route could be: the reciprocal of an OTS track; a track that follows part of an OTS track; a route that crosses 30W outside of the relevant OTS; a track that is completely outside of the OTS or a track that crosses one or more OTS tracks. In any event, operators are required to consider the implications of planning such routes and the OACCs will apply whatever restrictions are necessary to random routes to protect the OTS traffic. The use of the unrestricted FLs (those not included in the TM for each route) would be appropriate. If an operator wishes to plan a route that uses part of the OTS, then the outside routes (most northerly or most southerly) should be planned to be used for the part of the OTS to be flown.

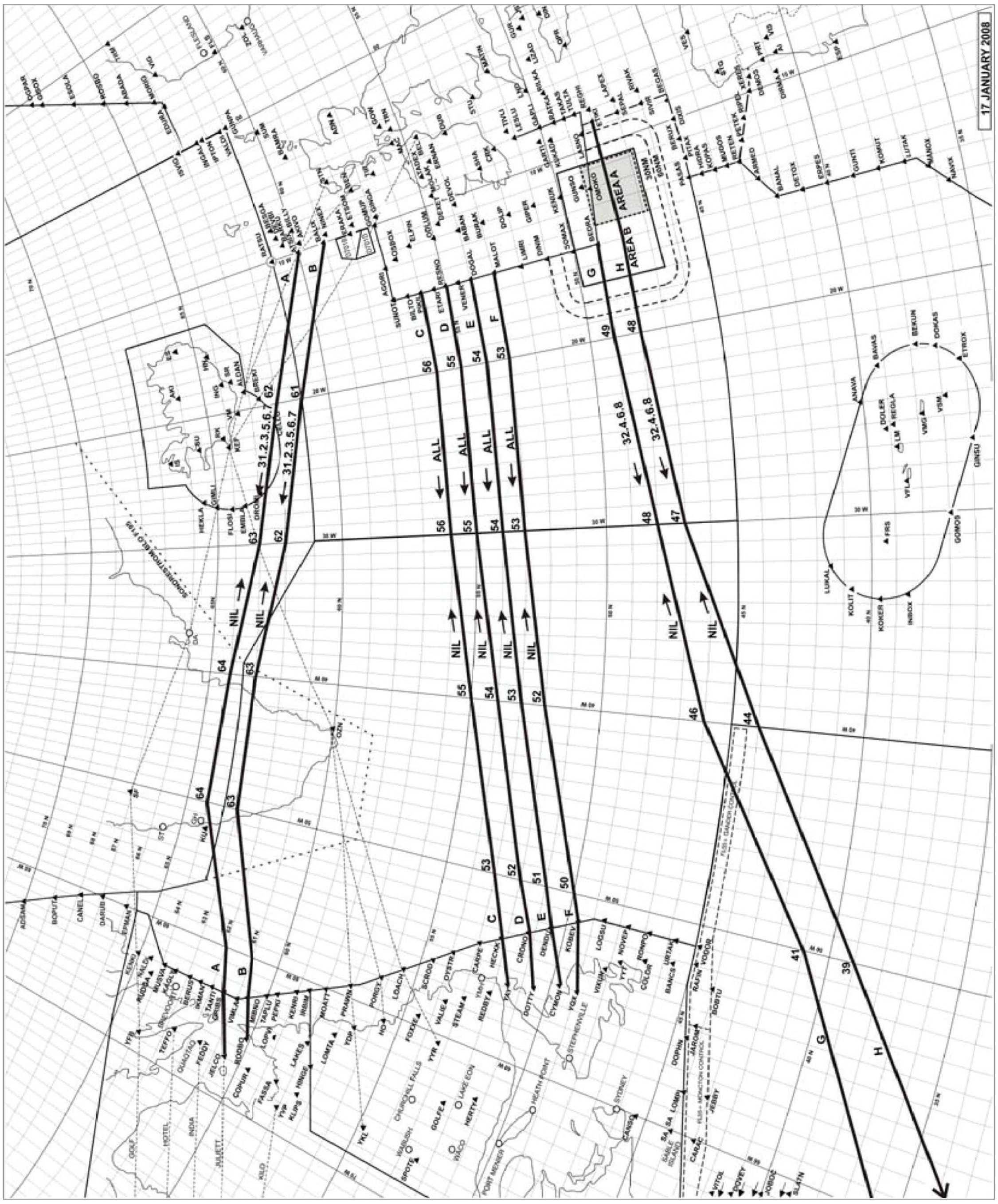


Figure 9.2: Example of day-time westbound organized track system

Example of a westbound NAT track message:

(NAT-1/2 TRACKS FLS 310/ 390 INCLUSIVE
OCTOBER 8/ 1130Z TO OCTOBER 8/ 1900Z
PART ONE OF TWO PARTS-

A 59/10 61/20 61/30 61/40 61/50 60/60 CIMAT
EAST LVLS NIL
WEST LVLS 310 320 330 340 350 360 390
EUR RTS WEST NIL
NAR N464B N466B N468B N472B N474B
B 58/10 60/20 60/30 60/40 59/50 PRAWN YDP
EAST LVLS NIL
WEST LVLS 310 320 330 340 350 360 370 380 390
EUR RTS WEST NIL
NAR N322B N328C N334B N336E N346A N348C N352C N356C N362B-

C 57/10 59/20 59/30 58/40 56/50 SCROD VALIE
EAST LVLS NIL
WEST LVLS 310 320 330 340 350 360 370 380 390
EUR RTS WEST NIL
NAR N242B N248B N250C N252B-

D 56/10 58/20 58/30 57/40 55/50 OYSTR STEAM
EAST LVLS NIL
WEST LVLS 310 320 330 340 350 360 370 380 390
EUR RTS WEST NIL
NAR N224C N228A N230B N232B-

(NAT-2/2 TRACKS FLS 310/390 INCLUSIVE
OCTOBER 8/ 1130Z TO OCTOBER 8/ 1800Z
PART TWO OF TWO PARTS-

F MASIT 56/20 56/30 55/40 53/50 YAY
EAST LVLS NIL
WEST LVLS 310 320 330 340 350 360 370 380 390
EUR RTS WEST VIA DEVOL
NAR N184B N188B N192B-

G 49/15 48/20 45/30 42/40 38/50 35/60 HENCH
EAST LVLS NIL
WEST LVLS 320 340 360
EUR RTS WEST VIA GUNSO
NAR NIL

REMARKS:

1. *TRACK MESSAGE IDENTIFICATION NUMBER IS 281 AND OPERATORS ARE REMINDED TO INCLUDE THE TMI NUMBER AS PART OF THE OCEANIC CLEARANCE READBACK*

2. *MNPS AIRSPACE EXTENDS FROM FL285 TO FL420. OPERATORS ARE REMINDED THAT SPECIFIC MNPS APPROVAL IS REQUIRED TO FLY IN THIS AIRSPACE. IN ADDITION, RVSM APPROVAL IS REQUIRED TO FLY BETWEEN FL310 AND FL390 INCLUSIVE*

3. *EIGHTY PERCENT OF GROSS NAVIGATION ERRORS OCCUR AFTER A REROUTE. ALWAYS CARRY OUT WAYPOINT CROSS-CHECKS (END OF PART TWO OF TWO PARTS)*

Example of an eastbound NAT track message:

(NAT-1/1 TRACKS FLS 310/390 INCLUSIVE
OCTOBER 9/ 0100Z TO OCTOBER 9/ 0800Z

PART ONE OF ONE PARTS-

W CYMON 51/50 52/40 52/30 52/20 53/15 BURAK
EAST LVLS 310 320 330 340 350 360 370 380 390
WEST LVLS NIL
EUR RTS WEST NIL
NAR N95B N97B-

X YQX 50/50 51/40 51/30 51/20 52/15 DOLIP
EAST LVLS 310 320 330 340 350 360 370 380 390
WEST LVLS NIL
EUR RTS WEST NIL
NAR N79B N83B-

Y VIXUN 49/50 50/40 50/30 50/20 51/15 GIPER
EAST LVLS 310 320 330 340 350 360 370 380 390
WEST LVLS NIL
EUR RTS WEST NIL
NAR N63B N67B-

Z YYT 48/50 49/40 49/30 49/20 50/15 KENUK
EAST LVLS 310 320 330 340 350 360 370 380 390
WEST LVLS NIL
EUR RTS WEST NIL
NAR N53B N55A

REMARKS:

1. CLEARANCE DELIVERY FREQUENCY ASSIGNMENTS FOR AIRCRAFT
OPERATING FROM MOATT TO BOBTU INCLUSIVE:
LOACH AND NORTH 128.7
SCROD TO YAY 135.45
DOTTY TO YQX 135.05
VIXUN AND SOUTH 119.425

2. TRACK MESSAGE IDENTIFICATION 282.
REMINDED THAT MNPS APPROVAL IS REQUIRED TO FLY IN THIS AIRSPACE. IN ADDITION, RVSM APPROVAL IS REQUIRED TO FLY WITHIN THE NAT REGION BETWEEN FL310 AND FL390 INCLUSIVE. PLEASE REFER TO CANADIAN NOTAM 980097 OR A3797.

3. 80 PERCENT OF GROSS NAVIGATION ERRORS OCCUR AFTER A REROUTE. ALWAYS CARRY OUT WAYPOINT CROSS-CHECKS.
(END OF PART ONE OF ONE PART)

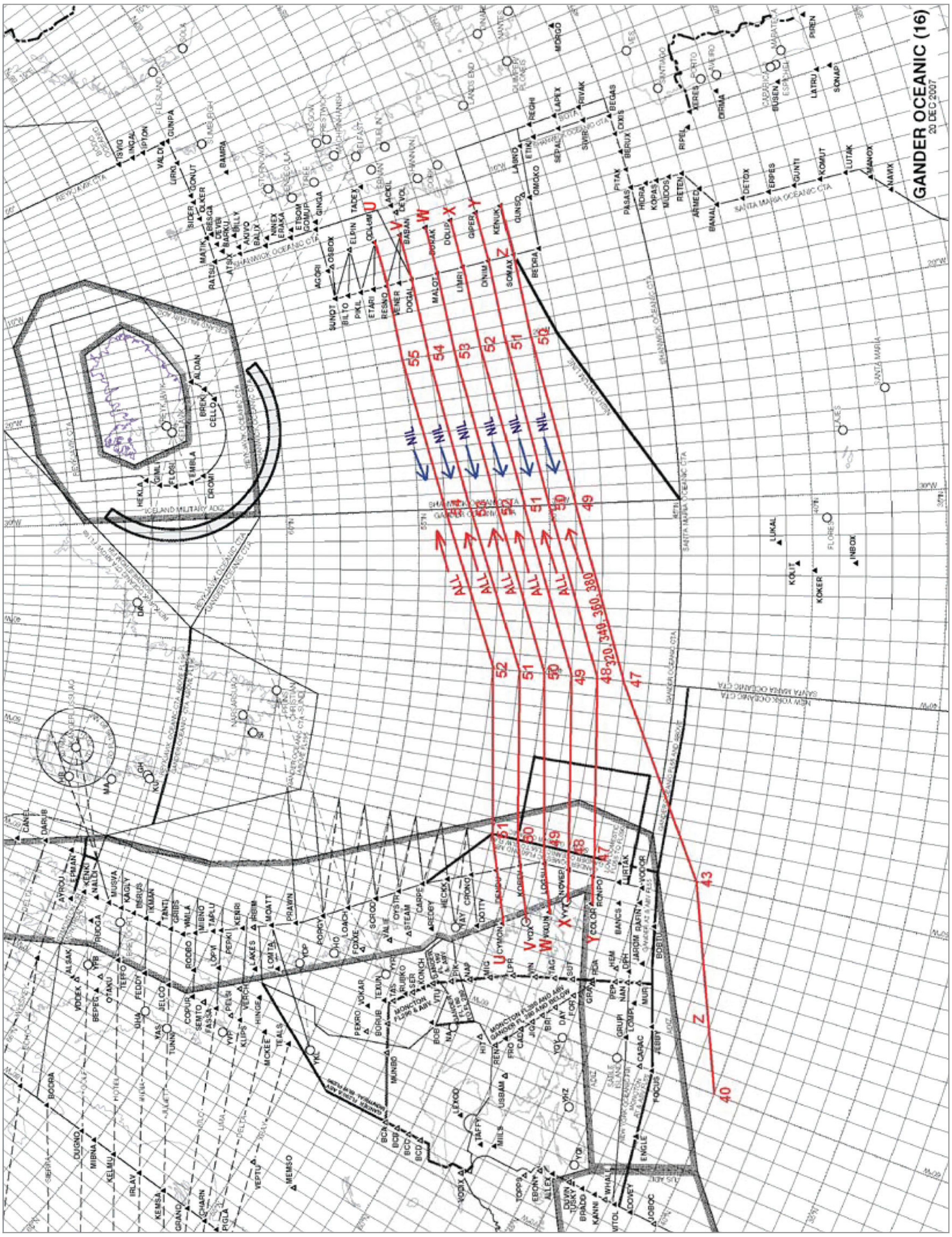


Figure 9.3: Example of night-time eastbound organised track system

Polar Track Structure (PTS)

The PTS no longer exists. You may possibly see old feedback questions about the PTS however, ignore them.

Figure 9.4: Blue spruce routes: SOTA & BOTA areas

Other Routes within NAT MNPS Airspace

Other routes within NAT MNPS Airspace (illustrated in *Figure 9.4*) are as follows:

(1)* 'Blue Spruce' Routes, established as special routes for aircraft equipped with only one serviceable LRNS. State approval for MNPS operations is required in order to fly along these routes.

(2) routes between Northern Europe and Spain/Canaries/Lisbon FIR. (T9*, T13 and T16);

(3)* routings between the Azores and the Portuguese mainland and between the Azores and the Madeira Archipelago;

(4)* routings between Iceland and Constable Pynt on the east coast of Greenland and between Kook Islands on the west coast of Greenland and Canada

(5) special routes of short stage lengths where aircraft equipped with normal short-range navigation equipment can meet the MNPS track-keeping criteria (G3 and G11). **State approval for MNPS operations is required in order to fly along these routes.**

Note: **routes identified with an asterisk in sub paragraphs (1), (2), (3) and (4) above may be flight planned and flown by approved aircraft equipped with normal short-range navigation equipment (VOR, DME, ADF) and at least one approved fully operational LRNS.*

Route Structures Adjacent to NAT MNPS Airspace

North American Routes (NARs)

The North American Routes (NARs) consist of a numbered series of predetermined routes which provide an interface between NAT oceanic and North American domestic airspace. The NAR System is designed to accommodate major airports in North America. These routes are subject to occasional changes and are re-published on a 56 day cycle.

Canadian Domestic Track Systems

Within Canada there are three track systems: the Northern Control Area tracks (NCAs), the Southern Control Area tracks (SCAs) and the Northern Organized Track System (NOROTS); these provide links for NAT traffic operating between Europe and North America to central and western North American airports.

North Atlantic European Routing Scheme (NERS)

The NERS exists to provide an interface between NAT oceanic and European domestic airspace. The scheme is similar in concept to the NARS. It consists of a numbered series of predetermined routes, designed to accommodate eastbound traffic exiting the NAT en route to a number of major European airports. The NERS valid for a particular day will be published in the NAT track message but will only be published when the traffic density warrants their use. They are not expected to be published every day.

Shannon Oceanic Transition Area (SOTA) and Northern Oceanic Transition Area (NOTA)

Parts of the Shanwick OCA are designated as the Shannon Oceanic Transition Area (SOTA) and the Northern Oceanic Transition Area (NOTA). MNPS Airspace requirements are still applicable from FL285 to FL420 in both areas. NOTA and SOTA have the same vertical extent as the Shanwick OCA. Air Traffic Services are provided by Shannon ACC using the call sign SHANNON CONTROL.

Brest Oceanic Transition Area (BOTA)

Part of the Shanwick OCA is designated as the Brest Oceanic Transition Area (BOTA). MNPS Airspace requirements are still applicable from FL285 to FL420. BOTA has the same vertical extent as the Shanwick OCA, and Air Traffic service is provided by the Brest ACC, callsign BREST CONTROL.

Communications

Due to the distances involved, the present primary method of communication is HF SSB voice. Long range VHF is available to aircraft when within 250 NM of land, and VHF is also used for the delivery of oceanic clearances to aircraft prior to entering the OCAs. There is also a VHF air-to-air frequency (123.45 MHz) to allow an aircraft experiencing any communications or navigation problems to talk to another aircraft. All aircraft flying on NAT routes are also required to monitor 121.5 MHz. It is important that pilots appreciate that routine air/ground ATS Voice communications in the NAT Region are conducted via aeradio stations staffed by communicators **who have no executive ATC authority**. Messages are relayed by the ground station to/from the air traffic controllers in the relevant OAC.

HF

Long range HF communications is not user friendly. The correct choice of frequency is crucial and this is time-of-day dependent. Also the susceptibility of HF to atmospheric interference makes continuous listening to HF painful! In common with all aeronautical HF networks around the world, the NAT region utilizes 'families' of frequencies. This means that all or selected ground stations monitor the same frequency. The frequencies used are 3, 5, 8, 11 and 13 MHz. The general rule is that to talk to a station 1 000 NM away you will need a higher frequency during the day than at night ("the higher the Sun, the higher the frequency"). The propagation of HF across the Atlantic is well researched and the geophysical anomalies due to sunspots and magnetic interference are quite predictable so the ground station will generally dictate the choice of frequency. The first HF frequency to use with the air-ground station will be specified in the oceanic clearance. The ground radio operator will be monitoring all the frequencies in the 'family' so with the first call to the air-ground station the frequency being used is indicated by using the following phraseology:

"Shanwick Speedbird 289 on 88"

This would tell the ground operator that you are calling him on 8864 MHz. For the northerly routes, both Gander and Shanwick will monitor the day/night long range frequencies, and if there are propagation problems with Gander, the aircraft should still be able to relay through Shanwick. The two OACCs have landline data links (as they do with all the other OACCs in the NAT Region). At the point where control would be transferred from one OACC to the other, it is standard procedure to copy the initial position report to the new OACC to the previous one using the phraseology:

"Gander copy Shanwick this is Speedbird 289 position … "

SATCOM Voice Communications

Since oceanic traffic typically communicate with ATC through aeradio facilities, a SATCOM call made due to unforeseen inability to communicate by other means should be made to such a facility rather than the ATC Centre, unless the urgency of the communication dictates otherwise.

SELCAL

When using HF communications and even when using ADS-C and/or CPDLC, pilots should maintain a listening watch on the assigned frequency, unless SELCAL is fitted, in which case they should ensure the following sequence of actions:

a) Provide the SELCAL code in the flight plan; (any subsequent change of aircraft for a flight will require passing the new SELCAL information to the OAC);

b) Check the operation of the SELCAL equipment, at or prior to entry into oceanic airspace, with the appropriate aeradio station. (This SELCAL check must be completed prior to commencing SELCAL watch); and

c) Maintain thereafter a SELCAL watch.

It is important to note that it is equally essential to comply with the foregoing SELCAL provisions even if SATCOM Voice or ADS/CPDLC are being used for routine air/ground ATS communications. This will ensure that ATC has a timely means of contacting the aircraft.

Position Reports

The system of ATC used across the NAT region is procedural ATC, which relies on pilot position reports to confirm the separation. As you have seen from the TM, the routes are organized to cross whole 5° of longitude at whole degrees of latitude. Likewise, whenever specified, north/south routes cross whole 10° of latitude at whole degrees of longitude. At these points pilots are required to make position reports. For an east/west route this is going to be at approximately every 500 NM. This meets the ICAO requirement for position reports to be made at intervals not greater than 1 hour.

Standard air/ground message types and formats are used within the NAT Region and are published in State AIPs and Atlantic Orientation charts. To enable ground stations to process messages in the shortest possible time, pilots should observe the following rules:

a) Use the correct type of message applicable to the data transmitted;
b) State the message type in the contact call to the ground station or at the start of the message;
c) Adhere strictly to the sequence of information for the type of message;
d) All times in any of the messages should be expressed in hours and minutes UTC.

The message types are shown below with examples:

Position
Example: *"Position, Swissair 100, on 8831, RESNO at 1235, Flight Level 330, Estimating 56 North 020 West at 1310, 56 North 030 West Next"*

Request Clearance
Example: *"Request Clearance, American 123, on 8831, 56 North 020 West at 1308, Flight Level 330, Estimating 56 North 030 West at 1340, 56 North 040 West Next. Request Flight Level 350"*

or if a position report is not required

"Request Clearance, Speedbird 212 on 3476, Request Flight Level 370"

Revised Estimate
Example: "Revised Estimate, Speedbird 212 on 3476, 57 North 040 West at 0305"

Miscellaneous
Plain language – free format

Data link communications are gradually being introduced into the NAT environment for position reporting. On first contact with the initial aeradio stations crews of participating aircraft should expect to receive the instruction "VOICE POSITION REPORTS NOT REQUIRED". Above 70N the position reports are made at intervals of 20° of longitude.

Radio Failure in the North Atlantic Area

In the case of radio failure prior to exiting the NAT region, the pilot shall maintain the last received and acknowledged oceanic clearance, including level and speed, to the last specified oceanic route point, normally landfall, then:

- Cleared On Filed Flight Plan Route: Continue on the filed flight plan route. The pilot shall maintain the last assigned oceanic level and speed to landfall, and after passing the last specified oceanic route point; the pilot shall conform to the relevant state procedures/regulations.

- Cleared Other Than Filed Flight Plan Route: After passing this point, the pilot shall conform to the relevant state procedures/regulations and rejoin the filed plan route by proceeding via the published ATC route structure where possible to the next significant point ahead as contained in the filed flight plan.

Initial Clearance

At least 40 minutes before entering the NAT airspace (above FL55) pilots are required to obtain an oceanic clearance directly from the initial OACC. The clearance request should include requested FL, and maximum acceptable FL at the entry to the OCA. As all the entry points to the OTS are within 250 NM of the coast, the aircraft should be able to obtain the clearance by VHF. Within the states concerned, the OACCs have remote VHF transmitter sites on discrete frequencies for this purpose. If direct communications are not possible, HF can be used through the air-ground station. Alternatively, a request could be made through the domestic ACC on the airways/UIR frequency in use. Recent advances in technology have made data link available for use with ATC and this is another possible source of obtaining the clearance. If the aerodrome of departure is less than 40 minutes flying time from the entry point to the OTS, the oceanic clearance will have to be obtained on the ground. Where this is normal procedure, the OACC has a local transmitter site close by i.e. Dublin, Shannon, and Prestwick.

The clearance will include the limit of clearance (normally the destination), the track identifier, the entry point, the initial FL, the Mach number required and any specific instructions. This must be read back, but an abbreviated read back is permitted replacing the route details with the track identifier plus the TMI. This indicates that the pilot has the route details in accordance with the TM for the current OTS. If the pilot does not include the track identifier and TMI, the OACC will then read the route details and the pilot will have to read this back. Any misunderstanding concerning clearances and re-clearances not picked up by the OACC is known as 'an ATC loop error'.

If an aircraft encounters, whilst en route to the NAT Oceanic Airspace, a critical in-flight equipment failure, or at dispatch is unable to meet the MEL requirements for RVSM or MNPS approval on the flight, then the pilot must advise ATC at initial contact when requesting oceanic clearance. After obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry, and if this changes by 3 minutes or more, should pass a revised estimate to ATC.

Pilots should pay particular attention when the issued clearance differs from the flight plan as a significant proportion of navigation errors investigated in the NAT involve an aircraft which has followed its flight plan rather than its differing clearance.

If the entry point of the oceanic route on which the flight is cleared differs from that originally requested and/or the oceanic flight level differs from the current flight level, the pilot is responsible for requesting and obtaining the necessary domestic reclearance. There are three elements to an oceanic clearance: route, Mach number and flight level. These elements serve to provide for the three basic elements of separation: lateral, longitudinal and vertical.

Transition

Because the OTS uses all the available FLs as ‘one way streets’ when an aircraft leaves the OTS and joins the domestic route system an adjustment in FL may be required. In order to make sure this is only conducted where there is no loss of separation, special areas known as transition areas have been established for this purpose. At the eastern side of the NAT region, the Shannon Oceanic Transition Area (SOTA), west of Ireland to 15W, and in the Bay of Biscay the Brest Oceanic Transition Area (BOTA), have been established. These are ostensibly special rules areas where the normal rules of the air are not complied with.

SSR

When flying in the NAT region, the last assigned SSR code by a domestic ATCU is to be maintained for a period of 30 minutes after entering the OCA. After that, mode A2000 plus C is to be set and maintained. In the event of emergency, radio failure or unlawful interference, the appropriate code should be squawked even though the aircraft is well out of range of a ground radar station.

Meteorological Reports

With effect from 18 November 2010 aircraft are no longer required to provide voice reports of MET observations of wind speed and direction nor outside air temperature. Nevertheless any turbulence or other significant meteorological conditions encountered should be reported to ATC. The format to be used for the reporting of such observations should, where appropriate, be by reference to geographical co-ordinates.

When a ground unit establishes an event contract with an aircraft to provide ADS position reports, it may also establish an additional periodic report contract (e.g. with a 30 min interval). Such ADS-C periodic reports, unlike event reports, contain wind and temperature data and thereby satisfy the MET authorities requirements for the provision of MET data. Similarly, “FMC waypoint position reports” sent via data link also include wind and temperature data and aircraft participating in such a data link programme are deemed to meet the MET authorities requirements. However, it must be appreciated that any such automated MET reports do not include information on any turbulence or any other unusual meteorological phenomena. Therefore any pilot providing position reports via data link, who encounters turbulence, etc. should report this information via voice or, if appropriate, via a CPDLC free text downlink message.

Special Contingencies and Procedures

The inability to maintain level, navigate accurately or communicate, when flying in the MNPSA, can have serious results. At the first indication that things are 'not normal' pilots are advised to communicate the problem to the OACC. Loss of HF communications may be overcome by asking an adjacent aircraft on VHF to relay. Remember all aircraft flying in the MNPSA are required to monitor 123.45 MHz and 121.5 MHz. Pressurization failure will require the aircraft to descend rapidly to a safe level and pilots are required to broadcast safety information (altitude passing) on 121.5.

Strategic Lateral Offset Procedure (SLOP)

If an aeroplane flying in the NAT MNPSA encounters wake turbulence and the pilot considers it necessary, a procedure has been established to allow the aeroplane track to be offset from that of the aeroplane causing the turbulence. The procedure is called the Strategic Lateral Offset Procedure (SLOP) and offers three options. The first allows the aeroplane to be flown along the cleared track centre line, the second to offset by 1 NM right, and the third to offset by 2 NM to the right only. If neither of the offset options are upwind of the other aeroplane, the pilot should contact the other aeroplane on 123.45 MHz and request that that aeroplane adopts an allowable alternate downwind (SLOP) offset.

If wake turbulence is encountered whilst flying in the NAT MNPS airspace, a report is to be submitted to the NAT Central Monitoring Agency.

Deviation Around Severe Weather

If the aircraft is required to deviate laterally from track to avoid weather (e.g. thunderstorms), the pilot should request a revised clearance from ATC and obtain essential traffic information prior to deviating. This is the case even when a pilot expects to have to deviate by a relatively small distance (e.g. less than 10 NM). However, if for any reason such prior revised ATC clearance cannot be obtained, the contingency procedures described below should be adopted. (Efforts should be continued to obtain an appropriate revised ATC clearance.)

a) If possible, deviate away from the organized track or route system;

b) Establish communications with and alert nearby aircraft broadcasting, at suitable intervals: aircraft identification, flight level, aircraft position (including ATS route designator or the track code) and intentions, on the frequency in use (when VHF) and on frequency 121.5 MHz (or, as a back-up, on the VHF inter-pilot air-to-air frequency 123.45 MHz);

c) Watch for conflicting traffic both visually and by reference to ACAS/TCAS (if equipped);

d) Turn on all aircraft exterior lights;

e) For deviations of less than 10 NM, aircraft should remain at the level assigned by ATC;

f) For deviations of greater than 10 NM, when the aircraft is approximately 10 NM from track, initiate a level change of +/-300 ft.

(Climb/descent depends on direction of flight and deviation)

Unable to Obtain Revised Clearance

If it is not possible to obtain a revised clearance immediately, it is to be obtained at the earliest possible time. In the meantime, the pilot shall:

- Broadcast position and intentions on 121.5 MHz at suitable intervals until a revised clearance can be obtained.
- Make maximum use of the aircraft lights to make the aircraft visible.
- Maintain a watch for conflicting traffic.
- Initiate such action as necessary to ensure the safety of the aeroplane.

If a pilot of an aeroplane is unable to obtain a revised ATC clearance, the aeroplane should leave its assigned route or track by turning at least 45° to the right or left whenever this is possible. The direction of the turn should, where possible, be determined by the position of the aircraft relative to any organized route or track system. Other factors may be the direction to an alternate aerodrome, terrain clearance and levels allocated to adjacent routes or tracks. Subsequent actions are determined by the ability of the aeroplane with respect to height keeping. When able to maintain assigned flight level:

- Turn to acquire and maintain in either direction a track laterally separated by 15 NM from its assigned route or track, and
- If above FL410, climb or descend 300 m (1000 ft), or
- If below FL410, climb or descend 150 m (500 ft), or
- If at FL410, climb 300 m (1000 ft) or descend 150 m (500 ft).

An aeroplane unable to maintain its assigned flight level should:

- Initially minimize its descent rate to the extent that it is operationally feasible.
- Turn while descending to acquire and maintain in either direction a track laterally separated by 15 NM from its assigned route or track, and
- For the subsequent level flight, a level should be selected which differs from those normally used by 300 m (1000 ft) if above FL410 or by 150 m (500 ft) if below FL410.

Navigation System Failure

If a failure occurs before entering the MNPSA the pilot should attempt to resolve the problem (determine that the system is useable) or land (or delay the take-off) and get the system repaired. Under no circumstances should an aircraft enter the MNPSA with unresolved navigation errors. Alternatively, the pilot may consider obtaining a clearance to remain outside MNPSA, e.g. below FL290, or re-file for one of the special routes designed for non-compliant aircraft. If however, the aircraft has triple LRNSs, the MNPSA requirement for two LRNSs would be met with one unserviceable, and the flight could proceed as planned. If an aircraft with only two LRNSs suffers a system failure after entering the MNPSA, the flight is to be continued in accordance with the clearance received. In this case the pilot should:

- Assess the situation.
- Prepare a proposal to put to the OACC.
- Advise and consult with the OACC.
- Obtain appropriate re-clearance prior to deviation from the previous clearance.

Whilst continuing the flight, the pilot should closely monitor the remaining system and cross-check heading information with the mag compass and visual indications such as other aircraft tracks and contrail direction. The pilot should also attempt to establish communications with another aircraft that the pilot can see and cross-check heading information with the other aircraft. If the remaining system fails after entering the MNPSA, the pilot should:

- Notify the OACC immediately.
- Make best use of the information obtained from other aircraft.
- Keep a good look out for other aircraft.
- Make maximum use of exterior lights.
- Consider climbing or descending 500 ft.
- Revert to manual navigation if the navigation computer has failed.

Errors Associated with Oceanic Clearances

Navigation errors associated with oceanic clearances fall into several categories of which the most significant are ATC system loop errors and waypoint insertion errors.

ATC System Loop Errors

An ATC system loop error is any error caused by a misunderstanding between the pilot and the controller regarding the assigned flight level, Mach number or route to be followed. Such errors can arise from:- incorrect interpretation of the NAT track message by dispatchers; errors in co-ordination between OACs; or misinterpretation by pilots of oceanic clearances. Errors of this nature, which are detected by ATC from pilot position reports will normally be corrected. However, timely ATC intervention cannot always be guaranteed, especially as it may depend on the use of third-party HF (or even voice communications).

Waypoint Insertion Errors

Experience has shown that many of the track-keeping errors in the NAT MNPS Airspace occur as a result of crews programming the navigation system(s) with incorrect waypoint data. These are referred to as waypoint insertion errors. They frequently originate from:

a. Failure to observe the principles of checking waypoints to be inserted in the navigation systems, against the ATC cleared route.

b. Failure to load waypoint information carefully.

c. Failure to cross-check on-board navigation systems.

Pre-flight and In-flight Procedures

The pre-flight procedures for any NAT MNPS flight must include a UTC time check and re-synchronization of the master clock. Operators must ensure that flight crew are familiar with the concept of cross-checking route inputs into the FMS. Ideally the route would be loaded independently, (each pilot loading his own FMS if this is the type of system installed) then cross-checked by the other pilot. This should be done by noting the position in the system, then comparing it to the Master Document, rather than the other way around. Alignment of the IRS, or Satellite Availability Prediction Programme, for flights using GNSS, must be ensured, and an altimeter cross-check conducted. Prior to entering the NAT OCA a check of the SELCAL, master clock and altimeter cross-check must be conducted. The altimeters must be within 200 ft of each other, and the standby altimeter difference should be noted, so that the error can be applied should there be a failure of the primary systems. The altimeters are to be compared at each subsequent waypoint, and disagreements in excess of 200 ft must be reported.

Questions

1. **What is the procedure if unable to continue in accordance with your clearance on the NAT OTS?**

    a. Attempt to obtain a re-clearance, but if unable turn to take up a track offset by 1 or 2 nautical miles to the right and climb/descend 500 ft
    b. Immediately climb to above FL410 or descend to below FL290
    c. Turn to take up a track offset by 500 NM and climb or descend 15 ft
    d. Turn to take up a track offset by 15 NM and climb/descend 500 ft

2. **What is the procedure for loss of HF comms on the North Atlantic?**

    a. Return to point of departure
    b. Continue in accordance with flight plan or, if cleared to do something else immediately return to flight plan route
    c. Turn to take up a track offset by 15 NM from track, and climb/descend 500 ft
    d. Continue in accordance with your last acknowledged clearance

3. **If travelling west at 72°N how often would you make a position report?**

    a. Every hour
    b. Every 10° of longitude
    c. Every 20° of latitude
    d. Every 20° of longitude

4. **What does MASPS stand for?**

    a. Minimum Aeroplane Separation Procedures
    b. Maximum Altitude Separation Parameters
    c. Minimum Aircraft System Performance Specification
    d. Maximum Aircraft Seating for Passengers Specification

5. **What specifically must be checked prior to oceanic flight?**

    a. Altimeters, waypoint insertion, master clock
    b. Altimeters, FMS, master clock, machmeter
    c. FMS, FGS, NOTAMS, in-flight catering
    d. ELTs, TLAs, FMS, FGS

6. **Over the North Atlantic, outside the times of the OTS which of the following aircraft would be on the correct FL?**

    a. Flying 045° at FL340
    b. Flying 090° at FL340
    c. Flying 270° at FL340
    d. Flying 315° at FL430

7. **What information must a pilot give when calling for oceanic clearance?**

    a. Time of entry, FL and type of aircraft
    b. Maximum Mach number and FL
    c. Maximum attainable FL and POB
    d. FL requested and maximum attainable FL

Answers.

1	2	3	4	5	6	7
d	d	d	c	a	c	d

Chapter

10

Special Operational Procedures and Hazards

Operating Procedures

All non-type related policies; instructions and procedures needed for a safe operation are to be included under the heading 'Operating Procedures' in Part A of the OM. This is to include:

- De-icing and anti-icing on the ground.
- Adverse and potentially hazardous atmospheric conditions.
- Wake turbulence.
- Incapacitation of crew members.
- Use of the Minimum Equipment and Configuration Deviation List(s).
- Security.
- Handling of accidents and occurrences.

Also under the 'Operating Procedures' heading will be detailed policy and procedures for the use of:

- Altitude alerting systems.
- Ground Proximity Warning Systems.
- TCAS/ACAS.

Aeroplane Operating Matters - Type Related

All type related instructions and procedures needed for a safe operation are included in Part B of the OM. The procedures will take into account any differences between types, variants or individual aeroplanes used by the operator. The following items are specifically included under this heading in OM Part B:

- Abnormal and emergency procedures.
- Configuration Deviation List.
- Minimum Equipment List.
- Emergency evacuation procedures.

Minimum Equipment List (MEL) and Master Minimum Equipment List (MMEL)

The MEL is applicable (can be used) up to the commencement of flight. This now implies that it can be used during the taxi and up to the point of commencement of flight. If there is a conflict between any airworthiness directive and the MEL, the airworthiness directive will override.

The following definitions are required knowledge:

- **Commencement of flight**: The point when an aeroplane begins to move under its own power for the purpose of preparing to take-off.

- **Inoperative**: The equipment does not accomplish its intended purpose or is not consistently functioning within its design tolerances or limits. Some equipments have been designed to be 'fault tolerant' and are monitored by computers which transmit a fault message to a centralized computer for the purpose of maintenance. This does not necessarily mean that the equipment is inoperative.

MEL - Operator's Responsibility

The operator is required to establish an MEL for each type of aeroplane used in the operation. The MEL is to be approved by the Authority. The MEL is to be based on, but must not be less restrictive than, the MMEL which has been accepted by the Authority. Unless permitted by the Authority, aeroplanes are only permitted to be operated in accordance with the MEL. Where granted, no such Authority permission will permit operations outside the constraints of the MMEL.

MEL - Commander's Responsibility

The commander is required to make a decision whether or not to accept an aeroplane with unserviceabilities allowed by the Configuration Deviation List (CDL) or the MEL.

Ground De-icing and Anti-icing Procedures

Ice will form on the airframe if there is:

- Water in a liquid state.
- Ambient air temperature below 0°C.
- Airframe temperature below 0°C.

The following types of weather conditions and definitions are required knowledge:

- Drizzle: Fairly uniform precipitation composed exclusively of fine drops (diameter less than 0.5 mm) very close together. Drizzle appears to float while following air currents although unlike fog, drizzle falls to the ground.

- Fog and Ground Fog: A visible aggregate of minute water particles (droplets) in the air reducing the horizontal visibility at the Earth's surface to less than 1 km.

- Freezing Fog: A fog formed by supercooled water droplets which freeze upon contact with exposed objects and form a coating of rime/clear ice.

- Freezing Rain/Drizzle: Rain or drizzle in the form of supercooled water droplets which freeze upon impact with the surface.

- Frost: Referred to as 'hoar frost'. A deposit of ice having a crystalline appearance assuming the form of scales, needles or fans. Frost is formed by sublimation (when water vapour is deposited on a surface whose temperature is at below zero).

- Rain: Liquid precipitation, in the form of drops of more than 0.5 mm in diameter or smaller drops which in contrast to drizzle, are more widely separated.

- Rime: A deposit of ice formed by freezing of supercooled water droplets on objects at temperature below or slightly above freezing point. It is composed of grains separated by air, sometimes adorned by crystalline branches.

- Slush: Water saturated snow which with a heel-and-toe slap-down motion against the ground will be displaced with a splatter.

- Snow: Precipitation of snow crystals mostly branched in the form of six-pointed stars. The crystals are isolated or agglomerated to form snowflakes.

- Dry snow: When the ambient temperature is below freezing.
- Wet snow: When the ambient temperature is near or above freezing.

De-icing is the process of removing ice from an airframe, whereas anti-icing is the process where the formation of ice on the airframe is prevented.

The effects of icing are wide-ranging, unpredictable and dependent on the individual aeroplane design. The magnitude of these effects is dependent upon many variables but the effects can be both significant and dangerous. Flight in known icing conditions is subject to the limitations laid down in OM Part B.

Basically the effects of icing are:

- Aerodynamic (ice alters the shape of the flying surface). Lift can be reduced by as much as 30% and drag increased by up to 40%. This will significantly increase stall speed, reduce controllability and alter flight characteristics.
- Weight (ice adds considerably to the mass of the aeroplane and affects the centre of gravity).
- Instruments: Ice forming on pitot tubes, static vents or angle of attack vanes can cause errors in indications and give false attitude, airspeed, angle of attack and engine power information for air data systems.
- Windscreen and canopies can become obscure, interference can be caused by ice on aerials, under-carriage operation may be affected by ice in the wheel wells, and ice films can cause skin friction.
- Ice build-up on critical surfaces of the aeroplane may also break away during the take-off and be ingested into engines, possibly damaging fan and compressor blades. The formation of ice on an aeroplane on the ground may have a completely different effect on aircraft flight characteristics than ice formation in the air.
- Ice, frost and snow formed on the critical surfaces on the ground can have a totally different effect on aircraft flight characteristics than ice formed in flight.

Operators are to establish procedures to be followed when ground de-icing and anti-icing is required. Also, operators are not to allow aeroplanes to fly in conditions where icing is expected unless the aeroplane is certificated accordingly. Where an aeroplane is to be flown at night in icing conditions, a light is to be provided to illuminate the airframe to see if ice is accruing. The light is to be positioned and of such intensity so that it will not adversely affect the performance of any duty.

The Clean Aircraft Concept

During conditions conducive to aircraft icing take-off shall not be attempted when ice, snow, slush or frost is present, or adhering to the wings, propellers, control surfaces, engine inlets or other critical surfaces. This is known as the clean aircraft concept. Variables that can affect the formation of ice are;

- Ambient temperature.
- Aeroplane skin temperature.
- Precipitation rate and moisture content.
- De-icing/anti-icing fluid type, concentration and temperature.

- Relative humidity.
- Wind.

Where an aircraft is contaminated by ice on the ground the following methods are approved to be used for de-icing:

- The application of de-icing fluids (including 'taxi through' systems).
- Warming of the airframe by use of hot air blowers.
- Manually sweeping the surface where frost and light ice has accumulated.

De-icing and anti-icing on the ground can be either a one-step or a two-step procedure:

- In the case of a one-step procedure, de-icing and anti-icing are carried out at the same time using a combined de-icing and anti-icing fluid to both remove frozen deposits and to protect the de-iced surfaces for a limited period of time.
- The two-step procedure involves a process of ice removal followed by a process of anti-icing.

The fluids used in both processes have 'holdover' times quoted against the nature of the ice to be removed and/or protected against, and a range of ambient temperatures. The Holdover Time (HOT) is the estimated time during which the de-icing/anti-icing fluid will be effective. The aircraft must commence its take-off roll within the HOT, or the whole process, de-ice followed by anti-ice, must be repeated. The HOT is dependent on the OAT, temperature of the skin, type of precipitant, wind and type and concentration of fluid. An example of a HOT table is shown below, and pilots will be required to interpret the HOT. A similar table, or details of where to find a table, would be in Part A of the Ops Manual. Currently there are three types of fluid in general use for turbojet aircraft, type I, II or IV. (Type III can be diluted type II or IV cleared for use on turboprop aircraft). Aircraft must be treated symmetrically, and the pilot in command must ensure that the critical surfaces of the aeroplane are free of ice, snow, slush or frost just prior to take-off. This check shall be accomplished as close to the time of take-off as possible and is normally made from within the aeroplane by visually checking the wings.

EXAMPLE ONLY - NOT FOR OPERATIONAL USE

	Approximate holdover times under various weather conditions (hours:minutes)						
OAT	*Frost*[1]	*Freezing fog*	*Snow*	*Freezing drizzle*[2]	*Light freezing rain*	*Rain on cold-soaked wing*	*Other*[3]
above 0°C (32°F)	0:45	0:12-0:30	0:06-0:15	0:05-0:08	0:02-0:05	0:02-0:05	
0°C to −10°C (32°F to 14°F)	0:45	0:06-0:15	0:06-0:15	0:05-0:08	0:02-0:05		CAUTION: No holdover time guidelines exist
below −10°C (14°F)	0:45	0:06-0:15	0:06-0:15				

1. During conditions that apply to aircraft protection for ACTIVE FROST.
2. Use LIGHT FREEZING RAIN holdover times if positive identification of FREEZING DRIZZLE is not possible.
3. Other conditions are: heavy snow, snow pellets, ice pellets, hail, moderate freezing rain and heavy freezing rain.

Note 1.— ISO Type I Fluid/Water Mixture is selected so that the freezing point of the mixture is at least 10°C (18°F) below actual OAT.

Note 2.— ISO Type I fluids used during ground de-icing/anti-icing are not intended for and do not provide ice protection during flight.

CAUTION: The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when the aircraft skin temperature is lower than OAT. Therefore, the indicated times should be used only in conjunction with a pre-take-off check.

OAT Outside air temperature °C Degrees Celsius °F Degrees Fahrenheit

Figure 10.1: Guideline for holdover times anticipated for ISO Type I fluid mixtures as a function of weather conditions and OAT

Bird Strike Risk and Avoidance

The risk to aeroplanes from collisions with birds and the ingestion or birds or bird remains into engines will always be a hazard as long as aeroplanes share the sky with birds. Action and procedures can be put into effect to minimize the risk and the awareness of these procedures and compliance is the best means of reducing the hazard. ICAO operates IBIS, the ICAO Bird Strike Information System which is designed to collect and disseminate information on bird strikes to aircraft. Aeronautical charts are annotated with known areas where birds congregate and where wildlife sanctuaries have been established. Similarly, the well defined migratory routes of birds, together with the times of the year during which such migrations occur, are also published in AIP ENR 5.6. Providing information is supplied by pilots and ground observers concerning observed moment of concentrations of birds to air traffic units at aerodromes, i.e. position, height, quantity and direction of flight, such information can be relayed to aircraft in flight in the vicinity of aerodromes thus aiding awareness and prompting, if necessary, avoiding action. Pilots are required to report a potential bird hazard to the appropriate ground station.

Hazard to Aeroplanes

Apart from the obvious hazard of airframe damage, bird strikes can cause loss of power if air intakes to engines are clogged, cooling systems can fail if radiator cooling air intakes are clogged, hydraulic pipes exposed with lowered undercarriage can be fractured, and windows and clear vision panels can become obscured. The highest risk to aeroplanes is in close proximity to the ground where deviation from initial or final flight path is impractical, and when power settings are crucial. Aerodromes close to coastal areas and natural areas of habitat for birds are the most vulnerable. A knowledge of the heights at which birds fly, times of day when movement to and from roosting areas is likely and periods of mass migration will assist pilots, air traffic controllers and operators to minimize the risk to aeroplanes. Where birds are a continual risk to aeroplanes, airport authorities set up bird control units (BCUs) employing trained operatives and techniques to reduce the number of birds visiting an aerodrome.

Bird Strike Report

In the event of an aeroplane suffering a bird strike, the commander is to submit a written report of the incident after landing. ICAO Doc 9137 contains significant data regarding bird strikes, their effects and ways to minimize the likelihood.

Incompatible Land Use around Airports

Regulations should be placed on the use of land around airports to reduce the attractiveness to birds. Land uses which have caused specific problems at airports are:

- Fish processing.
- Agriculture.
- Cattle feed lots.
- Rubbish dumps and landfill sites.
- Factory roofs and carparks.
- Theatres and food outlets.
- Wildlife refuges.
- Lakes.
- Golf/polo courses.
- Animal farms.
- Slaughter houses.

This does not mean that there will never be a carpark, or food outlet near an airport! But once an aerodrome is established the Authority will consider bird risk when assessing planning applications nearby.

Noise Abatement

EU-OPS requires noise abatement procedures to be established by operators for IFR operations in accordance with ICAO PANS OPS Doc 8168. Each state will detail noise abatement procedures for each aerodrome which can be found in the national Aeronautical Information Publication Section AD 2 and 3. The procedures have been designed for application to turbojet aeroplanes and comprise any one or more of the following:

- Use of noise preferential runways to direct the initial and final flight paths of aeroplanes away from noise sensitive areas.
- Use of noise preferential routes to assist aeroplanes in avoiding noise sensitive areas on departure and arrival, to direct aeroplanes away from noise sensitive areas located under or adjacent to the usual take-off and approach flight paths, and
- Use of noise abatement take-off or approach procedures, designed to minimize the overall exposure to noise on the ground and at the same time maintain the required level of flight safety.

An operator shall establish appropriate operating departure and arrival/approach procedures for each aircraft type in accordance with the following:

(a) The operator shall ensure that safety has priority over noise abatement, and

(b) These procedures shall be designed to be simple and safe to operate with no significant increase in crew workload during critical phases of flight, and

(c) For each aeroplane type two departure procedures shall be defined, in accordance with ICAO Doc. 8168 (Procedures for air navigation services, "PANS-OPS"), Volume I:

1. noise abatement departure procedure one (NADP 1), designed to meet the close-in noise abatement objective; and
2. noise abatement departure procedure two (NADP 2), designed to meet the distant noise abatement objective; and
3. in addition, each NADP climb profile can only have one sequence of actions.

Noise Preferential Runways

Preferred runway direction for take-off and landing, appropriate to the operation, are nominated for noise abatement to avoid noise-sensitive areas during the initial departure and the final approach phases of flight. Runways should not normally be selected for use for landing unless they are equipped with suitable glide path guidance, e.g. ILS or VASI (in VMC). A runway lead-in lighting system should be provided where it is desired to provide visual guidance along a specific approach path for purposes of noise abatement. Noise abatement should not be the determining factor in runway nomination under the following circumstances:

- If the runway surface conditions are adversely affected by water, snow, slush or ice etc.
- For landing in conditions when the ceiling is lower than 150 m (500 ft) above aerodrome

elevation, or for take-off and landing when the horizontal visibility is less than 1.9 km (1900 m).

- When the crosswind component, including gusts, exceed 28 km/h (15 kt).
- When the tailwind component, including gusts, exceed 9 km/h (5 kt), and
- When windshear has been reported or forecast or when thunderstorms are expected to affect the approach or departure.

Noise Preferential Routes

Noise preferential routes are established to ensure that departing and arriving aeroplanes avoid over flying noise-sensitive areas in the vicinity of the aerodrome as far as practicable. In establishing noise preferential routes, turns during take-off and climb should not be required unless:

- The aeroplane has reached (and can maintain throughout the turn) a height of not less than 150 m (500 ft) above terrain and the highest obstacles under the flight path.
- The bank angle for turns after take-off is limited to 15° except where adequate provision is made for an acceleration phase permitting attainment of safe speeds for bank angles greater than 15°.
- No turns should be required coincident with a reduction of power associated with a noise abatement procedure, and
- Sufficient navigational guidance should be provided to permit aeroplanes to adhere to the designated route.

Note: *PANS OPS Vol. 2 permits turns after take-off at 120 m (400 ft) and obstacle clearance of at least 90 m (300 ft) during the aeroplane turn. These are minimum requirements for noise abatement purposes.*

In establishing noise preferential routes, the safety criteria of standard departure and standard arrival routes regarding obstacle clearance climb gradients and other factors should be taken into full consideration. An aeroplane shall not be diverted from its assigned route unless it has attained the altitude or height, which represents the upper limit for noise abatement, or it is necessary for the safety of the aeroplane.

Procedures

The state in which the aerodrome is located is responsible for ensuring that the aerodrome operators specify noise abatement objectives. The state of the operator is responsible for the approval of safe flight procedures developed by the aeroplane operator.

Limitations

Noise abatement procedures should not be selected if noise benefits cannot be expected. The pilot in command has the authority to decide not to execute a procedure if conditions preclude the safe execution of the procedure.

Take-off

Noise abatement procedures in the form of reduced power take-off should not be required in adverse operating conditions such as detailed in the previous paragraph under Noise Preferential Runways.

Departure Climb

Aeroplane operating procedures for the departure climb are as follows:

- Procedures shall not be executed below a height of 240 m (800 ft) above aerodrome elevation.
- The procedure specified by an operator for any one aeroplane type should be the same for all aerodromes.
- There will be no more than two departure procedures to be used by one operator for an aeroplane type, one of which should be identified as the normal procedure and the other as the noise abatement procedure.
- Normal departure procedures typically include one of the two examples in the appendix to this chapter.
- All necessary obstacle data shall be made available to the operator and the procedure gradient shall be observed.
- Power settings to be used after engine failure/shutdown or other reason for loss of performance during the procedure are at the discretion of the pilot, and noise abatement considerations no longer apply.
- The minimum level of thrust for the flap/slat configuration, after power reduction is the lesser of max climb power and that necessary to maintain the engine inoperative net climb gradient.
- The minimum thrust levels which vary as a function of flap setting, altitude and aeroplane mass are included in the OM. The settings are to take account of engine anti-icing where applicable.
- Procedures are not to be used in conditions where windshear warning exists, or the presence of windshear or downburst activity is suspected.
- The maximum acceptable body angle specified for the aeroplane type shall not be exceeded.

Approach

In establishing noise abatement procedures the following shall be required:

- The aeroplane shall not be in any configuration other than the final landing configuration at any point after passing the outer marker or 5 NM from the threshold of the runway of intended landing (Stabilized Approach), whichever is earlier: and
- Excessive rates of descent shall not be required.

The following safety considerations should be taken into account. Glide path or approach angles should not require an approach to be made:

- Above the ILS glide path angle.
- Above the glide path of the VASI.
- Above the normal PAR final approach angle.
- Above an angle of 3° except when the ILS glide path requires higher.

The pilot should not be required to complete a turn on to final approach at distances less than will, in the case of visual operations, permit an adequate period of stabilized flight on final approach before crossing the threshold. In the case of instrument approaches, permit the aeroplane to be established on final approach prior to intercepting the glide path.

It has been found that reduced power/reduced drag approach techniques (or a combination of both) have proved to be both effective and operationally acceptable. The object of such techniques is to achieve uninterrupted descents at reduced power and drag by delaying the extension of flaps and landing gear until the final stages of the approach. These techniques result in higher than normal gear down and flap approach speeds.

Landing

Noise abatement procedures do not prevent the use of thrust reverse on landing. The use of a displaced landing runway threshold is only to be used for noise abatement if aeroplane noise is sufficiently reduced and the remaining runway distance is sufficient for all operational requirements.

Departure Climb Guidance

The following two examples of operating procedures for the climb have been developed as guidance and are considered safe in accordance with the conditions previously discussed under take-off. The first procedure (NADP 1) is intended to provide noise reduction in close proximity to the departure end of the runway. The second procedure (NADP 2) provides noise reduction to areas more distant from the runway end. The two procedures differ in that the acceleration segment for the flap/slat retraction is either initiated prior to reaching the maximum prescribed height or at the maximum prescribed height. To ensure optimum acceleration performance, thrust reduction may be initiated at an intermediate flap setting. The initial climbing speed to the noise abatement initiation point shall not be less than:

V_2 + 20 km/h to 40 km/h (10 to 20 kt)

The noise abatement procedure is not to be initiated at less than 240 m (800 ft) above the aerodrome elevation.

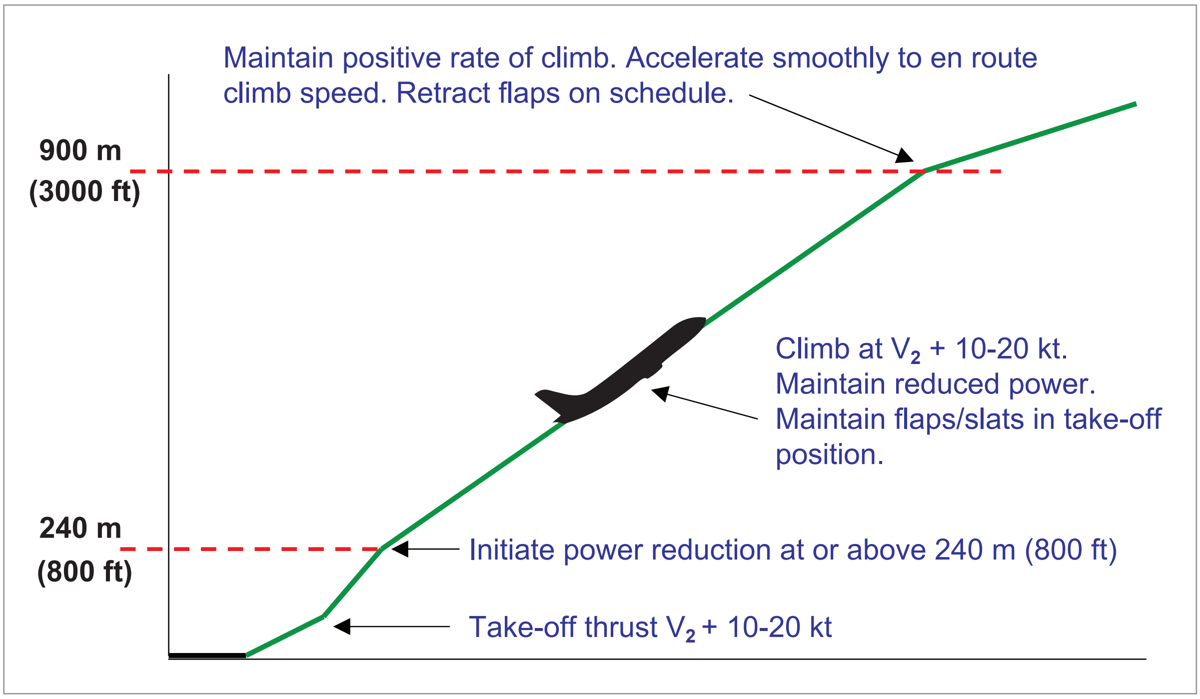


Figure 10.2: Noise abatement take-off climb. Example of a procedure alleviating noise close to the aerodrome (NADP 1)

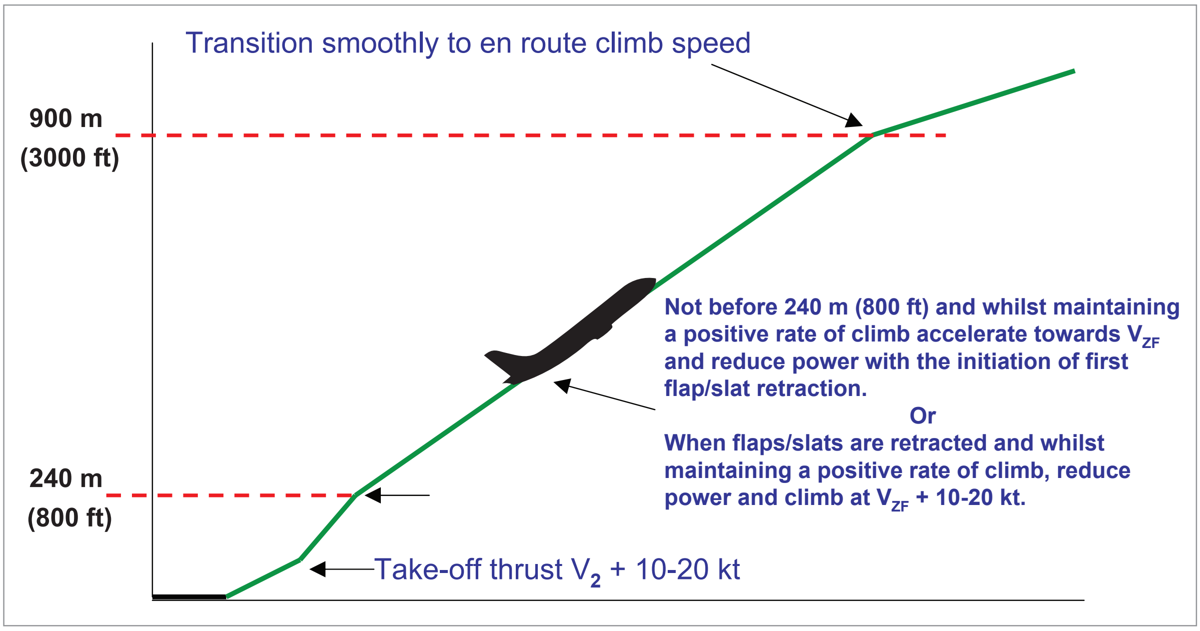


Figure 10.3: Noise abatement take-off climb. Example of a procedure alleviating noise distant from the aerodrome (NADP 2).

Constant Descent Final Approach(CDFA) Profile

Non-precision approaches conducted by commercial air transport aeroplanes used by EU operators should be flown on CDFA profiles, to ensure that a Stabilized Approach can be conducted. In this case, the aeroplane descends from the lowest holding altitude (LHA) in the arrival stack and adopts a 300 ft/NM rate of descent that is maintained all the way to the runway threshold. This minimizes power adjustments and negates the need for the straight and level segment to intercept the glide path from below. It also reduces fuel burn and although this is not a major saving per flight, when multiplied by the annual total of approaches made in an operation, amounts to a significant economy.

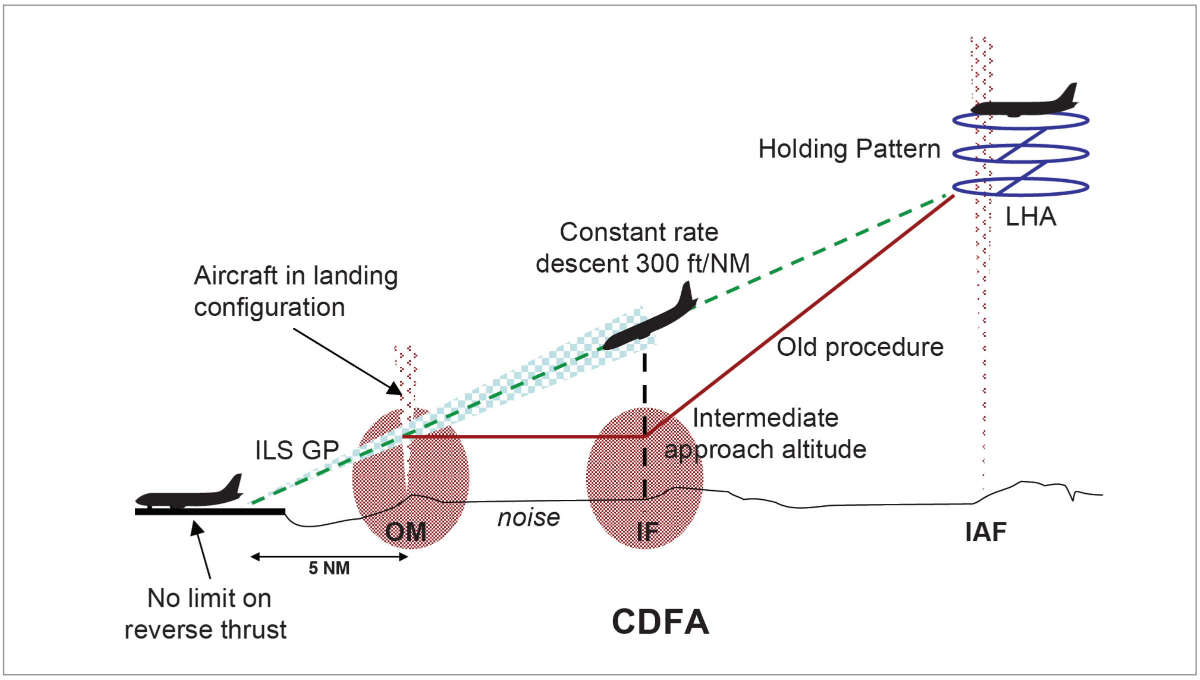


Figure 10.4: CDFA

Questions

1. What are the types of de-icing/anti-icing fluid in common use for turbojet aircraft?

a. Type I,II,III
b. Type II,III,IV
c. Type I,III,IV
d. Type I,II,IV

2. What can affect holdover time?

a. Type of fluid, OAT, precipitant, wind
b. Skin temperature, OAT, precipitant, location of de-ice pan
c. OAT, wind, type of fluid, whether engines are running or not
d. Wind, MTOM, whether it is daytime or night-time, airfield altitude

3. How can icing conditions affect performance?

a. Increase lift by 30%, decrease drag by 40%
b. Increase lift by 40% decrease drag by 30%
c. Decrease lift by 40% increase drag by 30%
d. Decrease lift by 30% increase drag by 40%

4. Which of the following is formally listed as incompatible land use around airports?

a. Zoo
b. Landfill
c. School
d. Coal mine

5. What is the minimum height for a power reduction on a Noise Abatement Departure Procedure?

a. 500 ft
b. 600 ft
c. 700 ft
d. 800 ft

6. Which of the following statements would not be acceptable in aerodrome procedures?

a. Use of reverse thrust should be avoided between the hours of 2200-0600
b. Use of reverse thrust is to be minimized between the hours of 2200-0600
c. Use of reverse thrust is prohibited between the hours of 2200-0600
d. Use of reverse thrust should be minimized at all times

Answers

1	2	3	4	5	6
d	a	d	b	d	c

Chapter

11

Fire and Smoke

11 Fire and Smoke

Fire and Smoke

By the inherent nature of the machine, fire is always a potential hazard where aeroplanes are concerned. The carriage of fuel which has a relatively low flash point, hot gases and hot materials and extensive use of and distribution of electricity, plus human interference, all make a volatile environment for fire to occur. Add to this ample supply of additional combustible material in the form of furniture, clothing and the contents of luggage and freight and a situation is created where, in any emergency situation, consideration of potential fire must be procedurally catered for.

In the design of the aeroplane, the manufacturer is required to build in fire detection and fire protection systems, detailing the correct use in the aeroplane manual (checklists). Likewise any maintenance schedule will contain procedures to reduce the possibility of fire during routine or non-scheduled maintenance. The operator is required to include procedures in the OM for abnormal and emergency operations whilst action specific checklists may either be verbatim extracts from the OM or extracts or annexes from the aircraft manual. In any case, such emergency drill action checklists are to be carried in the aeroplane.

The majority of situations to be catered for such as engine fires, fires in the cabin or the flight deck, hot brakes and the ingress of smoke and fumes into the aeroplane (this list is not exhaustive), require actions that are general in concept but modified by the individual type requirement.

A fire in the carburettor of a piston engine during engine start, caused either by malfunction of the engine (incorrect valve clearance or valve failure) or poor engine starting technique (‘pumping’ the throttle), requires a specific drill for the aeroplane (and engine) which will include the following actions depending on whether or not the engine has started. If it has not started, move the mixture control to ICO, open the throttle fully and continue to operate the starter motor. If it has started: keep it going. In either case, if the fire does not go out after a few seconds, action the engine fire drill (ground) specific for the aeroplane which will include: fuel off; electrics off; brakes off; evacuate the aeroplane.

In the case of an engine fire (other than above) other considerations must be taken into account in deciding the actions necessary. What is the situation of the aeroplane, airborne or on the ground? If on the ground, is the aircraft stationary or taxiing? If the aircraft is stationary, does it have passengers embarked, is it close to other aircraft (with or without passengers embarked) or near to a hangar or other vulnerable ground installation (refuelling point etc)? Clearly, the preservation of human life is paramount in any action, and consideration must be given to summoning trained specialist assistance (fire/rescue crews) and/or declaring the emergency to the relevant control unit. Again, type specific drills are required and these will be contained in or as an annex to, the aeroplane manual. However, initial actions in flight will be generally similar for the type of engine;

Piston Engines

Turn off the fuel (fuel selector off or mixture control to Idle Cut Off (ICO)) and allow the engine to run itself dry of fuel and stop. The engine and the induction system should then be purged of fuel and the fire should be extinguished. At this point the ignition should be switched off to the affected engine (making sure that the correct engine ignition system has been identified!)

Turbo-jet Engines
Close the engine thrust lever, move the engine HP cock to off and pull the appropriate (confirmed) engine fire warning switch. This will have isolated the fuel supply from the engine (usually both high and low pressure) thus removing the obvious source of fuel for the fire. If however, the warning persists, rotate (either left or right) the engine fire warning switch and hold in that position for one second to operate either of the two fire extinguisher systems. Wait 30 seconds. If the warning still persists, rotate the switch to the other system against the stop and hold for one second. This will operate the remaining extinguisher system for that engine. If the fire warning remains illuminated, the Boeing checklist for instance, advises landing at the nearest suitable airport!

Turboprop Engines
The procedure will inherently be the same as for a turbojet engine with the addition that at some stage during the procedure there will be requirement to feather the propeller.

Fire in the Aeroplane

Engine fires are a rare event, and the extinguishant used to combat such fires is predetermined. However, the most likely scenario for a fire in an aeroplane is either a fire caused by electrical arcing or overheating of electronic equipment, or fire generated in the galley or careless/deliberate extinguishing of smoking material where smoking is allowed. Illegal smoking is also a serious fire risk. In combating fire in the cabin and on the flight deck hand-held extinguishers are used. It is therefore necessary for cabin crew and flight deck crew to know which type of fire extinguisher should be used on what type of fire, and to be aware of the hazards associated with the use of extinguishers in the closed environment of the aeroplane.

The Number and Location of Hand-held Fire Extinguishers

The number and location of hand-held fire extinguishers should be such as to provide adequate availability for use, account being taken of the number and size of passenger compartments, the need to minimize the hazards of toxic gas concentrations and the locations of toilets, galleys etc. These considerations may result in the number being greater than the minimum specified.

Flight Deck Extinguisher
There should be at least one extinguisher, Halon 1211 (bromochlorodifluromethane, CBrCIF2) suitable for both flammable fluid and electrical equipment fires installed on the flight deck. Additional extinguishers may be required for the protection of other compartments accessible to the crew in flight.

Dry chemical fire extinguishers should not be used on the flight deck or in any compartment not separated from the flight deck, because of the adverse effect on vision during discharge and, if non-conductive, interference with electrical contacts by the chemical residues. Where a galley is not located on the main passenger deck, at least one extinguisher is to be provided at that location. Also, at least one readily accessible extinguisher is to be available in each class A or class B cargo or passenger compartment, and in each class E cargo compartment that is accessible to crew in flight.

The following table details the number of extinguishers which must be conveniently located in the passenger compartment:

Maximum approved passenger seating configuration	Number of Extinguishers
7 - 30	1
31 - 60	2
61 - 200	3
201 - 300	4
301 - 400	5
401 - 500	6
501 - 600	7
601 or more	8

Figure 11.1: Fire extinguishers

Where two or more extinguishers are required they must be evenly distributed in the passenger compartment. Where the maximum approved passenger seating is greater than 31 but less than 60, at least one extinguisher must be Halon 1211, and where the maximum approved passenger seating is greater than 61 two must be Halon 1211. Only Halon 1211 or water hand-held extinguishers are cleared for use on aircraft. (Other extinguishants may be present in automatic systems)

The following classification of fires is now in general use and it is common practice to identify hand appliances in relation to the class of fire for which they are intended, such as 'Class A' extinguisher, etc. Where an agent may be used against more than one class of fire, such agents are generally referred to as general purpose agents.

Figure 11.2

Smoke

The effects of smoke are reduced visibility and physiological changes to people. The physiological changes include the effects of irritation to the eyes, irritation to the air-ways, over stimulation of the nasal passages and irritation to the lungs. In dense smoke the rate of oxygen absorption in the lungs is reduced resulting in hypoxia after prolonged exposure leading to asphyxiation and death.

Smoke in the cockpit is an obvious flight safety hazard in that it will divert the attention of the pilot(s) from flying the aeroplane to combatting the source of the smoke. Training drills are the best method of dealing with this particular hazard but the success of any such drill relies on total crew co-operation.

In order to combat the effects of smoke in the cockpit, smoke hoods are provided, or the supplementary oxygen mask is designed to provide protection from smoke ingress. Specific drills will be detailed in the OM and will be type dependent.

Smoke in the passenger cabin and toilets can be caused by an engineering associated fire or by the actions of passengers. In particular the careless extinguishing of smoking material or the practice of illegal smoking in toilet areas in aeroplanes in which smoking is prohibited. Again the drills associated with combatting smoke in the cabin will be detailed in the operations manual and will centre on the control of the situation by the cabin staff not directly involved in fighting the fire or locating the source of the smoke.

Smoke will cause panic in passengers and the aversion to covering the mouth and nose by a drop out oxygen mask in the untrained, needs to be firmly handled. Reassurance is the best method calming upset passengers and the commander should keep the passengers fully informed. Ignorance breeds panic! Again, training through realistic drills is essential.

Smoke or fire in a cargo compartment needs to be combatted according to the accessibility of the cargo compartment whilst the aeroplane is airborne. There are five categories of cargo compartment in this respect:

- **Class A**

Smoke/fire easily detectable by a crew member at his/her station and each compartment easily accessible.

- **Class B**

A separate approved smoke/fire detection system giving warning at the Engineer/Pilot station, adequate access in flight and the containment of any extinguishing agent in the cargo compartment.

- **Class C**

A situation not meeting A or B above, but where a separate detection system exists, a remote controlled/automatic extinguisher system exists, a method of excluding smoke, fire and extinguishing agent from the cabin exists, and means of controlling ventilation/draughts in the cargo compartment exist.

- **Class D**

No longer cleared for passenger aircraft.

- **Class E**

(Cargo aeroplanes only). A separate approved smoke/fire detection system giving warning at the Engineer/Pilot station; means of shutting off the airflow exists without affecting the flight deck; means exists to exclude smoke, flames and noxious gasses from the flight deck; and crew emergency exits are accessible under all loading conditions.

The subsequent actions associated with any fire or instance of smoke in an aeroplane will be defined in the OM.

Crew Protective Breathing Equipment (PBE)

Un-pressurized aeroplanes with a MTOM greater than 5700 kg, or with more than 19 passenger seats, and all pressurized aeroplanes, must carry equipment which protects the eyes, nose and mouth of each flight crew member whilst on flight crew duty and provide oxygen for a period of at least 15 minutes. The oxygen supply may be from the supplemental supply as required by EU-OPS 1.770. Sufficient PBE must also be carried for each cabin crew member stowed at the cabin crew member station. Additionally, one set of PBE is to be stowed at or adjacent to the stowage of the hand-held extinguishers. Where a fire is possible in the cargo area, the PBE is to be stowed outside the area but adjacent to the entrance. Whilst using PBE, normal communications must not be prevented.

Crash Axes and Crowbars

Aeroplanes with a maximum take-off mass exceeding 5700 kg or having a passenger seating configuration of more than nine, are to be equipped with a crash axe or crowbar located on the flight deck. Aeroplanes with a passenger seating configuration of more than 200 are required to carry an additional crash axe or crowbar stowed in the rearmost galley area. Axes or crowbars stowed in the passenger cabin are not to be visible to the passengers.

Overheated Brakes

The heating effect of the aircraft braking system is a factor of the mass of the aircraft and the rate of deceleration required. Where such braking is abnormal (abandoned take-off at maximum take-off mass, turn back after take-off or landing on a short runway) excessive heating of the brake system (brake units at the wheels) may result in brake fires or inadequate dispersal of generated heat. Brake packs continue to heat, and reach their maximum temperature, up to 30 minutes after their use. This may cause tyres to ignite or explode, welding of brake components (seizing) and, greatly reduced braking action both during the period of hard barking and during taxiing after reducing to safe speed. It is therefore essential that other speed reducing methods are maintained (do not shut down engines that could provide reverse thrust). Due to the nature of the construction of braking systems, the components remain critically hot for considerable periods and the possibility of fires only reduces slowly. Calculate and wait for the expiry of brake cooling time before attempting a subsequent take-off. It is essential where hot brakes are concerned, that fire prevention/fighting personnel/equipment are/is in attendance and if taxiing the aircraft that a fire truck follows. Maintain two-way communications with the fire crew directly or via air traffic. Give consideration to where the aircraft is to be parked (proximity of other aircraft, buildings, refuelling points) and the possibility of an emergency evacuation of the passengers.

Questions

1. **The correct actions to be taken in the event of a carburettor fire on a piston engined aeroplane depend upon:**

   a. the type of fuel.
   b. whether the engine has started.
   c. the OAT.
   d. the accessibility of a fire extinguisher.

2. **The initial actions to be taken in the event of an engine fire depend upon:**

   a. the type of engine.
   b. whether the aeroplane is in the air or on the ground.
   c. how many passengers are on board.
   d. the availability of crash/fire crews.

3. **What equipment is required to be carried to combat the effects of smoke in the flight deck area?**

   a. Fire extinguishers.
   b. A drop out oxygen system.
   c. Smoke hoods with emergency 100% oxygen supply.
   d. Battery operated torches.

4. **Would you use a dry powder extinguisher on a liquid fire in an aeroplane?**

   a. Yes, but not on the flight deck.
   b. No, it is only for use on electrical fires.
   c. Yes anywhere.
   d. Yes, but only in confined spaces not accessible to passengers.

5. **Fire detection equipment fitted to aeroplanes is designed to:**

   a. detect fire and smoke by optical means.
   b. detect heat by electrical means and smoke by optical means.
   c. operate sprinkler systems.
   d. operate fire alarms and automatically operate CO_2 flooding of inaccessible spaces.

6. **If an aeroplane is certificated for 6 passengers, how many hand-held fire extinguishers are required to be carried in the aeroplane?**

   a. 1.
   b. Nil.
   c. 2.
   d. It depends upon the max take-off mass permitted.

7. **If an aeroplane is certificated for 10 passengers, how many hand-held fire extinguishers are required to be carried in the passenger compartment?**

   a. 1
   b. 2
   c. 3
   d. 4

8. If the galley is not located on the main passenger deck:

a. the closest extinguisher in the passenger compartment must be not more than 10 metres from the galley.
b. the galley must have an automatic extinguisher system and fire detection system.
c. separate extinguishers suitable for both oil and solid fires are to be available in the galley.
d. at least one extinguisher is to be positioned in the galley.

9. A crash axe and/or crowbar is/are required to be carried on the flight deck of aeroplanes:

a. in the public transport (passenger) role.
b. with a max take-off mass exceeding 5700 kg or 10 or more passenger seats.
c. with a max take-off mass of 5700 kg and 9 passenger seats.
d. that are carrying more than 200 passengers.

10. Which combination of the following statements correctly identifies the problems associated with overheated brakes after a heavyweight landing or an aborted take-off?

1. Reduced braking efficiency.
2. Inadvertent operation of fire extinguishers.
3. Extended brake cooling time.
4. Inadvertent operation of brake overheat sensors.
5. Problems with heat dispersal.
6. Risk of tyre explosion.

a. 1, 2, 3, 5 and 6.
b. All.
c. 1, 3, 5 and 6.
d. 2, 3, 4 and 5.

Answers

1	2	3	4	5	6	7	8	9	10
b	a	c	a	b	a	a	d	b	c

Chapter

12

Pressurization Failure

Pressurization Failure

The failure of the pressurization system of an aeroplane is potentially life threatening where the outside air pressure (partial pressure of oxygen) is inadequate to preserve life. Decompression of a pressurized cabin under any circumstances requires that the aeroplane is descended to a minimum of 10 000 ft or the lowest safe flight level whichever is the highest. The aeroplane should be flown during the descent, with regard to maintaining the flying integrity of the airframe. At the lower altitude sufficient oxygen should be present in the atmosphere to sustain life. During the descent supplemental oxygen is required for crew and passengers in accordance with the table below.

Decompression is defined as either slow, or rapid (or explosive). Rapid or explosive decompression is the result of a failure of the airframe to contain the cabin pressure. A slow decompression is the failure of the pressurization system to maintain the cabin pressure where there has not been a failure of the airframe.

Rapid or explosive decompression results in the cabin altitude quickly (or virtually instantaneously) decreasing to the ambient (outside) pressure. This will only occur due to a catastrophic failure of the pressure hull or the loss of a major door or hatch. In the case of an explosive decompression, major damage will have occurred as would be the case of a bomb exploding within the pressure hull or major fatigue failure. Where the flying integrity of the airframe is preserved the aeroplane may be landed safely. Rapid decompression results from a relatively minor rupture of the pressure hull or the loss of a small hatch (emergency escape or a window). In essence, if the size of the rupture is such that the cabin pressure and the outside air pressure are not equalized immediately. The decompression is therefore rapid and not explosive. In reality, the differentiation is academic where the flying integrity of the aeroplane is maintained.

A slow decompression occurs where the pressurization system cannot overcome the loss of pressure caused by a normally controllable vent/opening in the pressure hull; e.g. a leaking pressure seal, a not fully closed pressure relief valve or an inadequacy (failure) in the pressurization system. In a normal system, once the cabin pressure reaches 10 000 ft (700 mb) the altitude warning horn will sound. Prior to this the crew should notice the loss on gauging systems if fitted, cabin altimeter showing an increase or cabin differential pressure gauge showing a reduction. However physiological changes are often the first indication of a problem.

During a slow decompression, passengers and crew will be aware of barometric pressure changes on the ears. Other body cavities (teeth, sinuses and gut) may give rise to discomfort. If it is not possible to equalise the differential pressure by natural venting, serious damage may result. At night, night vision will be seriously impaired at relatively low cabin altitudes.

In extreme cases (rapid and explosive decompression), sinuses and teeth may explode, ear drums rupture, and severe abdominal distension may occur resulting in rupturing of internal organs. The effects especially in the head, may be pronounced where the person is suffering vent blockage due to a build of mucus with a cold. During prolonged periods of reduced oxygen, tunnel vision and sensorial depletion may result. The most obvious indication of a rapid or explosive decompression is white-out, where the moisture in the atmosphere vaporizes, causing instantaneous fog.

Minimum Requirements for Supplemental Oxygen for Pressurized Aeroplanes

The following table describes the requirement for supplemental oxygen (Note 1) as required by EU-OPS 1.770.

1. All occupants of flight deck seats on duty	Entire flight time when the cabin pressure exceeds 13 000 ft and entire flight time when cabin pressure exceeds 10 000 ft but does not exceed 13 000 ft after the first 30 minutes at those altitudes, but in no case less than: (i) 30 minutes for aeroplanes certificated to fly at altitudes not exceeding 25 000 ft (note 2) (ii) 2 hours for aeroplanes certificated to fly at altitudes more than 25 000 ft (note 3)
2. All required cabin crew members	Entire flight time when cabin pressure altitude exceeds 13 000 ft but not less than 30 minutes (note 2), and entire flight time when cabin pressure altitude is greater than 10 000 ft but does not exceed 13 000 ft after the first 30 minutes at these altitudes.
3. 100% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 15 000 ft but in no case less than 10 minutes (note 4).
4. 30% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 14 000 ft but does not exceed 15 000 ft
5. 10% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 10 000 ft but does not exceed 14 000 ft after the first 30 minutes at these altitudes.

Figure 12.1: Oxygen requirement

Notes:

1. *The supply provided must take account of the cabin pressure altitude descent profile for the routes concerned.*
2. *The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 10 000 ft in 10 minutes followed by 20 minutes at 10 000 ft.*
3. *The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 10 000 ft in 10 minutes followed by 110 minutes at 10 000 ft. The oxygen required in CS-OPS 1.780(a)(1) may be included in determining the supply required.*
4. *The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 15 000 ft in 10 minutes.*
5. *For the purpose of this table 'passengers' means passengers actually carried and includes infants.*

Questions

1. **What is a minimum supplemental oxygen requirement to be supplied in a pressurized aeroplane during an emergency descent?**

    a. A supply of oxygen sufficient for all crew and passengers to enable a shallow rate of descent to 10 000 ft or 2 hours whichever is the longer
    b. A supply of oxygen for the crew only for the entire time the aeroplane cabin pressure is above 8 000 ft
    c. A supply for all crew and passengers sufficient for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 15 000 ft in 10 minutes
    d. A supply for 10% of passengers whilst the cabin pressure is over 13 000 ft

2. **In a rapid or explosive decompression:**

    a. the cabin pressure control system immediately reduces the cabin pressure to ambient pressure to prevent the fuselage integrity being destroyed
    b. the cabin altitude quickly or instantaneously reduces to ambient (outside) pressure
    c. the cause of the decompression is usually catastrophic failure of the pressure hull
    d. cabin pressurization system failure will be the first indication that something is wrong

3. **The difference between slow and rapid decompression is:**

    a. a rapid decompression will be immediately noticeable, a slow decompression will require instrumentation to detect the failure
    b. a rapid decompression is caused by a pressure hull rupture whereas a slow decompression is caused by system failure
    c. the rate at which the cabin altitude climbs with respect to the desired climb setting or the automatic control setting
    d. the speed with which the cabin altitude rises with respect to the ambient (outside) pressure

4. **During a slow decompression, passengers will notice:**

    a. the cabin temperature will fall as the pressure reduces
    b. body cavities (sinuses, ears etc.) will become pressurized and may require assistance in venting
    c. as soon as the pressure falls, the oxygen drop-out system will operate
    d. no contra effects, as slow depressurization has no effect on the human body

5. **During a rapid or explosive decompression, passengers may notice:**

    a. gross discomfort, breathlessness, possible damage to sinus cavities
    b. tunnel vision and sensorial depletion
    c. marked reduction in night vision
    d. pain in muscles and joints caused by the bends

6. **In the event of a cabin depressurization, the actions of the pilot will be to:**

a. immediately commence a diversion to a suitable alternate
b. increase engine power to provide additional airflow to the pressurization systems
c. maintain the aeroplane attitude to prevent further damage to the airframe by over loading of the structure
d. commence a descent to an altitude where the supplemental oxygen supply is sufficient for all crew and passengers

Answers

1	2	3	4	5	6
c	b	d	b	a	d

Chapter

13

Windshear and Microburst

Windshear and Microburst

Low altitude windshear is a sudden change of wind velocity along the final approach path or along the runway and along the take-off and initial climb-out path. Vertical windshear is the change of wind vector with height. Horizontal windshear is the change of wind vector with horizontal distance. The most potent examples of windshear are associated with thunderstorms (cumulonimbus clouds), but windshear can also be experienced in association with other meteorological features such as:

- The passage of a front.
- A marked temperature inversion.
- A low level wind maximum, or
- A turbulent boundary layer.

Topography or buildings can exacerbate the situation, particularly when there is a strong wind.

The effect of windshear is an abrupt displacement from the flight path and the need for substantial control action to counter it. A windshear encounter is a highly dynamic event which can be extremely uncomfortable which can strike suddenly with devastating effects. An encounter may cause alarm, a damaged landing gear, or a total catastrophe. The most vital defence is avoidance.

Before a pilot can apply the recovery techniques he will have been taught in training, he must be able to recognize that the aircraft is encountering windshear. There is an unavoidable time lag between the pilot first seeing the signs, recognizing them, applying the appropriate recovery techniques and the aircraft responding accordingly. Reducing the time lag to a minimum means early recognition of the windshear condition by the pilot and the unhesitating application of the recommended windshear recovery techniques. Recognition and reaction times are largely a function of training, by giving the pilot the knowledge to quickly spot the first sign of windshear and the confidence to apply recovery techniques without hesitation.

Indications that an aircraft is encountering windshear may be derived from the flight deck instruments, from special on-board windshear warning equipment, from windshear warnings or other pilots' windshear reports or from external MET clues. Moreover, whether and how quickly the pilot recognizes the instrument and MET signs for windshear depends on factors such as whether the pilot has been forewarned to expect windshear and is therefore alert to the possibility, and the extent to which windshear has figured in the pilot's training.

Where an aeroplane encounters an abrupt decrease in headwind component or an increase in tailwind component, the indicated airspeed will decrease commensurate with the loss of headwind component with no decrease in ground speed. This will result in loss of lift and an increased sink rate during any approach phase. In this energy loss situation, the only remedy is to apply engine power to compensate for the energy loss and accelerate the aeroplane back to the approach reference speed.

An increase in headwind component or a decrease in tailwind component is an energy gaining situation. IAS will increase with no increase in ground speed resulting in greater lift. The gain in energy will be temporary because the gain will be compensated in additional lift. Because the energy gain is temporary, and the flight phase is such that a gain in height is required, no control action would be required as the desired climb rate v IAS will quickly be re-established.

Recognition of external MET clues to the possible presence of low-level windshear near an airport permits the pilot to make an early decision to avoid an encounter by going around or by delaying the approach or take-off until conditions improve. External clues that may be directly visible to the pilot include the following:

(a) Strong, gusty surface winds, especially where the aerodrome is located near hills or where there are comparatively large buildings near the runway,

b) Lenticular cloud (smooth lens-shaped altocumulus) indicating the presence of standing waves, usually downwind from a mountain,

c) Virga, i.e. precipitation falling from the base of a cloud but evaporating before reaching the ground (especially under convective cloud) because downdraughts may still exist and reach the ground even though the precipitation itself has evaporated,

d) Roll cloud girding the base of a thunderstorm and advancing ahead of the rain belt, indicating the presence of a gust front,

e) Areas of dust raised by wind, particularly when in the form of a ring below convective clouds, indicating the presence of a downburst,

f) Wind socks responding to different winds;

g) Smoke plumes sheared, with upper and lower sections moving in different directions; and

h) Thunderstorms, which should always be assumed to have the capability of producing hazardous windshear.

Entering a downdraught from a horizontal airflow, the aeroplane's momentum will at first keep it on its original path relative to the new direction of flow. In addition to a loss of airspeed, the change in relative airflow will also affect the angle of attack of the wing. The resulting decrease of angle of attack will cause a loss of lift which is not desirable near the ground. The risk of a downdraught will be more likely than an updraught below 1000 ft. The vital actions to counter the loss of airspeed (and lift) caused by windshear near the ground are:

- Briskly increase engine power. (Full power.)
- Raise the nose to check descent. (EU-OPs recommends 15°, unless otherwise stated.)
- Co-ordinate power and pitch.

Be prepared to carry out a missed approach rather than risk landing from a de-stabilized approach.

In a microburst situation, the combination of increasing headwind followed by a downdraught, followed by increasing tailwind will result in a temporary energy gain followed by increasing energy loss. The effect during any approach profile will be to cause the aeroplane to sink below the glide path although the first indication is the 'ballooning' of the energy gain. Any action to counter the energy gain will be potentially disastrous as this will compound what will happen shortly afterwards. A successful escape will depend upon an adequate reserve of engine power, height and speed. If the flight path is through the periphery of the microburst, lateral displacement will add to the problem if attempting to line up with the runway. The best defence is to expect the unexpected and know the signs of potential microburst/windshear activity.

If, after carefully assessing all the available information, the pilot decides to continue the approach to land or to proceed with the take-off, preparation should be made for possible encounters with windshear by taking the precautionary actions specified in aircraft OM and airline company flight manuals. However, avoidance is the best precaution.

Questions

1. **What is meant by 'low altitude windshear'?**

   a. Turbulence at or below FL50
   b. A sudden change in wind direction at any altitude below 2000 ft
   c. A sudden change in wind velocity on the runway, final approach or in the climb-out
   d. An unexpected crosswind when the aeroplane is on the runway

2. **Vertical windshear is defined as:**

   a. a change in wind velocity with height
   b. a change in wind speed with an increase in altitude
   c. a change in wind direction, contrary to that expected, with an increase in altitude
   d. a rapid change in speed of an ascending current of air

3. **Horizontal windshear is defined as:**

   a. a change in wind direction with a change in horizontal distance
   b. a change in wind force over a defined area
   c. a change of wind velocity with horizontal distance
   d. any change in speed of a wind that is blowing horizontally

4. **What would you expect to happen in an 'up and down draught' windshear?**

   a. The wind velocity to vary with both altitude and horizontal displacement from a datum
   b. Initially an updraught causing the aeroplane to rise uncontrollably, and subsequently a downdraught causing uncontrolled descent
   c. Encountering alternately rising and descending air currents in the vicinity of large cloud formations
   d. Vertical excursions in horizontal flight

5. **With what met phenomena is windshear most associated?**

   a. Thunderstorms
   b. Passage of a warm front
   c. Tropical revolving storms
   d. Standing mountain waves

6. **Apart from the answer to Q5, windshear can also be found in the vicinity of hills and structures. Where particularly would windshear in this instance be found?**

   a. Upwind and above the hills or structures
   b. In the lee of hills and structures but well above the ground
   c. Downwind of hills and structures from ground level upwards
   d. On the seaward side of hills and structures where no other obstructions are found

7. **If, during an approach to land you encounter an abrupt decrease in wind speed or a shift to a tail wind the aircraft will........ and you should...........**

a.	suffer a loss of lift	apply power
b.	increase speed due to reduced drag	lift the nose
c.	yaw to starboard	apply right rudder
d.	suffer an energy gain	reduce power and lower the nose

8. **Shortly after take-off the attitude of the aeroplane suffers an abrupt pitch-up and IAS rapidly decreases followed quickly by a decrease in altitude. Engine indications are normal. You should suspect what, and what should you do?**

a. Marked temperature drop; apply full power
b. Loss of headwind or an increase in tailwind; apply full power
c. Incipient engine failure (ignore instruments); lower the nose to gain airspeed
d. Local clear air turbulence; reduce speed to V_{RA} and ride it out

9. **On an ILS final approach, you notice that the sky is darkening, visibility is reducing and turbulence is increasing. At the same time you encounter an energy gain situation causing you to 'balloon' above the glide path. What should you do?**

a. Suspect windshear and correct power and attitude to regain the glide path
b. Suspect that you have passed through the top of the turbulence layer and that the wind is no longer geostrophic, so corrections to power and attitude are required
c. Suspect microburst activity and pre-empt the inevitable energy loss situation by leaving power and attitude settings as before and then correct once clear of the microburst
d. Suspect microburst activity, apply full power, climb as per the missed approach procedure and go around for a further approach after the microburst has cleared the approach area

10. **With which of the following should you be aware of the possibility of microburst activity?**

1. Thunderstorms
2. Cumulonimbus clouds
3. Sudden rain squalls
4. Gust front activity (rising dust clouds)
5. Unexpected windshear
6. Virga

a. All the above
b. 2, 4 and 5
c. 1, 3, 4, 5 and 6
d. 2, 5 and 6

Answers

1	2	3	4	5	6	7	8	9	10
c	a	c	d	a	c	a	b	d	a

Chapter

14

Wake Turbulence

Wake Turbulence

The term wake turbulence is used to describe the effect of the rotating air masses generated behind the wing tips of jet aircraft. Wake vortices are present behind all aircraft but are particularly severe when generated by large aircraft. Wake vortices are most hazardous to aircraft with a small wingspan during take-off, initial climb, final approach and the landing phase. The characteristics of the vortex are determined by the aircraft gross weight, the wingspan, airspeed and attitude; The greatest turbulence being produced by heavy aircraft, flying slowly in a clean configuration. The effects disperse and the localized effect of the vortex spreads and loses intensity. Practically, the vortex patterns from an aircraft may be regarded as two counter-rotating cylindrical air masses trailing from the aircraft. Typically, the two vortices are separated by about three-quarters of the aircraft wingspan and in still air tend to drift slowly downwards and, either level off usually not more than 1000 ft below the flight path of the aircraft, or on approaching the ground move tangentially at about 300 ft/sec from the track of the aircraft (in still air). This decays to an average sideways speed of 5 kt.

Wake vortex generation begins when the nose wheel lifts off the runway on take-off and ceases when the nose wheel touches down again. In a crosswind situation, the outward path of the upwind vortex will be opposed by the crosswind, whilst the downwind vortex will be assisted in the outwards dispersal. If the crosswind component is 5 kt, the upwind vortex will remain effectively stationary virtually underneath the flight path of the aeroplane. Windshear close to the ground can cause the vortices to descend at different rates and even cause one vortex to rise. Atmospheric turbulence and high winds close to the ground cause vortices to decay more quickly, thus conditions of light winds require additional attention.

Wake vortices from helicopters are generated by the down-wash of the main rotor where they are transformed into a pair of trailing vortices similar to those of fixed wing aeroplanes. Evidence suggests that per kilogram of aeroplane mass, helicopter vortices are more intense than those of fixed wing aeroplanes.

ICAO defines wake turbulence categories of aeroplanes by maximum take-off mass as follows:

Category	Max Take-off Mass
Heavy	Equal to or greater than 136 000 kg
Medium	Less than 136 000 kg but more than 7000 kg
Light	7000 kg or less

Figure 14.1: Wake turbulence categories (ICAO)

Separation minima are applied between aircraft by distance for both take-off and landing and where complex runway arrangements are in use. The following minima shall be applied to an aircraft on approach and departure phase of flight when

- An aircraft is operating behind another aircraft at the same altitude or less than 300 m (1000 ft) below, or

- Both aircraft are using the same runway or parallel runways separated by less than 760 m, or
- An aircraft is crossing behind another aircraft at the same altitude or less than 300 m (1000 ft) below.

Leading Aircraft	Following	Distance (NM)	Time Equivalent
Heavy	Heavy	4	-
Heavy	Medium	5	2 min
Heavy	Light	6	3 min
Medium	Heavy	3	-
Medium	Medium	3	-
Medium	Light	5	3 min

Figure 14.2: ICAO wake turbulence separation standard for landing

The separation standard for departure is as follows:

<table>
<tr><th colspan="4">Departure</th></tr>
<tr><th>Leading Aircraft</th><th colspan="2">Following Aircraft</th><th>Spacing</th></tr>
<tr><td>Heavy</td><td>Medium or Light</td><td rowspan="2">Departing from the same position</td><td rowspan="2">2 minutes</td></tr>
<tr><td>Medium</td><td>Light</td></tr>
<tr><td>Heavy</td><td>Medium or Light</td><td rowspan="2">Departing from an intermediate point on the runway</td><td rowspan="2">3 minutes</td></tr>
<tr><td>Medium</td><td>Light</td></tr>
</table>

Figure 14.3: ICAO wake turbulence separation standard for take-off

The above separation minima apply to the categories of aircraft where take-off and landing operations are being conducted on parallel runways (less than 760 m apart), or where the projected flight path of the following aircraft crosses that of the leading aircraft at the same level or within 1000 ft lower.

A separation of 2 minutes is to be applied between arrivals and departures where a medium or light aircraft arriving is following a heavy departing, or between a light arriving following a medium departing, where flight paths cross when a runway has a displaced landing threshold. The reverse situation, a medium or light aircraft departing following a heavy arriving (light aircraft departing following a medium arriving), also requires the 2 minute separation.

A similar 2 minute separation applies to a light or medium departing or arriving after a heavy (light departing or arriving after a medium) has made a low or missed approach in the opposite direction. The same separation criteria will apply for parallel runways less than 760 m apart.

Questions

1. **Wake vortex turbulence is correctly defined as:**

a. the displaced air in the wake of the passage of an aircraft
b. the effect of the rotating air masses generated behind the wing tips of all aeroplanes
c. the efflux from jet engines and the wash from propellers
d. 'dirty' air caused by the horizontal movement of an aeroplane through the atmosphere

2. **Wake vortex turbulence is caused by:**

a. the shape of the wing
b. differential speed of movement of air across the wing section
c. the interaction of the engine efflux/prop wash and the 'dirty' air from the wing
d. the disruption of airflow over a wing section when lift conditions exist

3. **Tip vortices are characterized by:**

a. two counter-rotating cylindrical air masses trailing aft from the aeroplane
b. visible disturbances like 'streamers' trailing from wing tips
c. standing waves emanating from the wing area spaced according to the speed of the aeroplane
d. rotating disturbances of the air whilst the aeroplane is in the ground effect region

4. **Vortex generation begins .... and ends ....**

a.	when the aeroplane moves	when the aeroplane stops
b.	when the nose wheel lifts off	when the nose wheel touches down
c.	when lift is being generated	when lift generation stops
d.	when speed exceeds V_1	when speed is lower than V_{AT}+10

5. **Which of the following describes the behaviour of vortices on the ground?**

a. In the absence of crosswind, the vortices move downwards and outwards from the runway centre line at a speed of approx 5 kt
b. With a crosswind, the downwind vortex is stationary and the upwind vortex moves away from the centre line at approx 5 kt
c. With a crosswind, the upwind vortex is stationary and the downwind vortex moves towards the centre line at approx 5 kt
d. With a crosswind, both vortices move away from the centre line in the upwind direction at approx 5 kt

6. **The strongest vortices are generated by:**

a. heavy aeroplanes, travelling fast, in a 'clean' configuration
b. heavy aeroplanes, travelling fast, in a 'dirty' configuration
c. heavy aeroplanes, travelling slow, in a 'clean' configuration
d. heavy aeroplanes, travelling slow, in a 'dirty' configuration

7. Which of the following conditions is worst with regard to wake vortex turbulence?

a. Light winds near the surface
b. Strong winds near the surface
c. Marked vertical windshear
d. Marked atmospheric turbulence near the ground

8. When comparing vortex generation between aeroplanes and helicopters:

a. aeroplanes generate more intense vortices per kg gross mass
b. a helicopter always generates more intense vortices because the diameter of the rotor is greater than a propeller
c. propeller aeroplanes generate more intense vortices than helicopters of the same gross mass
d. helicopters generate more intense vortices per kg gross mass than aeroplanes

9. ICAO categorizes aeroplanes with a max gross take-off mass of 138 000 kg as:

a. upper medium
b. medium
c. heavy
d. Cat D

10. Where a medium category aeroplane is landing behind a heavy category aeroplane, the minimum separation distance in NM is:

a. 3
b. 4
c. 5
d. 6

11. Where a light category aeroplane is landing behind a heavy category aeroplane, the minimum separation distance in NM is:

a. 3
b. 5
c. 4
d. 6

12. Where a light category aeroplane is landing behind a medium category aeroplane, the minimum separation distance in NM is:

a. 6
b. 5
c. 4
d. 3

13. Where a light or medium category aeroplane is taking off behind a heavy category aeroplane on the same runway and from the same point, the minimum separation spacing in minutes is:

a. 1
b. 2
c. 3
d. 4

14. **Where a light category aeroplane is taking off behind a medium category aeroplane on the same runway but the following aeroplane is departing from an intermediate point, the minimum separation spacing in minutes is:**

 a. 1
 b. 2
 c. 3
 d. 4

15. **Where parallel runway operations are being conducted and the runways are separated by 750 m:**

 a. the same wake turbulence separation criteria as single runway operations apply
 b. the separation is reduced to 2 minutes
 c. there is no need to apply separation
 d. separation is only applied if the net flight paths from the parallel runways cross at a distance of not more than 5 NM from the departure end of either runway.

16. **Where parallel runway operations are in use and the projected flight path of the following aeroplane crosses that of the leading aeroplane at the same level or within 1000 ft lower:**

 a. the same wake turbulence separation criteria as single runway operations apply
 b. the separation is reduced to 2 minutes
 c. there is no need to apply separation
 d. separation is only applied if the net flight paths from the parallel runways cross at a distance of not more than 5 NM from the departure end of either runway

17. **What is the minimum separation to be applied where a medium category aeroplane is about to take off after a heavy category aeroplane has made a missed approach in the opposite direction?**

 a. 1 minute
 b. 2 minutes
 c. 3 minutes
 d. 4 minutes

18. **The medium aeroplane taking off in Q17 is doing so on a parallel runway to the runway on which the heavy has just carried out the missed approach in the opposite direction. Is there any change in the separation standard applied?**

 a. Yes, the separation is halved
 b. No, providing the runways are less than 760 m apart
 c. Yes, they are changed to a separation distance
 d. Yes, the separation is doubled

Answers

1	2	3	4	5	6	7	8	9	10	11	12
b	d	a	b	a	c	a	d	c	c	d	b

13	14	15	16	17	18
b	c	a	a	b	b

Chapter

15

Security

15 Security

Security

The following definitions regarding security are required knowledge;

Aircraft Security Check An inspection of the interior of an aircraft to which passengers may have had access and an inspection of the hold for the purposes of discovering suspicious objects, weapons, explosives or other dangerous devices, articles and substances.

Screening The application of technical or other means which are intended to identify and/or detect weapons, explosives or other dangerous devices, articles or substances which may be used to commit an act of unlawful interference.

Security Safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human material resources.

Security restricted area Those areas of the airside of an airport which are identified as priority risk areas where, in addition to access control, other security controls are applied.

Unidentified baggage Baggage at an airport, with or without a baggage tag, which is not picked up by or identified with a passenger.

Security in civil aviation has been the subject of national and international law including ICAO conferences. Such law and requirements are designed to prevent unauthorized interference with flights and to protect passengers and crew whilst pursuing the aims of international air transport. In the relevant rules and laws, the responsibility for ensuring that all appropriate personnel are aware of the rules and regulations is placed with the operator.

Operators are required to operate training programmes to train personnel to minimize opportunities for unlawful interference and the consequences of such events should they occur. Following an act of unlawful interference on board his aeroplane, the commander, or, if for any reason he is unable to do so, the operator, is to submit a report without delay to the designated local authority and the Authority in the state of the operator.

In the event of unlawful interference in flight, the pilot in command shall endeavour to set the transponder to A-7500 unless the situation warrants the code A-7700. If ATC requests confirmation of code A-7500 the PIC, if able, should confirm verbally the situation. If this is not a viable option, the PIC should say nothing. ATC will take this as confirmation of the code, and initiate appropriate action in accordance with state procedures.

Wherever possible, an aeroplane subject to unlawful interference shall be flown on the assigned track until ATC can be informed or until within radar surveillance coverage. Where deviation from assigned track is unavoidable and ATC is not informed, the commander is to broadcast warnings on the emergency frequencies unless circumstances on board dictate otherwise. The use of transponder and any other system (data link) should be considered. If procedures have been detailed in Regional Supplementary Procedures they should be used if possible. If no applicable regional procedures exist, proceed at a level which differs from normal IFR cruising levels by 500 ft, if vertical separation minima is 1000 ft or 1000 ft in areas where vertical separation minima is 2000 ft.

Security

ICAO contracting states are obliged to take all adequate measures to protect passengers and crew of any aeroplane subject to unlawful interference until the journey can continue including a fully functional Air Traffic system. Such states will also provide landing clearance as may be necessitated by the circumstances. Where an aeroplane subject to unlawful interference lands in a contracting state, that state is to take all reasonable steps to prevent the aeroplane taking off unless its departure is necessary to protect human life. When an aircraft subject to interference has landed in a state other than the state of registry, the Authority of the state is to inform the state of registry and the state of the operator by the most expeditious means. Other states are to be informed where citizens of those states:

- have suffered fatalities or injuries.
- have been detained as hostages.
- are known to be on board.

ICAO is also to be informed.

An operator shall ensure that there is on board a checklist of the procedures to be followed in search of a bomb or improvised explosive device (IED) in case of suspected sabotage and for inspecting aeroplanes for concealed weapons, explosives or other dangerous devices. The checklist shall be supported by guidance on the appropriate course of action to be taken should a bomb or suspicious object be found, and information on the least-risk bomb location specific to the aeroplane. The least-risk bomb location, is, as the name suggests the preferred place on the aircraft to place any suspect or confirmed IEDs. Flight deck doors on commercial air transport aircraft must be capable of being locked and unlocked from the inside. Additionally, there must be a means available for the cabin crew to advise the flight crew of suspicious activity or security breaches. On aeroplanes with more than 60 passenger seats, or with a MTOM over 45 500 kg, the door must be capable of being remotely locked/unlocked from either pilot station, and a means to monitor the area immediately outside the door available to both pilots. The door is to be closed prior to engine start, and, other than for authorized access, to remain so until after engine shutdown. The door, and the surrounding bulkhead, must be bullet proof, and resistant to penetration by shrapnel.

Questions

1. Who is responsible for instigating training programmes, the aim of which is to minimize the opportunities for unlawful interference with flights?

a. The Authority of the State of Registration
b. The Authority of the State of the operator
c. The operator
d. The law enforcement agency with responsibility under the law of the state of registration of the aeroplane

2. Who is responsible for reporting acts of unlawful interference?

a. The commander or the operator
b. The ATCU for the airspace in which the event occurred
c. Any member of the flight crew
d. Any person on board the aeroplane

3. The operator is responsible for ensuring that a search procedure of an aeroplane is published. By what means are these procedures published?

a. In the operations manual
b. As a checklist
c. As a standing order or standard operating procedure
d. As an enclosure to the aeroplane handbook

4. After an act of unlawful interference a report is to be made. When and to whom?

a. Within 10 days and to the Authority of the state of registry
b. Immediately and to the Authority of the state of the airspace in which the event occurred
c. Without delay, to the designated local Authority and the Authority of the state of registration
d. Without delay, to the designated local Authority and the Authority of the state of the operator

5. When an unlawful interference occurs, the state over which the event occurs is required by international law to take adequate measures to protect passengers and crew. Such measures will include:

a. the provision of a fully functioning ATC system and a landing clearance if required
b. if the aeroplane lands, it is to be disabled to prevent subsequent take-off
c. facilities for the armed forces of the state of registry (if not the same as the state in which the aeroplane has landed) to storm the aeroplane by force
d. notification to ICAO that the event has occurred

6. If it is suspected that a bomb is on board an aeroplane the measures that should be taken are designed to:

a. disable the device
b. find out what will trigger the device
c. prevent knowledge of the device on board getting to the passengers
d. locate and move the device to the ‘least-risk’ location and apply as much padding as possible

Answers

1	2	3	4	5	6
c	a	b	d	a	d

Chapter 16

Emergency and Precautionary Landings

Emergency and Precautionary Landings

During the progress of an emergency situation, it may become evident that it is desirable to abandon further flight. Clearly, where this is done it should be achieved with the minimum risk to the crew and passengers and where possible to preserve the integrity of the airframe. The variety of situations range from minor restrictions of performance, to major (or catastrophic) structural failures or total propulsion system failures. It may be that the speed with which a situation deteriorates will dictate the action to be taken, but where possible consideration should be given at an early stage to landing the aircraft whilst full control (or with only minor limitations to performance) remains with the pilots.

In the extreme, total engine failure or severe structural failure will necessitate immediate landing providing the attitude of the aeroplane can still be controlled. If there is no airfield immediately available, then the aeroplane will have to be landed either on unprepared land or on the surface of the sea. In any such event, procedures will be laid down in the OM (type specific) to cater for the situation of an emergency landing or ditching. In all aircraft however, unless otherwise stated, for an emergency landing on land undercarriage should be down, and for all landings on water the gear must be up.

Ditching

During design, the ditching (landing on the surface of the sea) characteristics of the aeroplane will be explored fully and final attitudes, speeds and configurations suggested that would give the best chance of the airframe surviving the ditching. Statistically, ditching is generally successful although subsequent survival and rescue depends on many other factors. From data in the UK and the USA, 88% of ditchings result in few, if any, injuries to pilots or passengers. In the cases where death results from ditching, it is mainly caused by drowning subsequently. The success of ditching depends on the level of preparedness. The success of survival afterwards depends on rapid rescue and this will only result from good communications during the initial emergency and after the decision to ditch has been taken. Ditching is a deliberate landing on water, it is not an uncontrolled impact. Limitation to injuries of passengers will be achieved by adopting a braced posture whilst securely restrained in the seat harness, wearing a life jacket after having been fully briefed about what to expect during the landing and what to do afterwards. It is also imperative that loose articles are stowed, seats correctly positioned and access to emergency exits cleared. Supervision of this is the responsibility of the cabin staff and will form an essential part of cabin crew training.

The flight deck crew will action ditching checklists (type specific) and make any decisions necessary. It is a recommended (successfully proved) practice to land along the swell direction, on the crest of the swell. This will be where the water reaches its high point, the water will therefore be travelling downwards on initial contact, thereby reducing the impact force. However it must be borne in mind that swell is produced by tidal movement of the water, whereas waves are caused by the wind, and may be running across the swell. Therefore the best compromise between swell, waves and wind should be aimed for. In any event, the impact of the landing will be higher than a normal landing and the severity of the impact force will increase with sea state. Again it is recommended to land the aeroplane at the lowest possible speed (gear up) with an attitude such that the tail will touch first. The aeroplane should be flown onto the water, not dropped onto it through stalling. If the approach attitude and speed is satisfactory, it is inevitably there will be one or two minor skips before the main impact.

This will result in very high rotational (pitch) g force and may tend to ‘dig’ the nose into the water, compounding the effect. Clearly this will be exaggerated as sea state increases, and will be accompanied by uncontrolled roll. The main effect will be, however, rapid deceleration and the pre-landing preparation in the cabin will be to counter the effect of this deceleration. The aeroplane will come to rest very quickly, and unless the airframe has been catastrophically damaged, it should float for sufficient time for the crew and passengers to exit the cabin and board the dinghies.

Precautionary Landing

If the nature of the emergency is such that diversion to an en route (or nearest) aerodrome is elected, then ATC should be informed of the decision to divert, the nature of the emergency and the assistance required. It is assumed that emergency communication procedures (Mayday/Pan Pan) will be employed to initially alert ATC to the emergency. During the transit to the diversion aerodrome, there may be time for ATC to ‘scramble’ fixed wing SAR assets to escort the aeroplane in the emergency, or to raise the readiness level of assets on the ground. In any event, where it is feasible to do so, the instructions from ATC should be complied with regarding heights to fly, routeing and communications. It must always be foremost in consideration, that the situation could rapidly deteriorate forcing emergency landing or ditching. It will be the responsibility of ATC to alert the ground emergency services (fire/rescue, medical) and to pass necessary information to the commander of the aeroplane in emergency.

Passenger Briefing

In any emergency situation, fear amongst passengers is inevitable. This can lead to panic, disregard of authority and possible medical problems caused by anxiety, hypertension or hyperventilation. In the strong, the desire for self-preservation, may overcome self-discipline, and in the weak there may be a tendency to give up there and then. However, the cause of fear is ignorance, and the best way to overcome this is to brief the passengers fully (and also the cabin crew) about what has happened, what is being done and what is likely to happen subsequently. If a decision is made to carry out an emergency landing/ditching, the time between advising the passengers that this will happen until just before the event should be used in preparing the cabin and the passengers for the event. A continual stream of advice and instructions, information and practice, will occupy the minds of the passengers (and of course prepare them mentally and physically). The authority of the commander and the appreciation of the implied skill level of the crew will be reinforced by PA messages from the flight deck. The visual presence of the flight attendants in the cabin until they have to take up their landing positions will reinforce the opinion that the situation is fully under control.

Any procedure employed before an emergency landing/ditching must include a comprehensive brief to the passengers concerning the evacuation of the aeroplane after the event. The brief must stress the authority of the cabin crew with the requirement that the passengers do as they are told. In a ditching situation the correct fitting and use of life preservers (jackets) must be restated.

It should have already been covered during the initial passenger brief. The passenger brief card (one at each seat) will repeat and reinforce the information.

Evacuation

In the event of an emergency landing/ditching or following a precautionary landing, rapid evacuation of the aeroplane is essential to prevent loss of life. In any emergency the possibility of fire cannot be ruled out, and the only action passengers can take in the event of fire is to get as far away from the aeroplane as quickly as possible. Even if no fire is present, the risk still remains. During the initial passenger brief, the position of emergency exits and the routes to be taken to them from individual seats is explained. The passenger brief card (one at each seat) will reiterate the information. Successful evacuation of the aeroplane relies on firm control by the cabin crew, imposition of strict discipline and the correct use of the equipment. Drills and crew training are the responsibility of the operator and such procedures including preparation for the evacuation will be detailed in OM Part B. The aircraft must be stopped, and all engines shut down before ordering an evacuation. Aeroplanes with more than 44 passenger seats must be capable of being evacuated in less than 90 seconds in a simulated emergency.

Megaphones

An operator shall not operate an aeroplane with a maximum approved passenger seating configuration of more than 60 and carrying one or more passengers unless it is equipped with portable battery-powered megaphones readily accessible for use by crew members during an emergency evacuation, to the following scales:

For each passenger deck, passenger seating configuration number of megaphones required:

61 to 99	1
100 or more	2

For aeroplanes with more than one passenger deck, in all cases when the total passenger seating configuration is more than 60, at least 1 megaphone is required.

Questions

1. **An emergency landing or ditching is defined as:**

   a. a procedure that is not a normal landing where the intent is to attempt to preserve the integrity of the airframe to permit orderly and controlled evacuation of passengers from the aeroplane.
   b. any landing where the pilot does not have full control of the aeroplane.
   c. any landing where the structural integrity of the aeroplane has been seriously affected.
   d. a landing for which ATC permission has not been previously obtained.

2. **The aim of a ditching procedure is:**

   a. to enable the pilot to land the aeroplane on water rather than a crash landing on land.
   b. to land on water if the undercarriage is not able to be lowered correctly.
   c. to land the aeroplane on water if it is not possible to reach land.
   d. to land the aeroplane on water if it is on fire.

3. **A precautionary landing is a procedure that:**

   a. enables the aeroplane to land at the destination with unserviceabilities that prevent a normal instrument approach being carried out.
   b. enables a landing after the declaration of a state of emergency or urgency.
   c. enables a landing if it is suspected that the undercarriage is not properly lowered.
   d. is carried out in the event of landing at an alternate aerodrome.

4. **What is the purpose of the passenger briefing given in the event of a precautionary landing being necessary?**

   a. To find out if there are any other pilots on board who may have experienced the situation and can help.
   b. To prepare the passengers for the worst outcome.
   c. To stop the passengers pestering the cabin staff so that they can get on with their preparations for crash-landing or ditching.
   d. By involving the passengers and sharing information, fear may be overcome and greater survivability achieved.

5. **In the event of a successful crash landing or ditching, rapid and controlled evacuation from the aeroplane is essential. In order to achieve this:**

   a. all doors and windows should be opened as soon as the aeroplane comes to rest.
   b. women and children should be evacuated first.
   c. the use of slides/chutes is preferred.
   d. the cabin staff have to impress their authority and frequently carry out drills and practices.

6. One way in which passengers can be reassured during an emergency is:

a. to regularly see members of the flight crew calmly moving about the cabin in a relaxed manner.
b. for the captain or first officer to keep a running commentary going over the PA.
c. for the cabin staff to ensure that the passengers are aware of what is happening and that they are complying with instructions.
d. for the cabin staff to direct the passengers' attention to the emergency passenger brief cards and make sure that they have read them.

7. Briefing the passengers about the emergency prior to the crash landing /ditching must include:

a. comprehensive brief concerning evacuation.
b. how to tackle any fires that may result, including the use of extinguishers.
c. a short brief concerning survival in the environment to be encountered.
d. deputizing passengers to take over from the crew if they are all killed.

8. If a ditching is inevitable:

a. non-swimmers are to be evacuated first.
b. life jackets are to be inflated before leaving the aeroplane.
c. the use of life jackets is to be reiterated before the ditching.
d. passengers should be briefed that even if they successfully evacuate the aeroplane it is inevitable that some of them will die from drowning.

9. Where are details of drills and crew training requirements for evacuation of an aeroplane in an emergency published?

a. In the Training Manual (Part B section 11 – Emergency Procedures).
b. In the Aeroplane Manual.
c. In the aircrew training notes.
d. In the Operations Manual (Part B section 11 – Emergency Evacuation Procedures).

10. If the captain elects to ditch the aeroplane, it is recommended to:

a. land along the swell.
b. land into the swell but downwind.
c. land into the swell but into wind.
d. land into wind regardless of the swell direction if the wind speed is over 20 kt.

11. The method of alighting the aeroplane on water during a ditching is to:

a. carry out a normal approach with flaps and gear selected as normal but to calculate all speeds plus 10 kt.
b. reduce the approach angle to 1.5° (150 ft per mile), add 15 kt to all speeds, keep the aeroplane clean (no flaps or gear) and fly it onto the surface.
c. fly a normal approach but keep the gear up and land at the lowest possible speed with the nose raised for the tail to strike first.
d. fly a normal approach to stalling speed and then drop the aeroplane vertically onto the water.

12. During a ditching passenger injuries can be limited by:

a. ensuring that all seat belts are fastened as tightly as possible and passengers brace themselves against the seat in front.
b. ensuring that seat belts are fastened and passengers adopt a braced position with heads as far forward with hands clasped behind the neck so as to minimize further forward movement of the body at impact, and the wearing of life jackets.
c. ensure that all loose objects in passenger cabin are held tightly by passengers.
d. illuminating the No Smoking light, ensuring seats are fully forward, internally stowed dinghies are placed by emergency exits for quick deployment.

13. During a ditching:

a. there will be one or two minor skips after the main impact.
b. it is inevitable that the nose will dig in and the aeroplane will immediately start to submerge.
c. the main effect will be rapid deceleration and the preparation in the cabin will be to counter the effects of this deceleration.
d. as sea state (wave height and swell height) increases, the effect of the initial high rotation will be reduced and the accompanying uncontrolled roll will disappear.

14. In the event of a precautionary landing, who is responsible for alerting the emergency services?

a. ATC.
b. The commander.
c. The local constabulary.
d. The operations despatcher.

Answers

1	2	3	4	5	6	7	8	9	10	11	12
a	c	b	d	d	c	a	c	d	a	c	b

13	14
c	a

Chapter

17

Fuel Jettison

Fuel Jettison

In the event of an emergency occurring when the aeroplane mass exceeds the maximum landing mass, and the decision of the commander to land as soon as possible, a system is fitted to the aeroplane to dump fuel by a controlled process. The system used to facilitate this is the fuel jettison system. Every aeroplane must have a fuel jettison system fitted unless the maximum landing mass exceeds the maximum take-off mass less the mass of the fuel necessary to carry out a 15 minute flight consisting of a take-off, climb to safe height, go-around and landing at the aerodrome of departure (all flown in the landing configuration). The use of a fuel jettison system in an emergency is not prohibited by the Rules of the Air prohibition on the dropping or spraying of materials from aeroplanes.

Jettison System Certification Requirement

Where a fuel jettison system is required, the system must be capable of jettisoning enough fuel in 15 minutes (starting at max take-off mass) to reduce the aeroplane mass to enable the aeroplane to meet the climb requirements of CS-25. Prior to certification, jettison trials must demonstrate that the jettison system is free from fire hazards, fuel discharges are clear of the aeroplane, fuel or fumes do not enter any part of the aeroplane and that the jettison operation does not affect the controllability of the aeroplane.

Jettisoning Procedure

Pilots of aircraft in flight are permitted to jettison fuel in an emergency. It must be borne in mind that fuel jettison is an emergency procedure to reduce aircraft mass expeditiously. The decision to jettison rests with the commander alone but the decision to jettison must be compatible with safety and the ability of the aeroplane to continue flying. When an aircraft operating within controlled airspace needs to dump fuel, the flight crew shall co-ordinate with ATC the following : route to be flown, which, if possible, should be clear of cities and towns, preferably over water and away from areas where thunderstorms have been reported or are expected, the level to be used, which should be not less than 1800 m (6000 ft) and the duration of the fuel dumping. If the use of flaps or slats adversely affects the jettisoning of fuel, their use during jettisoning must be prohibited, and a placard stating this must be positioned adjacent to the jettison control.

Safety

Unless there is an overriding requirement to jettison fuel, the aeroplane should be flown to an allocated area at an allocated height prior to commencing jettison. Consideration should be given to the weather conditions and areas of electrical storm activity should be avoided, as should areas of excessive turbulence. The no smoking light is to be illuminated and passengers briefed. ATC is to be informed that jettison is about to commence. Once jettison has begun, electrical switching should be restricted to essential use only, HF radio transmission suspended and VHF transmissions restricted to further emergency/flight safety communications only. The flow of fuel from the jettison vents is to be visually monitored (where possible) confirming flow started and flow stopped as required. During jettison manoeuvres should be smooth and the operation of flaps, slots or slats restricted to essential use only. Once the jettison is complete, ATC should be informed.

Questions

1. **Where a fuel jettison system is fitted to an aeroplane it must be capable of:**

   a. reducing the aeroplane mass from max take-off mass to max landing mass in 15 mins
   b. reducing the aeroplane mass from max take-off mass to max landing mass in 10 mins
   c. reducing the aeroplane mass from max take-off mass to max landing mass in 20 mins
   d. reducing the aeroplane mass from max take-off mass to max landing mass in 5 mins

2. **Which of the following correctly describes the requirement of a fuel jettison system?**

   a. Free from fire hazards; discharges are clear of the aeroplane; fuel or fumes do not enter the aeroplane; control of the aeroplane is not affected by the jettison operation
   b. Free from fire hazards; discharges are clear of the aeroplane; fuel or fumes do not enter the aeroplane; normal radio operation can continue
   c. Free from fire hazards; discharges are clear of the aeroplane; fuel or fumes do not enter the aeroplane; must be safe to use in all weather/environmental conditions
   d. The system must contain a protection device to stop the jettison as soon as the gear is lowered, and also to prevent all tanks being drained totally

3. **Fuel jettison:**

   a. is a procedure to reduce mass in an emergency only
   b. is a procedure that may be employed to reduce aeroplane mass where an overweight landing may result in damage to the aeroplane
   c. may be authorized by ATC to reduce delays by protracted holding procedures
   d. may be ordered by ATC to reduce aeroplane mass in an emergency situation

4. **Fuel is to be jettisoned:**

   a. over the sea and then only above 10 000 ft
   b. over the sea, or over land above 10 000 ft agl
   c. anywhere and at any height if unavoidable in an emergency
   d. over the sea, or over land above 4000 ft in summer or 7000 ft in winter

5. **The following aeroplanes are required to have a jettison system:**

   a. all public transport aeroplanes
   b. only public transport aeroplanes with MTMA greater than 5700 kg
   c. all public transport aeroplanes requiring two pilots
   d. all aeroplanes, except where the max landing mass exceeds the max take-off mass less the mass of fuel required for a 15 minute flight to land back at the aerodrome of departure

6. **When jettisoning fuel, safety is an overriding consideration. Which of the following lists correctly identifies items to be considered when planning to jettison fuel?**

   a. Smoking; HF Radio; operation of flaps/gear/slats; weather conditions
   b. Height; speed; ATC clearance; weather; area
   c. Time required; position; other aeroplanes; proximity of cloud; aeroplane attitude
   d. OAT; wind direction; altitude; time of day; airspace restrictions; any other emergencies

7. **Once jettison has begun:**

   a. passengers are restricted to their seats and strapped in
   b. normal operation of flaps/gear and lift enhancers is permitted
   c. HF radios may be used but limited to essential transmissions only
   d. fuel flow from the vents is to be visually monitored (where possible)

8. **Once the fuel jettison is complete:**

   a. it is essential that the fuel remaining is balanced in the tanks and a revised endurance calculated
   b. ATC is to be informed that jettison is complete
   c. the NO SMOKING light is to be extinguished
   d. normal food distribution service is to recommence

Answers

1	2	3	4	5	6	7	8
a	a	a	c	d	a	d	b

Chapter

18

Transport of Dangerous Goods by Air

Transport of Dangerous Goods by Air

ICAO Annex 18 details the international Standards and Recommended Practices for the carriage of articles or substances which are capable of posing significant risk to health, safety or property when transported by air. Operators are not permitted to transport dangerous goods (as defined in Annex 18) unless approved by the Authority. The operator's eligibility to the carriage of dangerous goods will be highlighted in their Air Operator's Certificate.

The following are defined in relation to the transport of dangerous goods by air:

Cargo Aircraft
Any aircraft, other than a passenger aircraft which carries goods or property.

Consignment
One or more packages of dangerous cargo from one shipper at one time and at one address, in one lot, moving to one consignee at one destination address.

Crew Member
A person assigned to duty on an aircraft during flight time, by an operator.

Dangerous Goods
Articles or substances which are capable of significant risk to health, safety or property.

Dangerous Goods Accident
An occurrence associated with and related to the transport by air of dangerous goods which results in fatal or serious injury to a person or major property damage.

Dangerous Goods Incident
An occurrence other then a dangerous goods accident related to the transport by air of dangerous goods (not necessarily occurring on board an aircraft) which results in injury to a person, property damage, fire, breakage, spillage, leakage of fluid or radiation or other evidence that the integrity of a package has not been maintained. Any occurrence relating to the transport of dangerous goods which seriously jeopardizes the aircraft or its occupants is also deemed to constitute a dangerous goods incident.

Exception
A provision which excludes a specific item of dangerous goods from the requirements normally applicable to that item.

Exemption
An authorization issued by an appropriate national Authority providing relief from the provisions of the regulations.

Flammable
The property of material to ignite if the temperature of the material is raised above the flash point (same meaning as inflammable in English).

Flight Crew Member
A licensed crew member charged with duties essential to the operation of an aircraft during flight time.

Incompatible
Describing dangerous goods which, if mixed, would be liable to cause a dangerous evolution of heat or gas, or produce a corrosive substance.

Operator
A person, organisation or enterprise engaged in or offering to engage in aircraft operation.

Overpack
An enclosure used by a single shipper to contain one or more packages to form one handling unit of convenience of handling or stowing.

Package
The complete product of the packing operation consisting of the packaging and its contents prepared for transport.

Packaging
Receptacles or any other components or materials necessary for the receptacle to perform its containment function and to ensure compliance with the packaging requirement of Annex 18.

Packing
The operation by which articles or substances are enveloped in wrappings and/or enclosed in packaging or otherwise secured.

Passenger Aircraft
An aircraft that carries any person other than a crew member, an operator's employee in an official capacity, an authorized representative of an appropriate national Authority or a person accompanying a consignment or other cargo.

Pilot in Command
The pilot responsible for the operation and safety of the aircraft during flight time.

Proper Shipping Name
The name to be used to describe a particular item or substance in all shipping documents and notifications and, where appropriate, on packaging.

Serious Injury
An injury which is sustained by a person in an accident and which:

- Requires hospitalization for more than 48 hours commencing within seven days from the date the injury was received, or
- Results in a fracture of any bone (except simple fractures of fingers, toes, or nose), or
- Involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage, or
- Involves verified exposure to infectious substances or injurious radiation.

State of Origin
The State in the territory of which, the cargo was first loaded on an aircraft.

State of the Operator
The State in which the operator has his principle place of business or, if he has no such place of business, his permanent residence.

UN Number
The four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods to identify a substance or a particular group of substances.

Unit Load Device
Any type of freight container, aircraft pallet with a net, or aircraft pallet with a net over an igloo.

Technical Instructions

ICAO publishes Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO document 9284), and all operators are to take all reasonable measures to ensure that dangerous goods are packed as specified in the Technical Instructions. Articles that would normally be classified as dangerous goods in the Technical Instructions may be carried on board an aeroplane excluded from the provisions provided that they are:

- required to be aboard for operating reasons.
- carried as catering or cabin service supplies.
- for use in flight as veterinary aid or as a humane killer for an animal.
- carried for use in flight as medical aid for a patient, providing that:
  - gas cylinders have been purpose manufactured.
  - drugs etc. are under the control of trained person(s).
  - equipment with wet cell batteries are kept upright.
  - such items are stowed properly for take-off/landing.
  - are carried by passengers or crew members.

Items carried as replacements for those detailed above, shall be carried in accordance with the Technical Instructions. An operator shall ensure that articles and substances or other goods declared as dangerous goods that are specifically identified by name or generally described in the Technical Instructions as being forbidden for transport under any circumstances are not carried on any aeroplane.

Labelling and Packaging

Operators are responsible for ensuring that all dangerous goods are carried and packed and labelled in accordance with the Technical Instructions. The **shipper** is responsible for checking that dangerous goods offered for transport are not forbidden items and are properly classified, packed marked and labelled and accompanied by the properly executed dangerous goods transport documentation (Annex 18-Technical Instructions). Operators are required to produce and follow a checklist (the Acceptance Checklist) for the acceptance procedure for dangerous goods.

Loading Restrictions

Only dangerous goods specified in the Technical Instructions are to be carried in passenger cabins or on the flight deck. Where carried in the cargo compartments, goods are to be loaded, segregated, stowed and secured as specified in the Technical Instructions. Where goods are marked ‘Cargo Aircraft Only’, operators are to ensure that such goods are loaded in accordance with the Technical Instructions in dedicated cargo aeroplanes. If radioactive material is carried, the radiation exposure of transport and storage personnel must be so controlled that none of them are likely to receive a radiation dose in excess of that permitted for members of the public.

Provision of Information

When dangerous goods are carried on an aeroplane, the operator is to provide the commander with the required written information as specified in the Technical Instructions. The OM (Part A section 9) is to include information to enable the flight crew to carry out its responsibilities for the carriage of dangerous goods and also the actions to be taken in the event of an emergency. Passengers are to be informed of the types of dangerous goods that must not be carried on an aeroplane. As a minimum, the information should consist of warning notices or placards prominently displayed where tickets are sold, passengers checked in, boarding areas and luggage check in areas. A warning note may be printed on the ticket or ticket jacket. Any such warning issued to passengers may include reference to dangerous goods that may be carried. For persons offering goods for carriage, information is to be made available and prominently displayed containing warnings about dangerous goods.

Emergencies

If an in-flight emergency occurs, the pilot in command should inform ATC for the information of the airport authorities, of any dangerous goods on board. The operator is required to inform the State in which the accident/incident has occurred that the aircraft was carrying dangerous goods.

Training

Dangerous goods training programmes are to be established and updated in accordance with the requirement of the Technical Instructions.

Accident and Incident Reporting

An operator must report dangerous goods incidents and accidents to the Authority and the appropriate Authority in the State where the accident or incident occurred. The first report should be despatched within 72 hours of the event unless exceptional circumstances prevent this and include the details that are known at that time. If necessary, a subsequent report must be made as soon as possible. Reports are also to be submitted if undeclared or misdeclared dangerous goods are discovered in cargo or passengers' baggage.

Acceptance of Dangerous Goods

(a) An operator shall not accept dangerous goods unless:

1. the package, overpack or freight container has been inspected in accordance with the acceptance procedures in the Technical Instructions;

2. except when otherwise specified in the Technical Instructions, they are accompanied by two copies of a dangerous goods transport document.

3. the English language is used for:

   (i) package marking and labelling;
   and
   (ii) the dangerous goods transport document,

in addition to any other language requirements.

(b) An operator shall use an acceptance checklist which shall allow for all relevant details to be checked and shall be in such form as will allow for the recording of the results of the acceptance check by manual, mechanical or computerized means.

Inspection for Damage, Leakage or Contamination

(a) An operator shall ensure that:

1. Packages, overpacks and freight containers are inspected for evidence of leakage or damage immediately prior to loading on an aeroplane or into a unit load device, as specified in the Technical Instructions;

2. A unit load device is not loaded on an aeroplane unless it has been inspected as required by the Technical Instructions and found free from any evidence of leakage from, or damage to, the dangerous goods contained therein;

3. Leaking or damaged packages, overpacks or freight containers are not loaded on an aeroplane;

4. Any package of dangerous goods found on an aeroplane and which appears to be damaged or leaking is removed or arrangements made for its removal by an appropriate Authority or organization. In this case the remainder of the consignment shall be inspected to ensure it is in a proper condition for transport and that no damage or contamination has occurred to the aeroplane or its load; and

5. Packages, overpacks and freight containers are inspected for signs of damage or leakage upon unloading from an aeroplane or from a unit load device and, if there is evidence of damage or leakage, the area where the dangerous goods were stowed is inspected for damage or contamination.

Labelling

The following labels are used to identify Dangerous Goods. The numbers refer to the Hazard Classes.

Explosive

Symbol (exploding bomb): Black
Background: Orange

** Place for division and compatibility group

Note: *Packages bearing this label marked Division 1.1 or 1.2 are not normally permitted for transport by air.*

Gas Flammable

Symbol (flame): Black or white
Background: Red

18 Transport of Dangerous Goods by Air

Gas Toxic

Symbol (skull and crossbones):	Black
Background:	White

Gas Non-flammable

Symbol (gas cylinder):	White
Background:	Green

Liquid Flammable

Symbol (flame):	Black or white
Background:	Red

Solid Flammable

Symbol (flame):	Black
Background:	White with seven vertical red stripes

Spontaneous Combustion

Symbol (flame):	Black
Background:	Upper half white, lower half red

Oxidizer

Symbol (flame over circle):	Black
Background:	Yellow

Figure '5.1' in bottom corner

Organic Peroxide

Symbol (flame):	Black or white
Background:	Upper half red, lower half yellow

Figure '5.2' in bottom corner

Danger If Wet

Symbol (flame):	Black or white
Background:	Blue

Toxic

Symbol (skull and crossbones):	Black
Background:	White

Infectious

The bottom part of the label should bear the inscription "INFECTIOUS SUBSTANCE - in case of damage or leakage immediately notify public health authority"

Symbol (three crescents superimposed on a circle) and inscription:	Black
Background:	White

Figure '6' in bottom corner

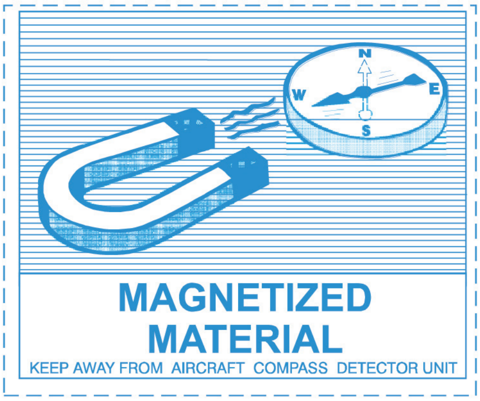
Radioactive

Radioactive material, Class 7, Category II — Yellow

Symbol (trefoil)	Black
Background:	Top half yellow with white border, bottom half white

Text (mandatory), black in bottom half of label: "Radioactive"; "Contents....."; "Activity....."; in a black outlined box — "Transport Index".

Two (2) red vertical stripes must follow the word "Radioactive".



Magnetized Material

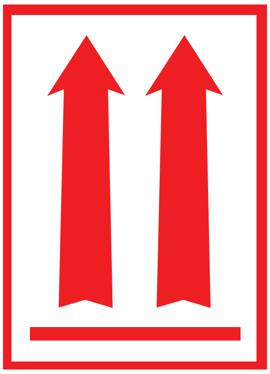
Colour: Blue on white
Dimensions: 110 mm × 90 mm

Cargo Aircraft Only

Colour: Black on orange
Dimensions: 120 mm × 110 mm

Corrosive

Symbol (liquids spilling from two glass vessels and attacking a hand and a metal): Black
Background: Upper half white, lower half black with white border



Package Orientation

Colour: Red or black on a contrasting background
Dimensions: 74 mm × 105 mm

Lithium Battery Handling Label

Colour: Black on a contrasting background
Dimensions: 120 mm × 110 mm

* Place for "Lithium ion battery" and/or "Lithium metal battery"

Keep Away from Heat

Colour: Red or black on a white background
Dimensions: 74 mm × 105 mm

Questions

1. **With regard to the transportation of dangerous goods by air, operators are required to comply with:**

   a. the manufacturer's specification for the storage of items with low flash points
   b. the Health and Safety requirements of the World Health Organization
   c. the United Nations' embargo on the transportation of hazardous materials
   d. ICAO Annex 18 SARPs

2. **Dangerous goods are defined as:**

   a. articles or substances which are capable of significant risk to health, safety or property
   b. any item which contains toxic liquids or solids.
   c. any item which has the capability to be used for purposes other than that intended.
   d. guns, ammunition, explosives, toxic waste, or chemical, biological or nuclear agents or reagents.

3. **With regard to dangerous goods, what does a UN number identify?**

   a. The international code for the country of destination.
   b. A substance or particular group of substances.
   c. The registered dangerous goods consignee.
   d. The identity of the registered carrier of dangerous goods.

4. **The document that identifies the technical instructions for the classification and safe transport of dangerous goods by air is called:**

   a. the Operations Manual.
   b. the Technical Instructions.
   c. the Loading Manual.
   d. ICAO Annex 19 (Carriage of Dangerous Goods by Air).

5. **Certain items, which by their nature are dangerous goods, may be carried in aeroplanes excluded from the provisions. Which of the following lists correctly identifies such items?**

   a. Veterinary aids or humane killers, ammunition, gas cylinders, catering supplies, personal items.
   b. Veterinary aids or humane killers, ammunition, equipment with wet cell batteries, catering supplies, personal items.
   c. Veterinary aids or humane killers, drugs, equipment with batteries, gas cylinders, catering supplies, personal items.
   d. Veterinary aids or humane killers, items required for operational reasons, medical aids for a patient, catering supplies, personal items.

6. **If an item which is excluded from the provisions is carried as a replacement (e.g. a replacement O_2 bottle for a patient) it must be classified as dangerous goods.**

   a. True.
   b. False.
   c. Class 7.
   d. Class 1.

7. Who is responsible for ensuring that dangerous goods are packed, labelled and carried in accordance with the regulations?

a. The commander.
b. The operator.
c. The shipping agent.
d. The consignee.

8. The requirements for packaging and labelling are to be found in:

a. the Technical Instructions.
b. the OM.
c. ICAO Annex 18.
d. EU-OPS 1.1215.

9. What is the purpose of the 'acceptance checklist'?

a. To ensure that the requirements of the Technical Instructions are complied with.
b. To enable the loading supervisor to take appropriate precautions.
c. To enable performance calculations to be made with regard to total cargo weight.
d. To ensure that the shipper is not trying to smuggle munitions of war.

10. Can dangerous goods be carried in the passenger cabin or on the flight deck?

a. Yes, but only goods specified in the Technical Instructions.
b. No.
c. Yes, if authorized by the Authority.
d. Yes, provided they are non-toxic.

11. If dangerous goods are to be carried, the commander is to be given information as specified in the Technical Instructions. Who is responsible for the provision of this information?

a. The Authority.
b. The operator.
c. The loading supervisor.
d. The shipper.

12. Operators are to establish Dangerous Goods training programmes. Where are details of the training required, published?

a. In the OM.
b. In the Training Manual.
c. In ICAO Annex 18.
d. In the Technical Instructions.

Answers

1	2	3	4	5	6	7	8	9	10	11	12
d	a	b	b	d	a	b	a	a	a	b	d

Chapter

19

Contaminated Runways

Contaminated Runways

The state of a runway for both take-off and landing are factors to be taken into account when calculating performance. In practical terms, pilots should be aware of the general implications of the state of the runway and meaning of the terminology used to describe the state of the runway.

Contaminated Runway

A runway is said to be contaminated if more than 25% of the surface area (whether in isolated patches or not) is covered by any of the following:

- Surface water more than 3 mm deep (0.125 in), or by slush or loose snow equivalent to 3 mm of water.
- Snow which has been compressed into a solid mass which resists further compression and will hold together or break into lumps if picked up (compacted snow).
- Ice, including wet ice.

Damp Runway

A runway is considered damp when the surface is not dry, but when the moisture on it **does not** give a shiny appearance.

Wet Runway

A runway is considered wet when the runway is covered with water, or equivalent, less than specified in contaminated runway above, or when there is sufficient moisture on the runway surface to cause it to appear **reflective**, but without significant areas of standing water.

Dry Runway

A dry runway is one which is **neither wet nor contaminated**, and includes those paved areas which have been specially prepared with grooves or porous pavement and maintained to retain effectively dry braking action even when moisture is present.

Contaminant Depth Limitations

It is inevitable that operations from contaminated runways will be required. In such cases, the following depths are quoted, above which take-offs should not be attempted:

- dry snow depth greater than 60 mm (very dry - 80 mm)
- water, slush or wet snow greater than 15 mm

Aquaplaning (Hydroplaning)

During take-off and landing operations from contaminated runways (3 mm or more water), aquaplaning (hydroplaning) is a hazard that must be considered. During take-off runs, as water (or any other liquid contaminant) is displaced by the tyres, a 'bow wave' effect is created in front of the tyre. By a factor of the specific gravity of the contaminant and the tyre pressure, a speed will exist at which the tyre will ride up over the 'bow wave' and friction with the runway will rapidly reduce.

Similarly, during landing runs, where touch-down speed is above the speed at which aquaplaning is likely, any application of the brakes may result in severe loss of friction between the tyre and the runway surface, thus drastically reducing braking. In this specific case the effect of aquaplaning will stop the rotation of the tyres and this can lead to dissipation of momentum energy in the form of heat generated in the contaminant. The temperature reached may scald tyres and skidding may result when the aquaplaning effect breaks down. In any case, loss of braking action and directional control are the hazards of aquaplaning. The aquaplaning speed is given by the formula:

$$V = 9\sqrt{\frac{P}{\sigma}}$$

where V is the ground speed in knots; P is the tyre pressure in lb/sq in and σ is the specific gravity of the precipitant (contaminant). This speed, however, assumes a rotating tyre (spin down speed). For a non-rotating tyre, as in the situation on initial touchdown (spin-up speed), the aquaplaning speed is 7.7 times the square root of the tyre pressure in psi. If the pressure is stated in bar, 1 bar is approximately equal to 14.5 psi.

Braking Action

From data collected from operations on compacted snow and ice, an assessment table has been produced to relate a measured braking coefficient to an estimated braking action and hence to a simple code for braking action. It must be borne in mind that the description "good" is a comparative value and is intended to mean that aeroplanes should not experience directional control or braking difficulties when landing, but conditions would not be as good as on a clean, dry, runway:

Measured Coefficient	Estimated Braking Action	Code
0.40 and above	Good	5
0.39 - 0.36	Medium to good	4
0.35 - 0.30	Medium	3
0.29 - 0.26	Medium to poor	2
0.25 and below	Poor	1
unreliable	UNRELIABLE	9

Figure 19.1: Braking action code

Coefficient of Friction

In terms of assessment of braking action and the exchange of information relating to it between ATC and the pilot, the coefficient of braking on a wet runway is a factor of the difference between the non-torque limited braking and the torque limited coefficient. In laymen's terms the difference between the maximum braking effect of a dry runway, and the braking effect on a wet (contaminated) runway for the same aeroplane at the same speed and the same mass.

Performance Considerations

Part B of the Ops Manual will contain type specific information on procedures associated with take-off and landing on contaminated runways, together with performance data and any wind limitations. (Crosswind, tail wind and possibly headwind gust limits).

SNOWTAMs

SNOWTAMs are issued by aerodromes where contamination is a common occurrence. ATPL students are to be familiar with item (F), type of contaminant, item (G), depth of contaminant over each third of the runway in mm, and item (H), braking action on each third of the runway, stated as a 2 figure number to indicate measured coefficient, or a one figure number to indicate braking action. The validity of a SNOWTAM is up to 24 hours. The codes for types of contaminant are:

NIL	CLEAR AND DRY
1	DAMP
2	WET or water patches
3	RIME OR FROST COVERED (depth normally < 1 mm)
4	DRY SNOW
5	WET SNOW
6	SLUSH
7	ICE
8	COMPACTED OR ROLLED SNOW
9	FROZEN RUTS OR RIDGES

The following are examples of SNOWTAMS;

Note: *Validity of a SNOWTAM is 24 hours.*

SWED0072 EDDM 12110810
(SNOWTAM0072)
(A) EDDM (B) 12110810 (C) 08L (F) 6/6/6 (G) 01/01/01H (H) 35/26/26
(N) 2,6 (R) 2,6 (T) RWY 08l PLANNED TO BE CLOSED DUE TO SLUSH REMOVAL

This decode is as follows:

A	Munich	
B	11 Dec 0810Z	
C	Rwy 08L	
F	Over the whole of the runway there is slush reported	
G	The mean depth of the slush is 1 mm over the entire length	
H	The friction measurements are:	
	(1st third)	0.35 (medium)
	(2nd third)	0.26 (medium/poor)
	(3rd third)	0.26 (medium/poor)
N	Taxiway is contaminated with wet slush	
R	Apron is contaminated with wet slush	
T	Remarks (self-explanatory)	

(A) EDDF	(B) 12111215	(C) 07L	(F) 1/1/1	(G) XX/XX/XX	(H) 5/5/5
(N) 2/5/6	(R) 2/5/6	(T) TWYS AND APRON SLIPPERY			

A	Frankfurt
B	11 December 1215Z
C	Rwy 07L
F	Runway is damp over the entire length
G	Mean depth of the contaminant is not measurable
H	Braking action over the entire length of the runway is good
N	Taxiway is contaminated with water patches, wet snow and slush
R	Apron is contaminated with water patches, wet snow and slush
T	Remarks - Taxiways and apron are slippery

The decode of the nature of the contaminant is on the SNOWTAM form.

Note: *Item D is the cleared runway length in metres. If less than published see item T.*
Item T. Describe in plain language any uncleared length in metres.

Questions

1. If 30% of the surface area of a runway is covered by surface water more than 3 mm deep, by slush, by loose snow or compacted snow which resists further compression, or ice (including wet ice), the runway is classified as:

a. wet
b. contaminated
c. unusable
d. useable with care

2. If the surface of a runway is not dry, but the moisture on it does not give a shiny appearance, the runway is:

a. wet
b. wet but not contaminated
c. dry
d. damp

3. If a runway is covered with water which is less than 3 mm deep, or where the surface appears reflective but without standing water patches, it is said to be:

a. wet
b. wet but not contaminated
c. dry
d. damp

4. A dry runway is one which:

a. can be wet if it has sufficient camber to allow the water to drain quickly off the surface therefore maintaining an 'effective dry' braking action
b. is wet but not to a depth of water greater than 3 mm
c. is not contaminated
d. can be wet if it has specially prepared grooved or porous surfaces, which maintain 'effectively dry' braking action

5. If a runway is contaminated with dry snow, the depth that will preclude operations is:

a. 60 mm
b. 15 mm
c. 10 mm
d. 3 mm

6. If a runway is contaminated with wet snow, slush or water, the depth that will preclude operations is:

a. 60 mm
b. 15 mm
c. 10 mm
d. 3 mm

7. **The effect whereby a tyre is lifted from the runway due to aeroplane speed along the runway is known as:**

a. surface water effect
b. hydroplaning
c. aqua-skimming
d. surface tension

8. **For any given contaminant (by specific gravity), the aquaplaning speed is given by:**

a. nine times the square of the tyre pressure (lb/sq in)
b. the tyre pressure (bars) divided by nine
c. nine times the square root of the tyre pressure (lb/sq in)
d. the square root of the tyre pressure (bars) multiplied by nine

9. **One bar (barometric pressure unit) is equal to:**

a. 14.5 psi
b. 28.82 in Hg
c. 29.92 lb/sq in
d. 1013.25 hPa m^{-2}

10. **Braking action on contaminated runways is given by:**

a. a simple code (1 – 5) or a description (excellent - bad)
b. a simple code (0.25 – 0.4) or a description (good – bad)
c. a simple code (1 – 5), a description (good – poor) or the measured coefficient of braking effect (< 0.25 - > 0.40)
d. the coefficient of braking action related to a simple code where 1 is poor and 5 is good, supplemented by a description of the braking effect and an aquaplaning warning

11. **Apart from aquaplaning and reduced braking efficiency, what other hazards are associated with heavy rain contamination of runways?**

a. Wet aeroplanes do not perform as well as dry ones
b. The efficiency of jet engines is reduced by the ingress of water diluting the fuel
c. The refraction of light from landing lights causes visual impairment
d. Water ingress into engines can cause flame-out

12. **In a SNOWTAM information is given concerning friction measurements (braking coefficient × 100) in which field of the message?**

a. F
b. G
c. H
d. N

Answers

1	2	3	4	5	6	7	8	9	10	11	12
b	d	a	d	a	b	b	c	a	c	d	c

Chapter

20

Revision Questions

20 Revision Questions

Questions

1. Who checks, before flight, that the aircraft's weight is such that the flight can be safely made, and that any transported cargo is properly distributed and secured?

a. The company's cargo technicians
b. The captain
c. The mechanic on board, or in his absence the co-pilot
d. The operator

2. FDRs must keep data and parameters for at least the last:

a. 30 hours of operation
b. 48 hours of operation
c. 10 hours of operation
d. the whole flight

3. When refuelling is being conducted with passengers embarking or disembarking:

a. refuelling is strictly prohibited whilst passengers are embarking/ disembarking
b. all flight crew must be on board
c. communications shall be maintained by ground crew and qualified crew on board
d. the stairs shall be fully extended

4. To act as co-pilot for take-off or landing you must have:

a. acted as PIC or co-pilot on type in the last 90 days
b. acted as PIC or co-pilot on type in the last 30 days
c. acted as PIC or co-pilot on type in the last 60 days
d. been at the controls for landing in the same type recently

5. When are life jackets required?

a. 50 NM from land
b. 100 NM from land
c. 300 NM from land
d. 400 NM from land

6. Where is the Minimum Equipment List?

a. Appended to the AFM
b. In the OM
c. In the maintenance documents
d. In the operations room

7. Aeroplanes with a take-off mass greater than 5700 kg shall be fitted with an independent automatically operated emergency power supply to operate and illuminate the artificial horizon for:

a. 15 mins
b. 30 mins
c. 60 mins
d. 2 hrs

8. **One shall not initiate any flight made in accordance with instrument flight rules unless the available information indicates that the conditions at the aerodrome of intended destination and destination alternate (if one is required) are, at the predicted time of:**

   a. take-off equal to or better than the minimum conditions required for aerodrome use
   b. arrival, and for a reasonable time before and after such a predicted time, equal to minimum conditions required for aerodrome use
   c. arrival equal to or better than the minimum conditions required for aerodrome use
   d. arrival better than the minimum conditions required for aerodrome use

9. **What is the co-pilot currency requirement?**

   a. 3 flights in the last 90 days
   b. 3 take-offs and landings in the last 60 days
   c. At the controls for 3 flights in the last 60 days
   d. At the controls for 3 take-offs and landings in the last 90 days

10. **Supplemental oxygen is used to:**

   a. provide oxygen to passengers who might require it, following a cabin depressurization
   b. assist a passenger with breathing difficulties
   c. protect a crew member who fights a fire
   d. provide passengers on board with oxygen during a cabin depressurization

11. **Information concerning evacuation procedures can be found in the:**

   a. OM
   b. AFM
   c. journey logbook
   d. OFP

12. **Where is the general information about the carriage of dangerous goods to be found?**

   a. OM
   b. AIC
   c. Aircraft flight notes
   d. Journey logbook

13. **The Minimum Equipment List (MEL) is established by the:**

   a. airline operator
   b. manufacturer
   c. aeronautical Authority the airline operator depends on
   d. Civil Aviation Authority of the European states

14. **The recent experience conditions of a captain assigned to a flight on an aircraft by an operator must not be less than:**

a. 6 take-offs and 6 landings as pilot in command on this type of aircraft during the last 90 days
b. 3 take-offs and 3 landings as pilot in command on this type of aircraft during the last 6 months
c. 6 take-offs and 6 landings as pilot in command on this type of aircraft during the last 6 months
d. 3 take-offs and 3 landings as pilot in command on this type of aircraft during the last 90 days

15. **A piece of equipment on your public transport aeroplane fails while you are still parked. The reference document you use to decide on the procedure to follow is the:**

a. OM chapter 'Abnormal and Emergency procedures'
b. AFM
c. EU-OPS
d. MEL

16. **When do you not need a destination alternate aerodrome?**

a. If there is a reasonable certainty that at the ETA at the destination aerodrome and a reasonable time before and after you can expect VMC
b. If the flight time is more than 6 hours
c. If the flight time is less than 1 hour
d. If your operator deems the weather to be suitable for a visual landing

17. **When are all flight crew members required to be at their stations?**

a. At all times except when they need to leave for operational or physiological reasons
b. Throughout the flight
c. At all times other than take-off and landing
d. As specified in the OM

18. **When are flight crew allowed to leave their stations?**

a. In the performance of their duties
b. At any time specified by the OM
c. When having lunch
d. Only when the captain allows it

19. **Who is the operator to provide an operations manual for?**

a. Operations staff
b. All company personnel
c. Only for flight crew
d. For the Authority

20. **What must be ensured with respect to navigation equipment?**

a. The failure of one piece does not affect another
b. All navigation equipment must be serviceable at the start of flight
c. All equipment must conform to ICAO specifications
d. If one piece of equipment fails there must be a spare available

21. **What skills constitute pilot proficiency checks?**

a. Simulator flying skills
b. The ability to land safely
c. Flying technique, emergency procedures and IFR
d. The ability to conform with set procedures

22. **How often should pilot proficiency checks be performed?**

a. No less than 6 months between checks
b. 2 checks every 13 months
c. 3 checks within the year with no less than 4 months between checks
d. 2 within a year, more than 4 months between checks

23. **Who is to ensure safe handling of flights?**

a. The Operator
b. The Authority
c. The State of Registration
d. The operations officer

24. **Destination alternate for a turbojet – what is the required fuel overhead?**

a. 30 minutes at cruise speed
b. 30 minutes at 1500 ft in standard conditions
c. 2 hours at 1500 ft in standard conditions
d. 30 minutes at endurance speed

25. **Who is responsible for ensuring that the aeroplane is airworthy prior to flight?**

a. Operator
b. State of Registration
c. Captain
d. State of the operator

26. **Following an indication of an unserviceability whilst taxiing to the holding point, what do you consult first?**

a. AFM
b. Operator
c. State of Registration
d. MEL

27. **Above what altitude are quick-donning masks required?**

a. 25 000 ft
b. 15 000 ft
c. 10 000 ft
d. 32 000 ft

28. **What is the oxygen requirement for the crew and 100% of the passengers in an unpressurized aircraft?**

a. 10 000 ft
b. 11 000 ft
c. 12 000 ft
d. 13 000 ft

29. **What is the requirement regarding the carriage of a CVR for aircraft registered before April 1998?**

a. Record last 30 mins of flight
b. Record for the duration of the flight
c. Record the last 25 hours of operation
d. Record the last 48 hours of flight

30. **What is the requirement for the carriage of life rafts?**

a. 30 mins or 120 NM whichever is less
b. 50 NM from land
c. 120 mins or 400 NM whichever is less
d. 60 mins flying time at the one engine out cruise speed

31. **Flight crew members on the flight deck shall keep their safety belt fastened:**

a. only during take-off and landing
b. while at their station
c. from take-off to landing
d. only during take-off and landing and whenever necessary by the commander in the interest of safety

32. **The EU-OPS document is based on:**

a. Federal Aviation Requirements. (FAR)
b. a JAA guide line
c. Rules of the Air
d. ICAO Annex 6

33. **On an ILS, you are told that the weather has dropped below company minima. When must you abort the approach?**

a. Start of the glide slope descent
b. FAF
c. Inner marker
d. Outer marker

34. **The MEL is drawn up by the:**

a. operator and may be more restrictive than the MMEL
b. operator and may be less restrictive than the MMEL
c. manufacturer and may be more restrictive than the MMEL
d. manufacturer and may be less restrictive than the MMEL

35. **On board a pressurized aircraft, a flight shall be undertaken only if the aircraft is provided with an oxygen reserve enabling all crew members and part of the passengers to be supplied with oxygen in the event of cabin depressurization, throughout the flight period, during which the pressure altitude is greater than:**

a. 11 000 ft
b. 10 000 ft
c. 12 000 ft
d. 13 000 ft

36. **A modern aircraft must be provided with a flight data recorder when its certified MTOM is greater than:**

a. 27 000 kg
b. 5700 kg
c. 20 000 kg
d. 14 000 kg

37. **Who provides the operations personnel with the OM and the amendments to keep it up to date?**

a. Aircraft manufacturer
b. ATS authority of the State of Registry
c. Aircraft operator
d. Owner of aircraft

38. **What is required for navigation in IMC?**

a. Radio equipment and equipment for guidance until the visual point
b. Anti-icing equipment
c. A serviceable weather radar
d. One VHF box and one HF box

39. **Who compiles the MEL and where does it go?**

a. The manufacturer and in the AFM
b. The manufacturer and in the OM
c. The operator and in the AFM
d. The operator and in the OM

40. **On an NDB approach with an MDH of 360 ft and a required RVR of 1500 m and a reported met vis of 2500 m, when can you start an approach; i.e. which is most correct?**

a. When the cloud base is above the system minimum
b. With any cloud base
c. When the cloud base is above 36 ft
d. When the cloud base report is received

41. **Where is permanent approval for the carriage of dangerous goods given?**

a. Certificate of airworthiness (CofA)
b. Aircraft registration
c. Air Operator's Certificate (AOC)
d. Insurance certificate

42. **How far away can a take-off alternate be for a 2-engine aeroplane?**

a. 60 mins at one engine cruise speed
b. 60 mins at normal cruise speed
c. 120 mins at one engine cruise speed
d. 120 mins at normal cruise speed

43. Who issues and updates the MEL?

a. The Authority
b. The designer
c. The manufacturer
d. The operator

44. Who accepts the MEL?

a. The country where the flight takes place
b. The country of the operator
c. The country of the designers
d. The country of the manufacturers

45. A Flight Data Recorder is required in aeroplanes over:

a. 20 000 kg
b. 5700 kg
c. 10 000 kg
d. 7000 kg

46. In determining Aerodrome Operating Minima, what of the following needs to be considered?

1. Crew composition
2. Ability to communicate/receive meteorological information
3. Significant obstacles in the missed approach area
4. Dimensions and characteristics of the runway
5. Navigation equipment in the aeroplane

a. 1, 2, 4 & 5
b. 1, 2 & 3
c. 2, 3, 4 & 5
d. all of the above

47. A list to be carried in the aeroplane detailing minimum equipment required must be approved by:

a. country of operations
b. country of operator
c. country of manufacturer
d. no such book is required to be approved by an authority

48. A pilot in command:

1. must comply with ATC instructions immediately
2. is only responsible when airborne
3. may deviate in an emergency
4. may deviate from complying with rules of the air in order to comply with an ATC instruction
5. may request a new clearance if unsatisfied

a. 1, 3, 4 & 5
b. 3 & 5
c. 3, 4 & 5
d. all of the above

49. If there is unauthorized use of equipment that affects the aeroplane's system, the commander:

a. may authorize its use for take-off and landing
b. must not authorize its use
c. may authorize its use for the whole flight
d. may authorize its use at his discretion

50. What is the currency requirement for a co-pilot?

a. 3 take-offs and landings on an aeroplane of the same type within the last 90 days
b. 3 take-offs and landings on an aeroplane of the same type within the last 60 days
c. 3 take-offs and landings on an aeroplane of the same type or approved simulator within the last 90 days
d. 3 take-offs and landings on an aeroplane of the same type or approved simulator within the last 60 days

51 From the flight deck you observe an aeroplane in the forward left position on an opposite parallel track. What Nav light will be observed?

a. Green
b. Red
c. White
d. All of the above

52. The MMEL is:

a. compiled by the manufacturer and approved by the operator
b. compiled by the manufacturer and approved by the state of design or state of the manufacturer
c. compiled by the operator and approved by the state of design
d. compiled by the manufacturer and not approved by the operator

53. All aeroplanes which individual certificates of airworthiness were issued after 1 January 1990 must be fitted with a flight data recorder when their maximum certificated take-off mass is greater than:

a. 20 000 kg
b. 27 000 kg
c. 5700 kg
d. 14 000 kg

54. The operator shall include in the OM a MEL which shall be approved by the authority of:

a. none, no approval is required
b. the country where the aeroplane is operated
c. the country where the aeroplane was manufactured
d. the country of the operator

55. At the alternate aerodrome, the commander of a turbojet engine aeroplane should have a fuel quantity (final reserve) sufficient for flying during:

a. 30 minutes at holding flight speed at 1500 ft
b. 45 minutes at holding flight speed at 1500 ft
c. 30 minutes at cruising speed
d. 45 minutes at cruising speed

56. The Minimum Equipment List (MEL) gives the equipment which can be inoperative when undertaking a flight and the additional procedures to be observed accordingly. This list is prepared by:

a. the operator, and it is inserted in the OM
b. the manufacturer, and it is inserted in the OM
c. the operator, and it is appended in the AFM
d. the manufacturer, and it is appended to the AFM

57. After an accident, the operator of an aeroplane equipped with a flight recorder must keep the original recordings for a minimum period of:

a. 30 days
b. 90 days
c. 45 days
d. 60 days

58. During a flight, the captain is informed that a passenger is using a portable electronic device, which is adversely affecting the aircraft's electrical avionics. The captain must:

a. stop the passenger from using the device
b. allow the device to be used at take-off and landing
c. allow the device to be used from take-off to landing
d. allow the device to be used for certain exceptions

59. A copy of which of the following documents must be kept on the ground by an operator for the duration of each flight?

a. The journey log
b. The ATC (Air Traffic Control) flight plan
c. The operational flight plan
d. The meteorological forecast

60. What manuals are to be carried?

a. Operations Manual in toto
b. Company instructions for all flight crew
c. All those specified in the CofA
d. Relevant parts of the ops manual and AFM

61. A copy of what info is to be left on the ground?

a. Passenger manifests, notification of special passengers
b. Route specific maps and charts
c. NOTAMs, tech log, op flight plan, mass & Balance, spec load notification
d. AICs, AISs, and all company NOTAMs

62. **Which of the following is to be left on the ground?**

a. The aeroplane noise certificate
b. The operations manual
c. Parts of the operations manual relevant to the flight
d. Operational flight plan

63. **Each flight is subject to a preliminary file collecting a certain amount of information. The operator will see that this file is kept on ground. It particularly contains:**

1. the weather conditions for the day including the weather forecast at destination
2. one copy of the operational flight plan and, if required, the weight and balance sheet
3. copies of the relevant aircraft's technical log
4. the en route NOTAM documentation when specifically issued by the operator.
5. special loads notification
6. charts

The combination regrouping all the correct statements is:

a. 1, 3 & 5
b. 2, 3, 4 & 5
c. 2 & 4
d. 1, 2, 3, 4, 5 & 6

64. **The first part of EU-OPS is applicable to:**

a. civil air transport
b. international commercial air transport of JAA state members
c. military & police transport
d. any operations overflying JAA states

65. **After an incident, the FDR recordings must be kept for:**

a. 30 days
b. 60 days
c. 90 days
d. 120 days

66. **Coverage of permanently illuminated white lights at the rear of the aircraft is:**

a. 140°
b. 70°
c. 110°
d. 220°

67. **The first part of the EU-OPS document relates to:**

a. aircraft proceeding from or over flying European States
b. JAA state operators flying civil commercial air transport aeroplanes
c. aeroplanes in the police/defence
d. treatment of passengers with pathological respiratory disorders

68. What is the requirement for the issue of an AOC?

a. Not already hold an AOC issued by another authority
b. Have a fleet of serviceable aeroplanes
c. Have registered offices in all countries of operations
d. Have facilities for all maintenance

69. The "NO SMOKING" sign must be illuminated:

a. when oxygen is being supplied in the cabin
b. in each cabin section if oxygen is being carried
c. during climb and descent
d. during take-off and landing

70. What are the rules on the carriage of PRMs?

a. Cannot impede the performance of crew duty
b. Must be seated away from emergency exits
c. No more than 5% of passengers may be PRMs
d. They must provide their own food

71. What is the system minimum for an NDB approach?

a. 200 ft
b. 250 ft
c. 300 ft
d. 350 ft

72. A category A aircraft can carry out an indirect (circling) approach followed by a visual manoeuvre only if the horizontal visibility is higher than or equal to:

a. 1600 m
b. 2400 m
c. 1500 m
d. 3600 m

73. What are the circling minimum visibility and MDH for a Cat B aeroplane?

a. 1600 m 400 ft
b. 1600 m 500 ft
c. 1500 m 450 ft
d. 1500 m 600 ft

74. According to EU-OPS 1.430, Airfield Operating Minima, what is the lowest MDH using ILS no glide path (LLZ only), VOR, NDB, SRA?

a. NDB – MDH 350 ft
b. VOR – MDH 250 ft
c. ILS (LLZ only) – MDH 200 ft
d. VOR/DME – MDH 300 ft

75. What is the minimum RVR for a CAT IIIC approach?

a. No minimum
b. 50 m
c. 75 m
d. 100 m

76. The considerations for a non-precision approach are:

1. MDA (H)
2. DH
3. ceiling
4. horizontal visibility

a. 2, 3 & 4
b. 1, 3 & 4
c. 1 & 3
d. 2 & 4

77. What is the minimum required RVR for CAT IIIB operations?

a. 100 m
b. 75 m
c. 150 m
d. 200 m

78. What is the minimum visibility for a Cat A aircraft during a circling approach?

a. 1500 m
b. 1600 m
c. 2400 m
d. 3600 m

79. A category II precision approach (CAT II) is an approach with:

a. a decision height of at least 100 ft
b. no decision height
c. a decision height of at least 200 ft
d. a decision height of at least 50 ft

80. When can special VFR be commenced?

a. Visibility greater than 1500 m
b. Greater than 3 km vis
c. Visibility no more than 3000 m
d. Greater than 5 km vis

81. What is V_{AT}?

a. $V_{SO} \times 1.3$
b. $V_{S1g} \times 1.3$
c. The lesser of V_{SO} or V_{SIg}
d. $V_{SO} \times 1.23$

82. According to EU-OPS 1.430 (Aerodrome Operating Minima) a Category IIIA approach has a Decision Height of less than 100 ft and a minimum RVR (Runway Visual Range) of:

a. 200 m
b. 250 m
c. 300 m
d. 230 m

83. What is the take-off RVR limit for a Cat A aeroplane, when high intensity centre line lights and edge lights are on and the crew is IFR qualified and approved?

a. 150 m if threshold RVR is available
b. 150 m
c. 200 m
d. 250 m

84. When is MDH referenced to the threshold as apposed to the aerodrome elevation?

a. The threshold is more than 2 m above the ARP
b. The threshold is less than 2 m above the ARP
c. The threshold is less than 2 m below the ARP
d. The threshold is more than 2 m below the ARP

85. What are the threshold speeds for a Cat D aeroplane?

a. 121 – 140 kt
b. 131 – 155 kt
c. 141 – 165 kt
d. 145 – 160 kt

86. What is the minimum horizontal visibility for a Cat D aircraft on a circling approach?

a. 1500 m
b. 1600 m
c. 2400 m
d. 3600 m

87. What is DH used for?

a. Visual manoeuvring
b. Circling to land
c. Precision approaches
d. Non-precision approaches

88. A category I precision approach (CAT I) is an approach which may be carried out with a runway visual range of at least:

a. 550 m
b. 350 m
c. 800 m
d. 500 m

89. When establishing an instrument approach procedure, 5 aircraft categories according to their speed at the threshold (V_{AT}) are established. This speed is equal to the stalling speed in the landing configuration multiplied by a factor of:

a. 1.5
b. 1.45
c. 1.15
d. 1.3

90. **EU-OPS 1.465 (VFR operating minima), establishes that, the operator shall ensure about VFR flights, that:**

a. for conducted VFR flights in airspace F, vertical distance from clouds is 250 m at least
b. Special VFR flights are not commenced when visibility is less than 3 km
c. for conducted VFR flights in airspace B, horizontal distance from clouds is 1000 m at least
d. for conducted VFR flights in airspace E, flight visibility at and above 3050 m (10 000 ft) is 5 km at least (clear of cloud)

91. **The Cat I minimum decision height is:**

a. no decision height
b. 50 ft
c. 100 ft
d. 200 ft

92. **What is the Cat IIIA RVR minimum?**

a. 50 m
b. 100 m
c. 200 m
d. 250 m

93. **The minimum visibility for a Cat C aeroplane on a circling approach is:**

a. 2400 m
b. 2500 m
c. 2600 m
d. 2700 m

94. **Aircraft are categorized according to their threshold speeds, multiplied by a factor. What aircraft category corresponds to a range of speeds 141 kt – 165 kt?**

a. B
b. E
c. D
d. C

95. **An aeroplane is starting a non-precision approach with an MDH of 250 ft and minimum visibility of 800 m. ATC gives threshold, mid-runway and final third RVRs. When may the approach be started?**

a. When threshold and mid-runway RVRs are greater than 800 m
b. When all 3 RVRs are greater than 800 m
c. When the met viz is greater than 800 m. RVR is for precision approaches only
d. When threshold RVR is greater than 800 m

96. The information to be considered for a non-precision approach is:

1. horizontal visibility
2. ceiling
3. minimum descent altitude
4. decision altitude

a. 1, 2 & 4
b. 1 & 3
c. 1 & 4
d. 1, 2 & 3

97. A category D aeroplane can carry out a circling approach only if the meteorological visibility is higher than or equal to:

a. 1500 m
b. 1600 m
c. 2400 m
d. 3600 m

Answers

1	2	3	4	5	6	7	8	9	10	11	12
b	c	c	a	a	b	b	c	d	a	a	a

13	14	15	16	17	18	19	20	21	22	23	24
a	d	d	a	a	a	a	a	c	d	a	b

25	26	27	28	29	30	31	32	33	34	35	36
c	d	a	d	a	c	b	d	d	a	d	b

37	38	39	40	41	42	43	44	45	46	47	48
c	a	d	b	c	a	d	b	b	d	b	b

49	50	51	52	53	54	55	56	57	58	59	60
b	c	b	b	c	d	a	a	d	a	c	d

61	62	63	64	65	66	67	68	69	70	71	72
c	d	b	b	b	a	b	a	a	a	d	c

73	74	75	76	77	78	79	80	81	82	83	84
b	a	a	b	b	a	a	b	a	a	c	d

85	86	87	88	89	90	91	92	93	94	95	96
c	d	c	a	d	b	d	c	a	c	d	d

97
d

Chapter

21

Index

21 Index

Index

N

O

P

U

V

W