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CHAPTER ONE

ICAO ANNEX 6

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INTRODUCTION

The International Civil Aviation Organisation (ICAO) publication Annex 6, titled Operation of Aircraft, contains the international Standards and Recommended Practices (SARPS) applicable to the issuing of an Air Operators Certificate (AOC) to conduct international commercial air transport. It has a JAA counterpart, JAR-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 JAR-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 JAR-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 Operators 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 (**E**xtended **T**win-engine **OP**eration**S**) 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 utilisation 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 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 safety management system, 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 standardised phraseology and language.

If the Operator uses aeroplanes with maximum certificated take off mass (MTOM) greater than 27,000kg, 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 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 organisation'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 organisation;
- 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).

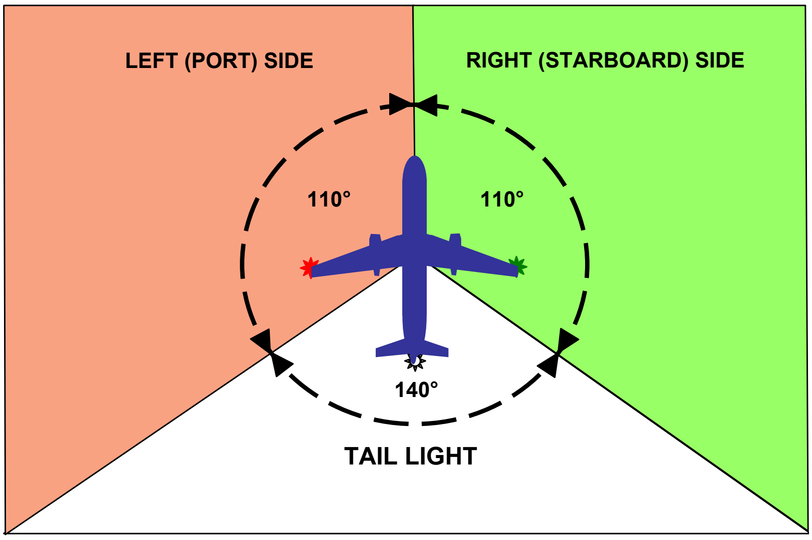


Figure 1.1 **Aircraft horizontal navigation lighting**

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

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).

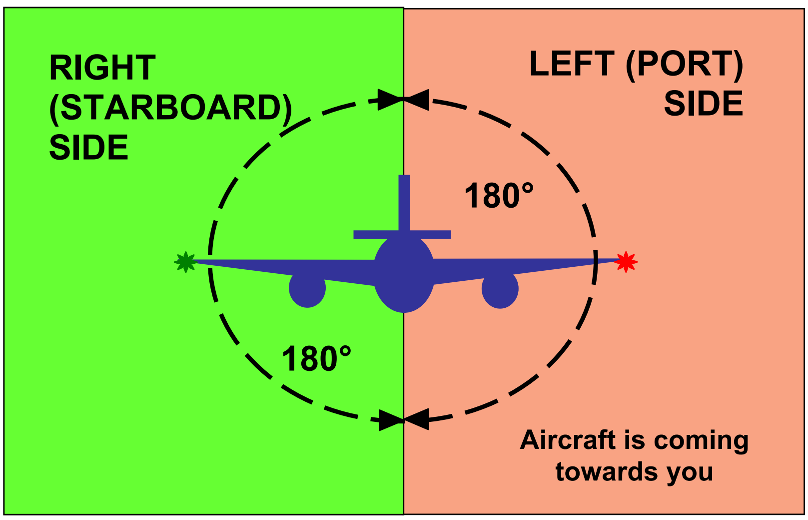


Figure 1.2 Aircraft vertical navigation lighting

CHAPTER TWO

CS-OPS GENERAL REQUIREMENTS

CONTENTS

APPLICABILITY

CS-OPS Part 1 contains and defines the requirements for the operation of civil aircraft in commercial air transportation by any Operator whose principal place of business is in a 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.

The requirements of Part 1 are applicable to Operators of aeroplanes:

Over 10 tonnes MTOM, or

With a maximum approved passenger seating configuration of 20 or more.

Part 1 is also applicable to Operators operating mixed fleets of aeroplane above and below this limit with the AOC certificated in a EASA Member State on or before 1 April 1998, and all Operators of other aeroplanes under an AOC certificated no later than 1 October 1999.

BASIC REQUIREMENT

It is a fundamental requisite of EASA Membership that a Member State accepts the Joint Aviation Requirements (JARs) as the law of that individual state. CS-OPS states that aeroplanes operated for the purpose of commercial air transportation must be operated in accordance with the requirements of CS OPS Part 1. The requirement is amplified to state that aeroplanes must be operated in compliance with the appropriate certificate of airworthiness and within the limitations of the appropriate Aeroplane Flight Manual. Where the use of a Synthetic Training Device (STD) such as a flight simulator is used to replace an aeroplane for training purposes, such STD 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 member's 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.

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 minimise the possibility of 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 400mn 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 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.

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, or
- 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 check lists are complied with in accordance with the requirements of the Operations Manual.

- 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 or the Configuration Deviation List.

- 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 flight 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 Operations Manual

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

UNAUTHORISED 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 Operations Manual relating to flight crew duty
- Parts of the Operations Manual required for the conduct of the flight
- The current Aeroplane Flight Manual (AFM) (unless the Authority has approved the Operations Manual 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
- Mass and Balance documentation
- Details of special categories of passengers (i.e. security personnel if not considered as crew; handicapped persons (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 authorised 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 - Commanders discretion applies).

PRODUCTION AND PRESERVATION OF DOCUMENTS AND RECORDINGS

Persons authorised 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 authorised 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 flight data recorder (FDR) and cockpit voice recorder recordings are to be retained for a period of 60 days unless a longer period is requested by the Authority.

Note: *JAR-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 doesn’t 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 utilising 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 a 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 CS -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 JARs; 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 C of A issued in accordance with ICAO Annex 8. A C of A issued by a 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
A 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 JAR-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 JAR-OPS 1 Sub Part C (Operator Certification and Supervision), shall remain the operator of the aeroplane.

Short Notice Leasing

In circumstances where an EASA operator is faced with an immediate, urgent and unforeseen need for a replacement aeroplane, the approval required to wet lease-in from a non-EASA source may be deemed to have been given, provided that the lessor is an operator holding an AOC issued by a State which is a signatory of the Chicago Convention; the lease-in period does not exceed 5 consecutive days; and the Authority is immediately notified of the use of this provision.

CHAPTER THREE

OPERATOR SUPERVISION AND CERTIFICATION

CONTENTS

RULES FOR THE CERTIFICATION OF AN AIR OPERATOR

Commercial air transportation 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 principle place of business. In the case of British Airways, this would the CAA of the UK as the principle 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 organisation 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 JAR 145 (EASA part 145) for the approval of maintenance operations. The operator may, however, elect to have the aeroplanes maintained by a third party organisation in which case, the operator is required to ensure that the maintenance organisation employed is JAR 145 (EASA part 145) approved. Where the operation carries out maintenance, the operator is required to ensure that access to the aeroplanes and the maintenance organisation is granted as required, and that access is also granted to any third party maintenance organisation 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 organisation/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 commercial air transport 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) authorised;
- The types (and marks or variant types) of aeroplanes authorised for use in the operation;
- The registration markings of the authorised aeroplanes;
- The authorised areas of operation;
- Any special limitations imposed by the authority;
- The special authorisations and approvals (if any) granted by the authority such as:
    - CATII/III operations (including the approved minima)
    - Operations in MNPS airspace
    - Extended Twin Operations (ETOPS)
    - Area Navigation Operations (RNAV)
    - Operations in accordance with Reduced Vertical Separation Minima (RVSM)
    - Operations involving the transportation of dangerous goods by air.

OPERATIONAL CONTROL

The Operator is required to exercise operational control of all flights undertaken by the operation. The method of exercising control is to be approved by the authority and is to be included in the operations manual.

Operational control means taking full responsibility for the initiation, continuation, termination or diversion of a flight. It does not imply a requirement for licenced flight dispatchers or the need for a full flight watch system.

A flight watch system offers continuous communications between the aeroplane and the operator's flight operations staff (not through ATC) giving the commander access to decision making at the operator level and also for making prior arrangements for en route rectification and fuel and stores uplift.

OPERATIONS MANUAL

Sub part P of JAR OPS contains the content requirements for the Operations Manual. The Operations Manual 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 Operations Manual
- Organisation 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 Operations Manual:

- 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 Operations Manual 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 JAR-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 manual 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

The Operator is responsibility to ensure that all personnel engaged in any ground or flight operation have been properly instructed and have demonstrated their abilities with regard to their particular duties. All such personnel must be made aware of their responsibilities, and the relationship of their duties, to the operation as a whole. Where necessary, training, as detailed in the Operations Manual Part D, is to be given to personnel.

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 organisation. Pre-flight inspections (see definition) need not necessarily be carried out by the part - 145 organisation. Continuing airworthiness requirements are laid down in 'EC regulation part -M'. CS-OPS no longer contains any requirements relating to aeroplane maintenance.

CHAPTER FOUR

OPERATIONAL PROCEDURES

CONTENTS

Continued . . . .

Contents Continued

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 Part B of the Operations Manual ensuring the procedures detailed in Part B are followed. The aircraft manufacturer's checklists contained in the aircraft flight manual (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.

PERFORMANCE AND OPERATING LIMITATIONS

Factors Affecting Aeroplane Performance Factors, which significantly affect the performance of the aeroplane, are to be taken into consideration either as direct operational parameters, or as allowances or margins which may be provided in the scheduling of performance data or in the code of performance for the operation of the aeroplane. The factors include: mass; operating procedures; the pressure-altitude appropriate to the elevation of the aerodrome; temperature; wind; runway gradient and condition of the runway (presence of slush, water and/or ice etc…).

MASS LIMITATIONS

The mass of the aeroplane at the start-up or take-off is not to exceed the mass at which take-off performance requirements can be complied with, or the mass at which the requirements for: the length of runway available; en-route – one engine inoperative; en-route – two power units inoperative, and landing, can be complied with, allowing for expected reductions in mass as the flight proceeds, and for fuel jettisoning as is necessary.

In no case is the mass at the start of take-off to exceed the maximum take-off mass specified in the flight manual for the pressure-altitude of the elevation of the aerodrome, and any other local atmospheric condition (if necessary). Neither is the estimated mass for the expected time of landing at the aerodrome of intended landing and at any destination alternate aerodrome, to exceed the maximum landing mass specified in the flight manual. Additionally, the mass at the start of take-off, or at the expected time of landing at the aerodrome of intended landing and at any destination alternate aerodrome, cannot exceed the relevant maximum masses applicable for noise certification standards, unless otherwise authorised in exceptional circumstances for an aerodrome or a runway where there is no noise disturbance problem.

TAKE-OFF

The aeroplane must, in the event of a critical power-unit failing at any point in the take-off, be able to discontinue the take-off and stop within the accelerate-stop distance available, or to continue the take-off and clear all obstacles along the flight path by an adequate margin until the aeroplane is in a position to comply with the en-route criteria. In determining the length of the runway available, account is taken of the loss of runway length due to alignment of the aeroplane prior to take-off.

EN ROUTE - ONE POWER-UNIT INOPERATIVE

The aeroplane must, in the event of the failure of the critical engine at any point along the route, be able to continue the flight to an aerodrome at which the landing standard can be met, without flying below the minimum flight altitude at any point.

EN ROUTE - TWO POWER-UNITS INOPERATIVE

In the case of aeroplanes having three or more engines, where the probability of a second power-unit becoming inoperative must be allowed for, the aeroplane must be able, in the event of failure of any two engines, to continue the flight to an en-route alternate aerodrome and land.

LANDING

The aeroplane must be able to land within the landing distance available, at the aerodrome of intended landing and at any alternate aerodrome, after clearing all obstacles in the approach path by a safe margin. Allowance is to be made for expected variations in the approach and landing techniques, if no such allowance has been made in the scheduling of performance data.

AEROPLANE PERFORMANCE OPERATING LIMITATIONS

The LOs require the student to be able to state the aeroplane performance operating limitations. This is a separate subject in its own right and detailed instruction is given during the study of subject 032 Performance. Remember however, that matters discussed in Performance lectures will be examinable in the OP examination.

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 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 maximising safety.

AUTHORISATION AND SELECTION OF AERODROMES BY THE OPERATOR

Only authorised 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 Plane (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.

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 aeroplane flight manual 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 aeroplane flight manual 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 Alternate(s):
The selected destination alternate (diversion) aerodromes are to be detailed in the Operational Flight Plan.

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 2000ft or circling height +500ft (whichever is greater) and the visibility will be not less than 5km.

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

Two destination alternates must be selected when the met reports/forecasts indicate that from 1 hour before until 1 hour after ETA at the destination, the weather conditions will be below the applicable planning minima, or no met information is available.

PLANNING MINIMA FOR IFR FLIGHTS

Take-off Alternate
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 below. 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.

Destination Alternate (except for isolated destination aerodromes)
For an aerodrome to be selected as a destination 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 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.

The planning minima defined in the table below are applicable to destination alternate, isolated destination. 3% ERA (see note below), and en-route alternate aerodromes:

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 1)
Non- precision	Non-precision RVR and the ceiling must be above MDH (See note 1) plus 200ft and 1000m
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.*

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 advent 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 (see below).

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 Operations Manual.

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'.

AOM is a major element of Chapter 5 - All Weather Operations and is covered in greater detail there.

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 instrument departure (SID) and approach procedures 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 by 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 responsible 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.

ROUTES AND AREA 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 engined aeroplanes are used, adequate aerodromes (for diversion in the event of an emergency) are available within the defined time/distance limitations.

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 and ATC. 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 auto pilot '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. For operations in MNPS airspace, the operator is to specify contingency plans to cover the possibility of system failures such that the aeroplane cannot comply with the requirements.

TWIN ENGINE OPERATIONS WITHOUT ETOPS APPROVAL

Before an operator can conduct operations using twin engined aeroplanes over routes where diversion (or adequate) aerodromes are sparse, approval of the authority has to be obtained and recorded in the AOC. In order for this approval to be granted, the routes have to be defined and approved within the following criteria:

- For Performance Class A aeroplanes with either:
  - Maximum approved passenger seating of 20 or more; or
  - Maximum take of mass of 45 360kg or more,

The maximum distance from an adequate aerodrome must be no more than the distance flown in 60 minutes at the one-engine-inoperative cruise speed (see below for definition).

- For Performance Class A aeroplanes (definition: all multi engine turbojet aeroplanes and turboprop aeroplanes with MTOM > 5700kg or passenger seating more than 9) with:
  - Maximum approved passenger seating of 19 or less; and

- Maximum take of mass less than 45 360kg,
- The distance flown in 120 minutes or, if approved by the Authority, up to 180 minutes for turbo-jet aeroplanes, at the one-engine-inoperative cruise speed.
- For Performance Class B (turboprop and piston engine aeroplanes with MTOM 5700kg or less; and seating 9 or less) or C (same as class A for multi engine piston) aeroplanes:
- The distance flown in 120 minutes at the one-engine-inoperative cruise speed or,
- 300nm whichever is less

DETERMINATION OF ONE-ENGINE-INOPERATIVE CRUISE SPEED

The Operator is required to determine a speed to be used for the calculation of the maximum distance to an adequate aerodrome for each two-engine aeroplane used in the operation. The speed defined is not to exceed V_{mo} (maximum operating speed) based on the TAS that can be maintained with one engine inoperative under the following conditions:

- ➢ ISA
- ➢ Level flight:
- ➢ For turbojet aeroplanes at:
    - FL170; or
    - At the maximum flight level to which the aeroplane, with one engine inoperative, can climb, and maintain, using the gross rate of climb specified in the aeroplane flight manual (AFM), whichever is less.
- ➢ For propeller driven aeroplanes at:
    - FL80; or
    - At the maximum flight level to which the aeroplane, with one engine inoperative, can climb, and maintain, using the gross rate of climb specified in the aeroplane flight manual (AFM), whichever is less.
- ➢ Maximum continuous thrust or power on the remaining engine;
- ➢ The aeroplane mass not less than that resulting from:
    - Take-off at sea level at maximum take-off mass; and
    - All engines climb to the optimum long range cruise altitude; and
    - All engines cruise at the long range cruise speed at this altitude, until the time elapsed since take-off is equal to the applicable threshold prescribed for non-ETOPS operations (previous paragraph).

The one-engine-inoperative cruise speed(s) determined with the above criteria for each aeroplane type used in the operation, together with the maximum distance from an adequate aerodrome, is to be detailed in the operations manual.

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 JAR-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 Operations Manual 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 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

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 impeded an emergency evacuation.

Before take-off and landing and whenever the 'fasten seat belt' signs are illuminated or it is otherwise ordered, checks are to be made to ensure that baggage is stowed where it will not impeded evacuation or cause injury by falling (or other movement).

SEATING OF PASSENGERS

Operators are required to establish procedures to ensure that only those passengers who appear to be reasonably fit, strong and able to assist the rapid evacuation of the aeroplane in an emergency, are allocated seats which permit direct access to emergency exits. If the procedure cannot be implemented at the 'check in' ('sit where you want' policy) an alternative procedure acceptable to the Authority which will ensure correct seating is to be established. Passengers not to be allocated such seats include:

- Passengers who, due to sickness, frailty, obesity or due to age, or who are suffering from obvious physical or mental handicap, would have difficulty in moving quickly if asked to do so or would have difficulty passing through an emergency exit;
- Passengers who are substantially blind or deaf, such that they may have difficulty with written or spoken instructions;
- Children;
- Deportees and persons in custody;
- Passengers with animals.

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 JAR-OPS) are available (fitted and serviceable - except as permitted by the MEL);
- The necessary parts of the Operations Manual are available on board the aeroplane;
- The documents required by JAR-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 i.e. height in feet to height in metres.
- Ground facilities and services are available and adequate;
- Operations Manual 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 JAR-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 embarking or disembarking. If other fuels are being used (i.e. 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 authorise 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 taxying and whenever deemed necessary in the interest of safety by the Commander. A seat 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 Operations Manual);

- 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 000ft for a period in excess of 30 minutes, and at all times whenever the cabin altitude exceeds 13 000ft.

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

The Operator is to establish procedures relating to the reporting of occurrences. Reports are to be raised for the following:

- Incidents: An occurrence other than an accident associate with the operation of an aeroplane which affects or could affect safety of the operation.
- Accident and serious incidents: Report to be submitted within 72 hours.
- Air traffic incidents: Submit ATIR (AIRPROX) initially by RTF to ATC and subsequently to the ATC authority on the approved form.
- ACAS resolution advisory; Report to be made to the ATC authority.
- Bird hazards and bird strikes: Also to advise ATC immediately. If strike discovered after landing and the Commander is not available to make the report, the Operator is to make the report to the authority.
- Dangerous goods incidents and accidents: Report to be despatched within the first 72 hours after the event unless exceptional circumstance prevent.
- Unlawful interference: As soon as practical also to the local authority and state of the operator.

- Encountering potential hazardous conditions; Irregularity in a ground navigation facility; a meteorological phenomena; volcanic ash cloud; etc…

CHAPTER FIVE

ALL WEATHER OPERATIONS

CONTENTS

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 create a framework within which operations specifically in poor visibility can safely be conducted, JAR-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: OPERATORS RESPONSIBILITY

An operator shall establish, for each aerodrome planned to be used, aerodrome operating minima that are not lower than the values given in JAR-OPS 1. These are reproduced in this chapter and are required learning. The method of determination 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.

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; and
- The means to determine and report meteorological conditions.

In categorising aeroplanes for the determination of operating minima, the indicated airspeed at threshold (V_{AT}) is calculated as below.

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 (V_{SO}) multiplied by 1.3, or V_{S1G} (the 1 G stalling speed) multiplied by 1.23 in the landing configuration at the maximum certificated 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 Table 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

Table 5.1 Aircraft Category

LOW VISIBILITY OPERATIONS - GENERAL OPERATING RULES

Low visibility operations consist of:

- Manual take-off (with or without electronic guidance);
- Auto-coupled approach to below DH, with manual flare, landing and roll-out;
- Auto-coupled approach followed by auto-flare, autolanding and manual roll-out;
- Auto-coupled approach followed by auto-flare, autolanding and auto roll-out when the applicable RVR is less than 400m.

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 Operations Manual. 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 Operations Manual. 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 air-borne equipment;
- Procedures for the take-off, approach, flare, landing, roll-out and missed approach;
- Procedures to be followed in the vent of failures, warnings and other non-normal situ-ations;
- 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 200ft 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 localiser sensitive area to be protected;
- The information used relating to wind velocity; windshear; turbulence; runway con-tamination and the use of multiple RVR assessments;
- Procedures to be used for practice approaches and landings on runways at which the full CAT II or III aerodrome procedures are not in force;
- Operating limitations resulting from airworthiness certification; and
- Information on the maximum deviation allowed from the ILS glide path or localiser.

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

- Each aeroplane is certificated for operations with DH below 200ft, or no DH, and equipped in accordance with JAR-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 150m RVR (Category A B and C aeroplanes) or 200m (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 Cat II and III approaches and Low Visibility take-offs.
- Low Visibility Take-Off (LVTO): A take-off where the RVR is less than 400m.
- 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.

  Note: *A typical secondary independent guidance system consists of a monitored head-up display providing guidance which normally takes the form of command information but it may alternatively be situation (or deviation) information.*

- 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.

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-engined 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 1500ft 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 table 5.2:

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

Table 5.2 Take-off RVR/Visibility Requirements

Notes:

1. *The higher values apply to category D aeroplanes only*
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-engined 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 tables 5.2 or 5.3.

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

Table 5.3 Take-off RVR/Visibility - flight path

Notes:
1. *1,500m 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*

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.

TABLE 5.2 EXCEPTIONS

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

- Low visibility procedures are in force;
- High intensity runway centreline lights spaced at 15m or less, and high intensity edge lights spaced at 60m or less are in operation;
- Flight crew members have satisfactorily completed training in a flight simulator;

- A 90m 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 (para-visual display) for take-off may reduce the take-off minima to an RVR less than **125m** for Cat A, B and C, or **150m** for Cat D but not lower than **75m**, 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,

- 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 operations manual. 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 JAR-OPS 1.

LOW VISIBILITY OPS - OPERATING PROCEDURES

An operator must establish procedures and instructions to be used for LV Take-off and Cat II and III operations. These procedures must be included in the Operations Manual and contain the duties of the crew members during taxying, 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 the 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; and

- The flight crew members are properly qualified prior to commencing a LV Take-off in RVR of less than 150m (Cat A, B and C aeroplanes) or 200m (Cat D) or Cat II/III approaches.

LOW VISIBILITY OPS - MINIMUM EQUIPMENT

An operator must ensure that the operations manual contains the minimum equipment that has to be serviceable at the commencement of a LV Take-off or a Cat II/III approach. 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 Table 5.4.

System minima	
Facility	**Lowest MDH**
ILS (no glide path - LLZ)	250ft
SRA terminating at 0.5nm	250ft
SRA terminating at 1nm	300ft
SRA terminating at 2nm	350ft
VOR	300ft
VOR/DME	250ft
NDB	300ft
VDF (QDM and QGH)	300ft

Table 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.

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

The lowest minima to be used by an operator for non-precision approaches are:

Non-precision approach minima **Full facilities** (notes: 1, 5, 6 and 7)				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250-299ft	800m	800m	800m	1200m
300-449ft	900m	1000m	1000m	1400m
450-649ft	1000m	1200m	1200m	1600m
650ft and above	1200m	1400m	1400m	1800m

Table 5.5 RVR for non-precision full facilities

Non-precision approach minima **Intermediate facilities** (notes: 2, 5, 6 and 7)				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250-299ft	1000m	1100m	1200m	1400m
300-449ft	1200m	1300m	1400m	1600m
450-649ft	1400m	1500m	1600m	1800m
650ft and above	1500m	1500m	1800m	2000m

Table 5.6 RVR for non-precision intermediate facilities

Non-precision approach minima **Basic facilities** (notes: 3, 5, 6 and 7)				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250-299ft	1200m	1300m	1400m	1600m
300-449ft	1300m	1400m	1600m	1800m
450-649ft	1500m	1500m	1800m	2000m
650ft and above	1500m	1500m	2000m	2000m

Table 5.7 RVR for non-precision basic facilities

Non-precision approach minima **No approach light facilities** (notes: 4, 5, 6 and 7)				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250-299ft	1500m	1500m	1600m	1800m
300-449ft	1500m	1500m	1800m	2000m
450-649ft	1500m	1500m	2000m	2000m
650ft and above	1500m	1500m	2000m	2000m

Table 5.8 RVR for non-precision no approach light facilities

Notes:

1. *Full facilities comprise runway markings; 720m or more of HI/MI (high/medium intensity) approach lights; runway edge lights; threshold lights and runway end lights.*
   The lights must be on.

2. *Intermediate facilities comprise runway markings; 420-719m of HI/MI (high/medium intensity) approach lights; runway edge lights; threshold lights and runway end lights.*
   The lights must be on.

3. *Basic facilities comprise runway markings; <420m of HI/MI (high/medium intensity) approach lights; any length of LI approach lights runway edge lights; threshold lights and runway end lights. The lights must be on.*

4. *Nil approach light facilities comprise runway markings; runway edge lights; threshold lights and runway end lights, or no lights at all.*

5. *The tables are applicable only to conventional approaches with normal descent slope of not greater than 4°. Greater descent slopes will usually require that visual glide slope guidance (i.e. PAPI) is also visible at the MDH.*

6. *The RVR figures are either reported RVR or met visibility converted to RVR in accordance with table*

Lighting elements in operation	**RVR = Reported Met Vis x**	
	Day	Night
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

Table 5.9 Conversion of Met vis into RVR

PRECISION APPROACH - CATEGORY I OPERATIONS

A Category I operation is a precision instrument approach and landing using ILS, MLS or PAR with a decision height not lower than 200 ft and with a runway visual range not less than 550 m. 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 Aeroplane Flight Manual (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

200ft.

A pilot may not continue an approach below the Category I decision height, 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; or
- Runway edge lights.

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

Category 1 minima				
Decision height (note 7)	**Facilities/RVR (note 5)**			
	Full (notes1 & 6)	**Interim (notes 2 & 6)**	**Basic (notes 3 & 6)**	**Nil (notes 4 & 6)**
200 ft	550m	700m	800m	1000m
201-250 ft	600m	700m	800m	1000m
251-300 ft	650m	800m	900m	1200m
301 ft and above	800m	900m	1000m	1200m

Table 5.10 RVR for Cat I approach vs. facilities and DH

Notes:

1. *Full facilities comprise runway markings, 720 m or more of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.*

2. *Intermediate facilities comprise runway markings, 420-719 m of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.*

3. *Basic facilities comprise runway markings, < 420 m of HI/MI approach lights, any length of LI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.*

4. *Nil approach light facilities comprise runway markings, runway edge lights, threshold lights, runway end lights or no lights at all.*

5. *The above figures are either the reported RVR or meteorological visibility converted to RVR.*

6. *The Table is applicable to conventional approaches with a glide slope angle up to and including 4°;*

7. *The DH mentioned in the table refers to the initial calculation of DH. When selecting the associated RVR, there is no need to take account of a rounding up to the nearest ten feet, which may be done for operational purposes, (e.g. conversion to DA).*

For single pilot operations, an operator must calculate the minimum RVR for all approaches in accordance with the appropriate tables. An RVR of less than 800 m is not permitted except when using a suitable autopilot coupled to an ILS or MLS, in which case normal minima apply. The Decision Height applied must not be less than 1.25 x the minimum use height for the autopilot.

For night operations at least runway edge, threshold and runway end lights must be on.

PRECISION APPROACH - CATEGORY II OPERATIONS

A Category II operation is a precision instrument approach and landing using ILS and 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 authorised 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 barrette of the touchdown zone lighting.

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

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

Table 5.11 RVR for Cat II approach vs DH

Notes:

1. *This reference to 'auto-coupled to below DH' 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. *300m may be used for a Category D aeroplane conducting an auto-land.*

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 200m.

- 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 200m but not less than 75m.

- 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 authorised to operate.

NO DECISION HEIGHT OPERATIONS

Operations with no decision height may only be conducted if:

- The operation with no decision height is authorised 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 with fail- passive flight control systems, 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 centreline 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) (Note 3)**	**Roll-out Control/ Guidance System**	**RVR (m)**
IIIA	Less than 100ft	Not required	200m (note1)
IIIB	Less than 100ft	Fail-passive	150m (notes 1 & 2)
IIIB	Less than 50ft	Fail-passive	125m
IIIB	Less than 50ft or no DH	Fail-operational	75m

Table 5.12 RVR for CAT III approach vs DH and roll-out control/guidance

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 and ATC (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. JAR-OPS 1 defines visibility for (VM(C)) as defined in table 5.12. These figures are different from the requirements of Annex 6.

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

Table 5.13 Visibility and 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. JAR-OPS 1 states that an Operator is not to conduct visual approaches when the RVR is less than 800m.

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

VMC Criteria

Notes:

1. *When the height of the transition altitude is lower than 3050m (10 000ft) AMSL, FL100 ("Flight Level one hundred") should be used in lieu of 10 000ft.*

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

SPECIAL VFR

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

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

CHAPTER SIX

AEROPLANE EQUIPMENT AND INSTRUMENTS

CONTENTS

Continued . . . . .

Contents Continued

INTRODUCTION

In addition to the minimum equipment necessary for the issue of a Certificate of Airworthiness (C of A), 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 minimum equipment list (MEL), in the operations manual 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 for safety, navigation or regulatory reasons.

INTERNAL DOORS AND CURTAINS

The requirements for the security of the flight deck have already been discussed, but JAR-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 leads to an emergency exit. The crew must have means of unlocking any door that can be locked by passengers (toilet doors).

FIRST AID KITS

JAR-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 authorised to carry. The kits are required to be inspected regularly and replenished as necessary. Additionally, Annex 6 and JAR-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 authorised to carry more than 30 passengers, if the flight is 60 minutes or more from qualified medical assistance.

Passengers	First Aid Kits
0 - 99	1
101 - 199	2
200 - 299	3
300 or more	4

Table 6.1 First Aid Kit Requirement

HAND-HELD FIRE EXTINGUISHERS

The aeroplane systems will have integrated fire extinguisher systems operated from the pilot stations. However, to fight fires on the flight deck and in the passenger cabin (and cargo compartment where necessary), hand held extinguishers are required to be carried. The content of the extinguisher is to be optimised for the type of fire likely to be encountered and to minimise the hazard form toxic gasses produced.

LOCATIONS

At least one, Halon 1211 (bromochlorodifluromethane - BCF) or equivalent extinguisher is to be positioned on the flight deck. JAR-OPS requires extinguishers to be fitted in the passenger cabin. Where more than one is carried, they are to be evenly distributed around the cabin.

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 x 3 cm are inserted so that there is no more than 2 m between adjacent markings.

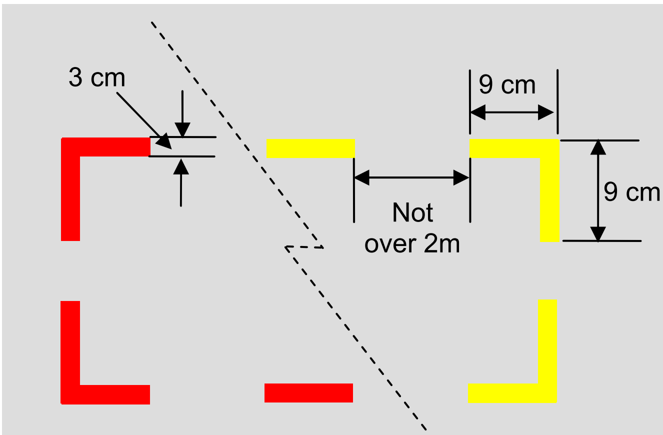


Figure 6.2 Break In Markings Means of Emergency Evacuation

Where the sill height of an emergency exit is more than 1.83m (6 ft) above the ground with the landing gear extended, or 1.83m 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 1.83m above the ground. If require, a separate flight crew emergency exit is to be equipped with a similar device if the exit is more than 1.83m 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 commercial air transport. JAR-OPS requires the carriage of a CVR in specific aeroplanes.

There are 3 cases:

Case 1: Aeroplanes with C of A issued on 1 April 1998 or later; multi engine turbine; max passengers more than 9; MTOM greater than 5 700 Kg

Case 2: After 1 April 2002, aircraft with C of A issued on or after 1 January 1990 up to and including 31 March 1998; multi engine turbine; max passengers more than 9; MTOM of 5 700 Kg or less.

Case 3: Any aeroplane with C of A issued before 1 April 1998 and MTOM over 5 700 Kg.

DATA RECORDED

A CVR is designed to record:

- Voice communication transmitted into or out of the cockpit
- The aural environment on the flight deck
- Voice communications of flight crew members using the intercom
- Voice or audio identification of navigation or approach aids in the headset or on the speaker
- Voice communications of flight crew members using the PA system

CVRS – OPERATION, CONSTRUCTION AND INSTALLATION

For Case 1 and Case 3, the CVR has to be capable of retaining the information recorded during at least the last 30 minutes of its operation. For case 2, the CVR has to be capable of recording the last 2 hours of data. 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. The regulatory requirements for the carriage of FDRs occupy many pages in both Annex 6 and JAR-OPS but the LOs for Operational Procedures require the student to have knowledge only of the parameters recorded; the rules for retention of data, and the rules regarding location, construction installation and operation of FDRs as detailed in Annex 6 only.

For Classification

Flight data recorders - 1

a. An operator shall not operate any aeroplane first issued with an individual Certificate of Airworthiness on or after 1 April 1988 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 Certificate of Airworthiness on or after 1 June 1990 up to a maximum certificated take-off mass over 5700 kg unless it is equipped with a flight data recorder that uses a digiatl 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 Ceritifcate of Airworthiness, before 1 June 1990 which has a maximum cerficated tak-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.

Data Link Communications

For aeroplanes with C of A issued after 1 January 2005, the FDRs fitted to aeroplanes that have CVRs fitted, and which use data link systems for communication, are to be capable of recording all the data link communications. This will become a general requirement with effect from 1 January 2007.

Recording Duration

Type I and Type 2 and Type 3 FDRs are to be capable of recording the at least the last 25 hours of their operation.

Construction and Installation

Clearly, the FDR must be capable of withstanding any disaster that befalls the aeroplane, and as we have already stated, it must be capable of being located after an accident. It is required to be constructed, located and installed so as to provide maximum practical protection for the recordings. Specifications are laid down for crashworthiness and fire resistance and JAR-OPS applies the standards specified by the European Organisation for Civil Aviation Equipment (EUROCAE). The FDR should be located close to the rear pressure bulkhead, or as far aft as possible. The electrical supply should be from a bus-bar that gives the maximum reliability of power supply without jeopardising essential or emergency electrical loads. The FDR system must be capable of being functionally checked before flight.

Operation of FDRs
Not surprisingly, FDRs are not to be switched off during flight time. Following an accident or an incident, the FDR is to be de-activated after landing and is not to be switched on again until cleared for use after the conclusion of any investigation.

Combination Recorders
Recorders which act as both an FDR and a CVR are permitted by JAR-OPS. Such a combination recorder may be fitted to aeroplanes with MTOM of 5 700 kg or less, or to bigger aeroplanes if two of the combination recorders are fitted.

Flight Recorder
Records Operators are required to make sure that if an aeroplane is involved in an incident or an accident the flight recorder records and the recorders are retained in safe custody until the requirements of Annex 13 (Accident Investigation) have been complied with.

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 flights are to be equipped with:

- A magnetic compass;
- An accurate timepiece indicating the time in hours, minutes and seconds;
- A sensitive pressure altimeter;
- An ASI, and
- Such additional instruments or equipment as may be prescribed by the appropriate authority.

Controlled VFR Flights
VFR flights that are operated as controlled flights (in classes B and C airspace) are to be equipped as for IFR flights.

Compliance with IFR
All aeroplanes operated under IFR, or when the aeroplane cannot maintain the desired attitude without reference to one or more flight instruments, must be equipped with:

- A magnetic compass;
- An accurate timepiece indicating the time in hours, minutes and seconds;
- Two sensitive pressure altimeters with counter drum-pointer, or equivalent presentation. Neither 'three-pointer' nor 'drum-pointer' altimeters satisfy the requirement;
- An ASI with means of preventing malfunctioning due to either condensation or icing;

- A turn and slip indicator;
- An attitude indicator (artificial horizon);
- A heading indicator (directional gyroscope);
- A means of indicating whether the power supply to the gyroscopic instrument is adequate;
- A means of indicating in the flight crew compartment the outside air temperature;
- A rate-of-climb and descent indicator, and
- Such additional instruments or equipment as may be prescribed by the appropriate authority.

Note: *The requirements of the turn and slip indicator, attitude indicator and heading indicator may be met by combinations of instruments or by integrated flight director systems provided that the safeguards against total failure, inherent in the three separate instruments, are retained,*

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

Each turbo-prop aeroplane with MTOM> 5700kg or passenger seating of more than 9 is to be fitted with an altitude alerting system capable of alerting the flight crew when approaching a pre-selected level and alerting the crew by an aural warning when deviating from a pre-selected level. An exemption is given to aeroplanes registered before 1 April 1972.

STANDBY HORIZON

All aeroplanes of a maximum certificated take-off mass of over 5 700 kg introduced into service after 1 January 1975 are to be fitted with an emergency power supply, independent of the main electrical generating system, for operating and illuminating an attitude indicating instrument (artificial horizon), clearly visible to the pilot-in-command, for a minimum period of 30 minutes. The emergency power supply is to automatically operate after the total failure of the main electrical generating system and give a clear indication on the instrument panel, that the attitude indicator is being operated by emergency (stand-by) power.

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. For multi engine aircraft this is considered to be more than 93 Km (50 NM) from shore. Also, anywhere over water beyond the gliding distance of a single engine aircraft, or wherever the Authority of a State considers it necessary. 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

Additionally, flights over water more than 120 minutes at one engine inoperative cruising speed, or 740 km (400 NM), whichever is less, away from land suitable for making an emergency landing in the case of multi engine aeroplanes, and 30 minutes or 185 km (100 NM), whichever is less, for all other aeroplanes, are required to carry sufficient life-rafts to carry all persons on board. These are to be stowed ready for use in emergency, and fitted with life-saving equipment including means of sustaining life (food; water etc…); and equipment for making the pyrotechnic (rockets and flares) distress signals described in Annex 2 (Rules of the Air).

REMOTE AREAS

When operated across land areas where search and rescue would be difficult, aeroplanes are to be equipped with the signalling and life-saving equipment (including means of sustaining life; food, water etc…) as may be appropriate to the area to be overflown (i.e. Desert; Artic; Jungle, Ocean)

WEATHER RADAR

When carrying passengers in pressurised 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. JAR-OPS expands the requirement to include un-pressurised aeroplanes with MTOM greater than 5 700 kg; and any un-pressurised aeroplane with more than 9 passenger seats after 1 April 1999. For propeller driven aeroplanes with MTOM not exceeding 5 700 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. Such aeroplanes are to be equipped with an ice detection device or a method of illumination to detect ice formation.

RADIATION MONITORING INDICATOR

All aeroplanes which are intended to be operated above 15 000 m (49 000 ft), are required to carry equipment to measure and continuously indicate on each flight, the current dose rate and the cumulative dose of cosmic radiation being received. The display unit of the equipment shall be readily visible to a flight crewmember. Individual records are kept for crewmembers that are liable to high exposure. The Commander or the pilot to whom the flight has been delegated will initiate a descent as soon as practicable when the limit values of cosmic radiation specified have been exceeded.

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 (GPWS)
TERRAIN AWARENESS WARNING SYSTEM (TAWS)

Too many aircraft have been lost and crew and passengers killed by inadvertent controlled flight into terrain. 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, and is required to be fitted to all commercial air transport aeroplanes with MTOM greater than 5 700 kg or approved passenger seating of more than 9. Many systems use a female voice to announce the warning and state the required action. The voice is affectionately known as 'Auntie Betty'. 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.

Additionally, from 1 January 2003 all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15 000 kg or authorised to carry more than 30 passengers, are to be fitted with a GPWS incorporating a predictive terrain hazard warning function. The warnings given are to be given in such time as to allow the crew to take the necessary recovery action so as to prevent controlled flight into terrain.

COMMUNICATIONS EQUIPMENT

An aeroplane used for commercial air transport 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. JAR-OPS requires two independent VHF radio systems to be fitted. The communications equipment must also be capable of tuning to other stations on the frequencies specified by the Authority of the State being overflown. Essentially, the equipment must be able to transmit/receive on the aeronautical emergency frequency 121.500 MHz.

INTERNAL COMMUNICATIONS

Aeroplanes are required to have a public address (PA) system and a crew intercommunications system (crew 'interphone' or intercom). The PA system is required (by JAR-OPS) for all aeroplanes engaged in commercial air transport with more than 19 passenger seats. The crew interphone is required for all aeroplanes with MTOM greater than 15 000 kg or having more than 19 passenger seats, if the C of A was issued on or after 1 April 1965 and the aeroplane was registered in a JAA state on 1 April 1995.

AUDIO SELECTOR PANEL (ASP)

The crew interphone system (between the flight crew) also carries the incoming audio output from the radio equipment to the pilot's headset or loudspeaker. Each position of the flight deck is required to have an ASP so that the crew member can select (by switching and volume control) the audio services required. Typically and ASP permits the audio output from the VHF and HF radios; VOR; DME; ADF; markers; and ILS to be routed to the headset. It is usual for the ASP to also have a microphone selector switch to connect the pilot's microphone to the transmitter circuit of equipment that can transmit audio frequency (VHF and HF).

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 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 FL 290 and FL 410, 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 the aeroplane is to be operated under IFR and instrument procedures are required to comply with IFR departure and arrival procedures, the aeroplane is to be fitted with not less than one; VOR; ADF and DME; one ILS (or MLS); one marker 75 MHz beacon receiver information. The requirement for VOR/DME/ADF is to be doubled where navigation along a route 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 5 700 kg.

EMERGENCY AND SURVIVAL EQUIPMENT

In order to assist the Search and Rescue organisation plan and execute any SAR operation, the Operator is required to maintain lists of all the emergency and survival equipment fitted to aeroplanes used in the operation. The list is to include: number, colour and type of life rafts; details of pyrotechnics (flares and rockets); details of emergency medical supplies; water supplies, and the type and frequencies of portable emergency radio equipment.

ITEMS NOT REQUIRING APPROVAL

The following items referred to above 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 pilot's 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.

'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 summarised in the two tables below.

The minimum requirements for supplemental oxygen to be carried in pressurised aeroplanes, 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 13,000ft and entire flight time when cabin pressure exceeds 10,000ft but does not exceed 13,000ft after the first 30 minutes at those altitudes, but in no case less than: 1. 30 minutes for aeroplanes certificated to fly at altitudes not exceeding 25,000ft (note 2) 2. 2 hours for aeroplanes certificated to fly at altitudes more than 25,000ft (note 3)
2.	All required cabin crew members	Entire flight time when cabin pressure altitude exceeds 13,000ft but not less than 30 minutes (note 2), and entire flight time when cabin pressure altitude is greater than 10,000ft but does not exceed13,000ft after the first 30 minutes at these altitudes
3.	100% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 15,000ft 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 14,000ft but does not exceed 15,000ft
5.	10% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 10,000ft but does not exceed 14,000ft after the first 30 minutes at these altitudes.

Table 6.3 Supplemental Oxygen for Pressurised Aeroplanes

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 000ft in10 minutes followed by 20 minutes at 10 000ft.*

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 000ft in 10 minutes followed by 110 minutes at 10 000ft.*

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 000ft 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-pressurised 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 10,000ft
2.	All required cabin crew members	Entire flight time at pressure altitudes above 13,000ft and for any period exceeding 30 minutes at pressure altitudes above 10,000ft but not exceeding 13,000ft
3.	100% of passengers (note 1)	Entire flight time at pressure altitudes above 13,000ft
4.	10% of passengers (note 1)	Entire flight time after 30 minutes at pressure altitudes greater than 10 000ft but not exceeding 13,000ft

Table 6.4 Supplemental Oxygen for Un-pressurised Aeroplanes

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 > 5700kg 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. 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 5700kg 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

Table 6.5 Requirement for Megaphones

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)

All aeroplanes registered after 1 January 2002 are required to be fitted with an ELT capable of transmitting on;

- 121.5 MHz (warning and DF tone similar to a police car siren); and
- 406 MHz (SARSAT data uplink).

The ELT is to be coded in accordance with ICAO Annex 10 and registered with the national agency responsible for initiating Search and Rescue.

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 (the old JAR25 - Large Aeroplanes) or equivalent, no greater distance than that corresponding to 90 minutes at cruising speed from an area suitable for making an emergency landing.

CHAPTER SEVEN

CREW, LOGS AND RECORDS

CONTENTS

CREW COMPOSITION

The minimum flight crew is specified in the Aeroplane Flight Manual (AFM) and the operational flight crew is to be no less than this. Additional crew members may be required when the Operations Manual 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-Commander (PIC) as defined in the requirements for flight crew licences (JAR-FCL), 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 50nm radius from the aerodrome of departure providing the pilot has a minimum of 500 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 Operations Manual) 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 Operations Manual. For multi-pilot operations, the pilot must complete an appropriate command course as defined in the Operations manual. 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 competence.

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 turbo-prop 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 FAR-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 Operations Manual. 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 Operations Manual.

DIFFERENCE AND FAMILIARISATION 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. Familiarisation 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 Operations Manual. 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 JAR-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 Operations Manual. 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.

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 Operations Manual 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 suitable 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 TRI or 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.

ROUTE COMPETENCE

Route competence is defined as knowledge of:

- Terrain and minimum safe altitudes;
- Seasonal meteorological conditions;
- Meteorological, communication and ATC facilities, services and procedures;
- SAR procedures;
- Navigational facilities associated with the route.

AERODROME COMPETENCE

Operators are required to categorise all the aerodromes to be used within the scope of the operation. The operator is then required to make sure that the pilots are familiar with the classification system and the requirements for operations into and out of each category of aerodrome. The categories of aerodromes are as follows:

Category A Aerodrome
An aerodrome which satisfies all the following:

- An approved instrument approach procedure;
- At least one runway with no performance limited procedures for take-off and/or landing;
- Published circling minima not higher than 1000ft AAL; and
- Night operations capability.

Category B Aerodrome
This is an aerodrome that doesn't satisfy the requirements for Category A or which requires extra considerations. The following would categorise an aerodrome as Category B:

- Non-standard approach aids and/or approach patterns; or
- Unusual local weather conditions; or
- Unusual characteristics or performance limitations; or
- Any other relevant considerations including obstructions, physical layout, lighting etc…

Prior to operating at a Category B aerodrome, the Commander should be briefed or self briefed by means of programmed instruction on the aerodrome(s) concerned and should certify that he has carried out these instructions.

Category C Aerodrome
This is an aerodrome that requires additional considerations to a Category B aerodrome. Prior to operating at a Category C aerodrome, the Commander should be briefed and visit the aerodrome as an observer and/or undertake instruction in a flight simulator. This instruction should be certified by the Operator.

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 Operations Manual 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 Operations Manual.

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. JAR 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 JAR-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 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 Operations Manual, 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; and

- Medically fit (passed an initial medical assessment) and physically capable of discharging the duties specified in the Operations Manual.

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 Operations Manual.

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 complete 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 Operations Manual. In the absence of instructions from the Commander, during turbulence the Senior Cabin Crew Member is entitled to suspend non-safety related activities and illuminate the 'fasten seatbelt' sign.

Recurrent Training for Cabin Crew Members
Operators are to ensure that each cabin crew member undergoes recurrent training covering the normal and emergency procedures and drills relevant to the type and variant of aeroplane flown. Recurrent training syllabi are to be approved by the authority and to be in accordance with JAR-OPS. The period of validity of recurrent training for cabin crew is 12 months with the 3 month rule applying.

Refresher Training for Cabin Crew Members
If a cabin crew member has been absent from flying duty for a period of more than 6 month and still remains within the current period of recurrent training, returns to flying duty, then the crew member is required to undergo refresher training as specified in the Operations Manual. Where a crew member has not been absent for a period of 6 months but has not flown the type or variant now to be flown, the crew member is to undertake a refresher course or to operate two re-familiarisation sectors.

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 Operational Flight Plan 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;
- 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 check-points/waypoints. Estimate and actual time's 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. These alternate airfields must also have the details indicated by *;
- Initial ATS flight plan clearance and re-clearance;
- In flight re-planning calculations; and
- Relevant met information;

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 operations manual. 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	24 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

Table 7.1 Retention of Flight Prep Documentation

Reports	
Journey Log	3 months
Flight reports for recording details of any occurrence, as prescribed in JAR-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

Table 7.2 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

Table 7.3 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

Table 7.4 Cabin Crew Records

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

Table 7.5 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 check list	3 months after the completion of the flight

Table 7.6 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. Currently there are no JARs in section Q of JAR-OPS and each operator will be applying national requirements. In the UK the flight and duty limitations are defined in CAP393 (the Air Navigation Order).

CHAPTER EIGHT

LONG RANGE FLIGHT AND POLAR NAVIGATION

CONTENTS

ETOPS

The regulations concerning the operator's responsibilities for the selection of routes and operations in RVSM airspace are covered in Chapter 4 of these notes. Within the context of ETOPS, an adequate aerodrome is defined as:

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 the necessary ancillary services such as ATS, sufficient lighting, communications, weather reporting, navaids and emergency services.

The limitations imposed by JAR-OPS on ETOPS with and without special approval are covered in Chapter 4 of these notes.

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 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 ADF bearings from 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 over-all air traffic situation.

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 acknowledges 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.

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 121.5Mhz 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 90° 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 organised 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 300m (1000ft); or

- If below FL410, climb or descend 150m (500 ft); or

- If at FL410, climb 300m (1000ft) or descend 150m (500ft)

An aeroplane unable to maintain its assigned flight level should:

- Initially minimise 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 15nm 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.

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. VOR's in the Canadian Northern Control Area are oriented to true north. Where the primary heading information is derived from an IN 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.

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 time 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).

CHAPTER NINE

MINIMUM NAVIGATION PERFORMANCE SPECIFICATION AIRSPACE MNPSA

CONTENTS

Continued . . . . . .

Contents Continued

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 are at peak time as many as 300 aircraft flying across the 'pond'. 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 Operations Manual 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 'standardises' 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 (currently Edition 2005)
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 i.e. 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 the weak horizontal component of the Earth's magnetic field (less than 6μ Tesla) 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.

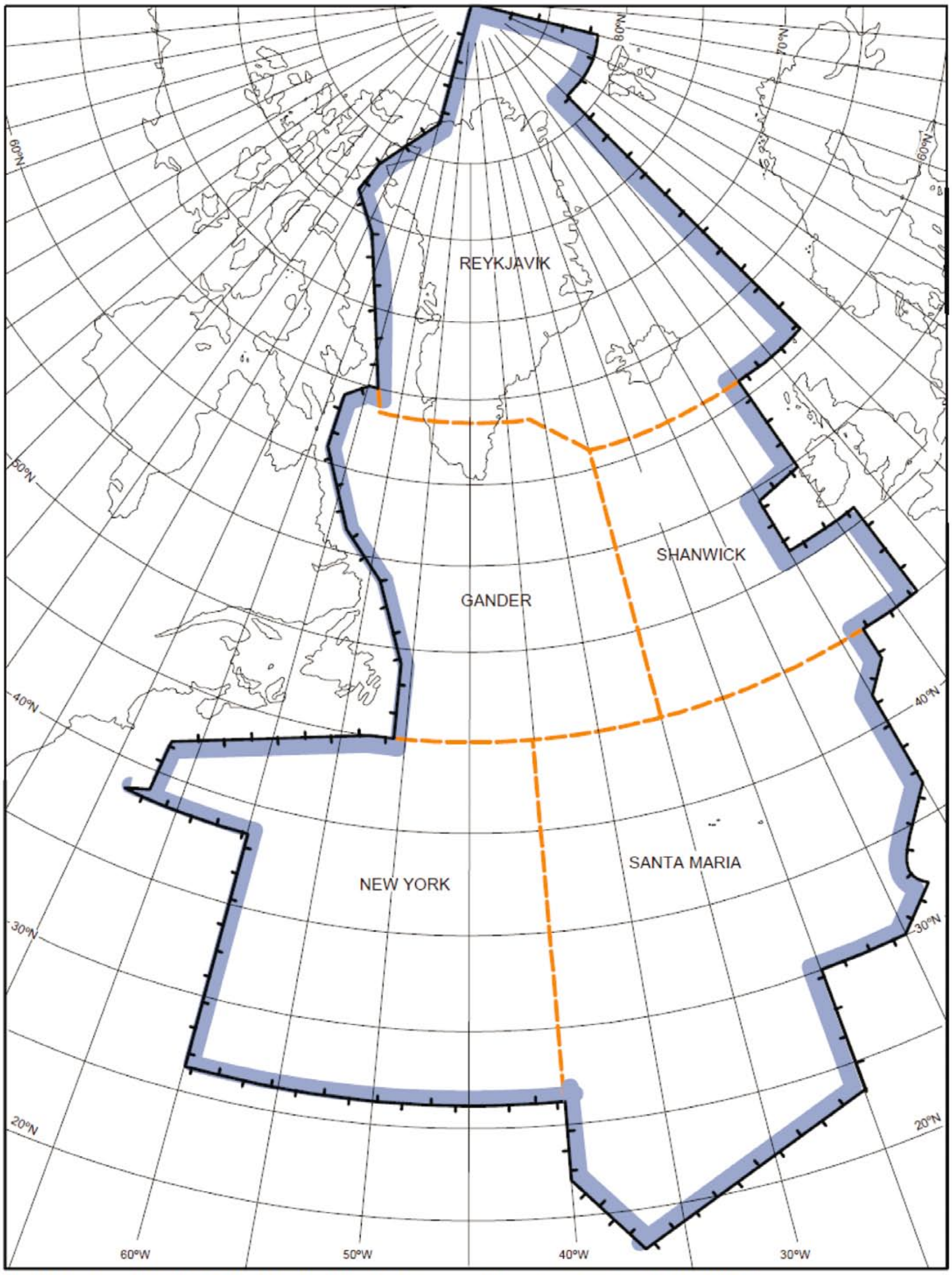
THE AIRSPACE

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 the SW boundary of New York is the northern boundary of the Miami OCA (which is not part of the MNPSA area and the easterly boundary of Reykjavik is the western boundary of the BödØ (pronounced Boo der) OCA. BödØ 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 requiring the aircraft to be able to navigate within strict performance criteria. The RNP requirement is RNP 20. The operator approval for MNPS operations is to be indicated with the insertion of the letters SX in item 10 of the FPL. Speed in the MNPSA is reported by Mach No and strict adherence to the cleared speed is required.

NORTH ATLANTIC MNPS AIRSPACE OPERATIONS MANUAL
Edition 2008



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

Because the FLs allocated in accordance with the semi-circular rule (see Rules of the Air - Air Law) would give FL 290, FL 330, FL370 and FL410 for eastbound traffic, and FL310, FL 350 and FL390 to westbound traffic, the effect is to further concentrate traffic into 'desirable' FLs. One solution to making more FLs available is to use RVSM (reduced vertical separation minima). Trials with RVSM over the NAT region started in 1997 and full implementation was achieved in 2002. RVSM reduces the vertical separation between aircraft from 2000 ft to 1000 ft despite the requirements of the Rules of the Air and altimeter inaccuracies. The MNPSA is defined vertically between the VFR flight levels of FL285 and FL420 (encompassing IFR RVSM FLs 290 through 410 inclusive). To achieve the reduced minima, the aircraft using RVSM have to have specially approved systems, the airspace has to be approved for RVSM and the Operator's AOC has to certify the approval to fly in accordance with RVSM procedures. Specific aeroplane requirements are:

- Two independent baro-altimeter systems agreeing within +/- 200ft
- An auto-pilot height lock
- An automatic altitude deviation warning system
- SSR with altitude reporting mode (mode C)
- ACAS II

NAVIGATION SYSTEM REQUIREMENTS

In order to achieve RNP20, aircraft have to be fitted with approved long-range navigation equipment. Additionally, to cover the case of a navigation system failure, the requirement is for two long-range navigation systems (LRNS) for flight within the MNPSA. Approved LRNSs are:

- GNSS (GPS)
- INS (Inertial reference system)
- LORAN C.

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

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 IN 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 vent 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, a 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 11 am 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 10 am (1500z) would land at 9 pm 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 utilisation 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 organised tracks and the overall concept is called the organised tack system (OTS). Whilst this appears to be much formalised 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 organised 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 mid point 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, doesn't 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 OTS periods of validity are:

Daytime OTS 1130z to 1900z at 30W;

Night time OTS 0100z to 0800z at 30W

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. 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 (Iat/long positions and named positions) by designator, and remarks including the track message identifier (TMI) and notices regarding airspace reservations and navigational data.

The daytime OTS message is published at 0000z, and the night time OTS message at 1200z.

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. The individual track can then be identified by the inclusion of the track letter as a suffix to the Julian date. e.g. 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 aphabetic character, i.e. TM1059A, 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 i.e. 59/10 meaning 5900N01000W) or a named position (the ICAO standard for position names is used - 5 letters i.e. 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 61/4061/5060/60 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 N4648 N4668 N4688 N4728 N4748

This implies that there are no specified European routes to the start point, and from CIMAT the NAR (North American routings) are N4648 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.

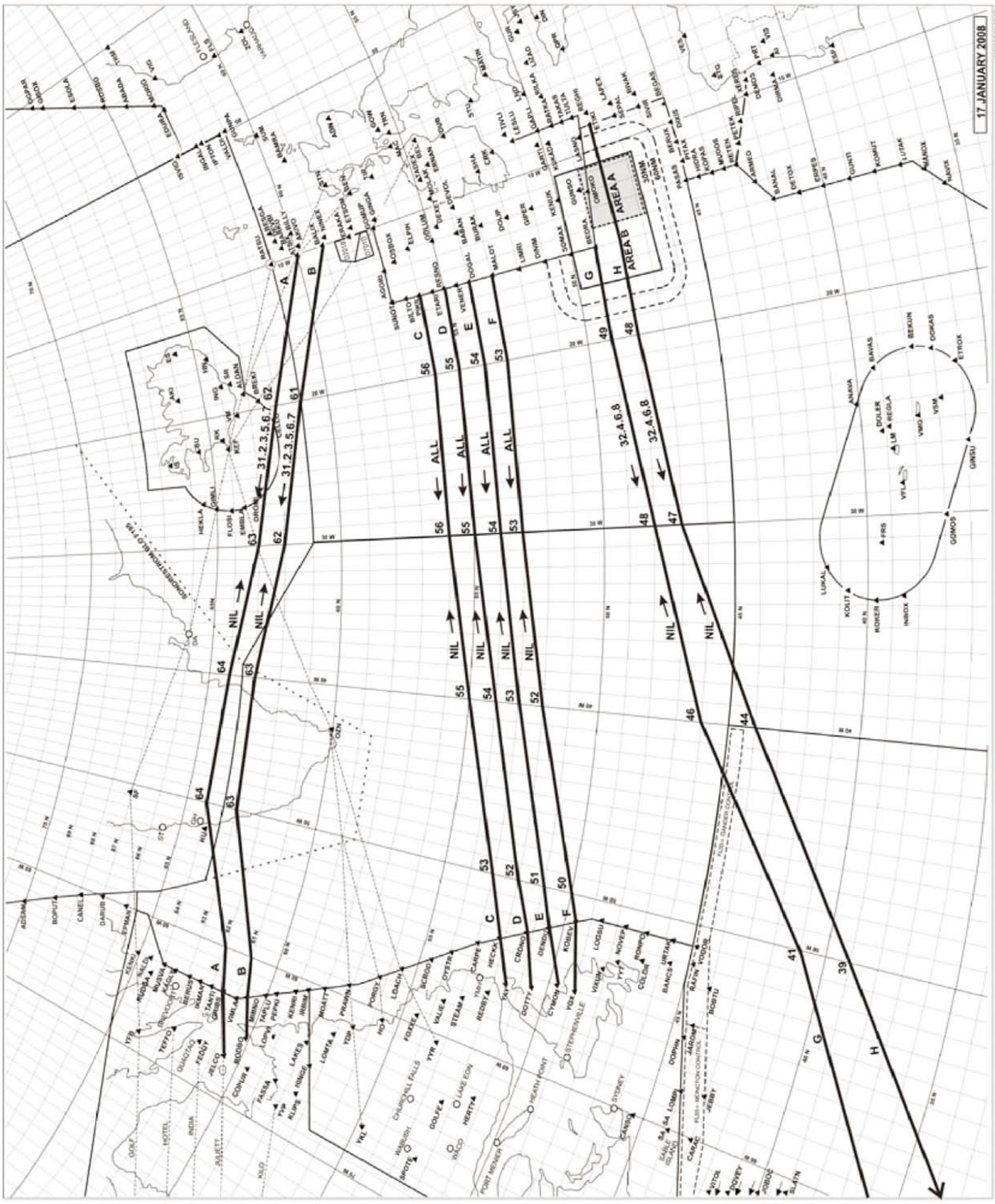


Figure 9.2 Example of Day-time Westbound Organised Track System

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)

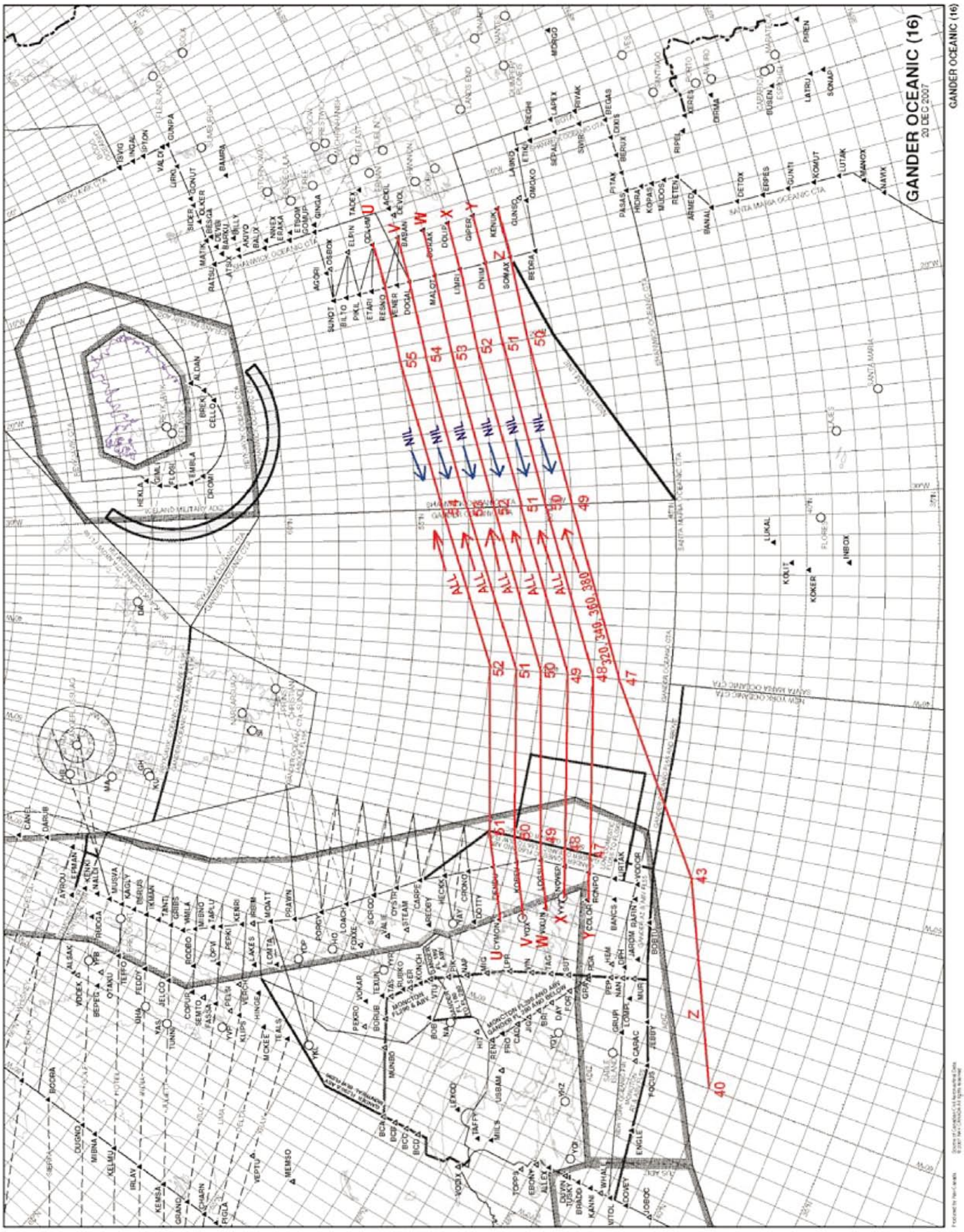


Figure 9.3 Example of Night-time Eastbound Organised Track System

POLAR TRACK STRUCTURE (PTS)

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

BLUE SPRUCE ROUTES

Where an aircraft is unable to comply with the MNPSA requirements regarding LRNS, routes have been established offering near continuous VOR/ADF information. These routes transit Iceland, southern Greenland and Labrador (Canada) with minimal ocean crossing time. They use the VOR and NDB beacons on those landmasses together with facilities on the Hebrides, Orkney Shetland and Faeroe Islands. Clearly, there is a time and fuel penalty for using these routes, but they are useful for non-scheduled and general aviation operations.

Figure 9.4 Blue Spruce Routes: SOTA and BOTA Areas

SHANNON OCEANIC TRANSITION AREA (SOTA)

Part of the Shanwick OCA is designated as the Shannon Oceanic Transition Area (SOTA). The purpose of the airspace is to allow aircraft to transition to, and descend from, oceanic levels and domestic FIR/UIR levels. MNPS Airspace requirements are still applicable from FL285 to FL420. SOTA has the same vertical extent as the Shanwick OCA. SHANNON ACC, using the call sign SHANNON CONTROL, provides air Traffic Service.

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 (123.450 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 121.5MHz. VHF communications are also available along the entire length of the Blue Spruce routes.

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 utilises '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 1000nm 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 ... "*

SELCAL

To avoid the need to continuously monitor the HF frequency and listen to all the other transmissions and the background noise, a system has been devised that permits the ground station to 'call' the aircraft using a specific coded message that only that aircraft will respond to. The system is called Selcal ('**sel**ective **cal**ling') and is a transmission on the frequency in use of mixed tones. In the aircraft there is a receiver with 'tuned reeds', which are 'activated/vibrated' by the tones, and in turn illuminate a light on the flight deck to indicate that the aircraft is being called by the ground station. At the initial call on HF to the first air-ground station, the operator will ask for the aircraft Selcal code (4 letters equating to the tuned reeds in the aircraft receiver) which will then be transmitted to check the aircraft system is operating. If successful, the pilot will be advised to maintain a Selcal watch. This satisfies the requirement of Class A airspace to maintain a listening watch with the ATCU.

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 organised to cross whole 10° 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 500nm. The standard Airep position report is required using section 1 of the model Airep on page 434A of the Jeppesen Airways Manual. The report is made in the following manner:

"Shanwick Speedbird 289 *position"*

"Speedbird 289 *go ahead"*

"Position Speedbird 289 *59N 20W at 1050 FL330 estimating 58N 30W at* 1136 *58N 40W next'*

Above 70N the position reports are made at intervals of 20° of longitude.

SEPARATION

The OCA will arrange separation between aircraft flying the same OTS track at the same allocated FL. Whilst the route is not defined by radio navigation aids, the sophistication of the LRNS and the RNP (defined as RNP 20 but statistically defined as RNP12.6) is sufficient to permit the longitudinal separation to be reduced to 10 minutes. Given that the route time whilst in the MNPSA may be as much as 5 hours, to maintain the separation the speed of the aircraft concerned must be precisely maintained. To achieve this, the 'Mach number technique' is applied. The Mach number technique is no more than reporting speed using Mach number and requiring the aircraft to be separated to fly at the same Mach number. Typical cruising Mach number for a modern turbojet aircraft is M0.82, which equate, as a rough rule of thumb, to 8.2 nm per minute.

Lateral separation between aircraft at the same level is achieved by the OTS track structure, which requires the tracks to be not less than 1° of latitude apart for east/west tracks. This is not less than 60 nm and allows the aircraft navigation to be within 20nm of where the pilot reports (RNP20), plus a 'buffer' of 20nm. Historically, the RNP achieved before the introduction of GNSS proved to be RNP12.6 and this has been used to determine the required accuracy of navigation in the MNPSA.

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. 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 no 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 doesn't 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'.

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.

GROSS NAVIGATION ERROR (GNE)

As the aircraft approaches landfall, the pilot is required to confirm the aircraft position with reference to land based radio navigation beacons. If the plotted position is more than 25 nm 'off track' (it is implied that the error must be across track not long track) this is a gross navigation error (gross meaning large). The GNE is based on 2 x RNP 12.6 equating roughly to 25nm. All instances of GNE are to be reported as it means that separation may have been compromised by inaccurate navigation. Pilots are routinely warned that GNE usually occurs after routing changes, so extra vigilance is required.

METEOROLOGICAL REPORTS

Because of the lack of ground stations in the area concerned, met reports from aircraft are the best means of getting up to date information to the met offices. All aircraft are required by law to report instances of severe weather (icing, turbulence etc...) however; the routine weather provides trend information which enables the met men to 'fine tune' their forecasts for successive flights. One aircraft per hour flying each route will be asked to *"send met-reports"* which should be added to the routine position reports. The met addition is to include the wind speed and direction at altitude determined from the navigation system, and the outside air temperature. Any occurrences of moderate or severe weather should also be reported. Every aircraft flying off of the OTS should make met reports with each position report. The word 'spot' is sometimes used to refer to the spot wind (the wind at a particular point along a route).

"Shanwick Speedbird 289 *position spot 270 at* 45 *temp minus* 47"

"Speedbird 289 *position (read back) met copied"*

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 123.45MHz and 121.5MHz. Pressurisation 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.

STANDARD 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 Standard Lateral Offset Procedure (SLOP) and offers three options. The first allows the aeroplane to be flown along the cleared track centreline, the second to offset by 1nm and the third to offset by 2nm. 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.

FAILURE TO OBTAIN A NECESSARY RE-CLEARANCE

A circumstance may arise where a pilot is unable to continue the flight in the MNPSA in accordance with the received clearance. The procedure can also be used if the aircraft doesn't have the necessary navigation accuracy due to progressive equipment failure, or following a total communications failure. After exhausting all means of trying to obtain a re-clearance, the pilot must leave the OTS. Initially the aircraft is climbed or descended through 500ft (half the applicable vertical separation) and a turn right or left then made. The aircraft is then flown to a position 15nm offset from the OTS track and then turned to parallel the track. Throughout the procedure, the pilot should broadcast the aircraft position and level as frequently as possible on whatever frequency is available. This manoeuvre provides a limited amount of vertical and lateral separation.

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 below MNPSA e.g. below FL290. If however, the aircraft has triple LRNSs, the MNPSA requirement for two LRNS 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 500ft
- 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.

CHAPTER TEN

SPECIAL OPERATIONAL PROCEDURES AND HAZARDS

CONTENTS

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 Operations Manual. 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 Operations Manual. 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 Part B of the Operations Manual:

- 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 taxy 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 centralised computer for the purpose of maintenance. This does not necessarily mean that the equipment is inoperative.

MEL - OPERATORS 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 0.5mm) 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 1km.

- Freezing Fog: A fog formed by super-cooled 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 super-cooled 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 0.5mm in diameter or smaller drops which in contrast to drizzle, are more widely separated.
- Rime: A deposit of ice formed by freezing of super-cooled 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 dependant on the individual aeroplane design. The magnitude of these effects is dependant 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 Part B of the Operations Manual.

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 effects 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 if 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 completely different effect on aircraft flight characteristics than ice formation in the air.

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

Chapter 2 of ICAO Doc 9640 is entitled 'The Clean Aircraft Concept'. The student is required to be familiar with this concept. During conditions that are conducive to the formation of aeroplane ice during ground operations, a commander shall not attempt a take off unless the external surfaces are clear of any deposits of ice which may adversely affect the performance of the airplane. The commander shall not fly the plane if icing is expected and the aeroplane is not certificated for flight where icing is expected. The commander may find information concerning the de-icing /anti-icing of aeroplanes in the Operations Manual (Part A section 8), chapter 12 of the aircraft maintenance manuals, and also in ICAO DOC 9640 - manual of Aircraft Ground De-icing/Anti-icing.

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 is the effective time during which the process of de- icing/anti-icing is active. After the expiry of the holdover time, the process is to be repeated if required.

There are currently three types of de-icing/anti-icing fluids in use and are normally applied heated. These are:

- ISO type I fluid (un-thickened)
- ISO type II fluid (thickened)
- ISO type IV fluid (thickened)

These fluids may be applied either 'neat' or diluted in accordance with the table of holdover times.

The procedures for the de-icing/anti-icing of aeroplanes are contained in the Operations Manual and from the procedure and the type of fluid to be used can be assessed from the prevailing weather conditions, the temperature of the airframe, the type of likely contaminant (type of icing) and the resulting holdover time. Clearly, the aim of the exercise is to provide the aeroplane fit to fly within the holdover time so that the aircraft de-icing/anti-icing systems are fully operative at the expiry of the holdover time. The process of de-icing/anti-icing is quality controlled by the operators QA system.

In interpreting the holdover timetables, the outside air temperature (OAT) must be known or forecast and the type of icing (contaminant) assessed or forecast. Within the range of OAT existing or likely, a range of time in hours and minutes is quoted against fluid/water concentrations for each contaminant. Additional warning notes caution against the use of the fluid type in severe weather conditions.

THE ANTI-ICING CODE

It is important that the flight crew get clear and precise information from persons who have carried out any de/anti-icing procedures. In order to improve the quality of communication between the de/anti-icing team and the flight crew, it is recommended that an anti-icing code be used. This will enable the flight crew to assess the holdover time. The code must contain the following information:

- Type of fluid
- Percentage of fluid to water
- Time the application began (local time)

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 minimise 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. 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 minimise the risk to airplanes. 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.

NOISE ABATEMENT

JAR-OPS requires noise abatement procedures are 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 2and 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 minimise the overall exposure to noise on the ground and at the same time maintain the required level of flight safety.

A noise abatement procedure shall be developed by the operator for each aeroplane type (with advice from the aeroplane manufacturer, as needed) and agreed to by the State of the Operator.

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). 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 150m (500ft) above aerodrome elevation, or for take-off and landing when the horizontal visibility is less than 1.9km (1900m);
- When the crosswind component, including gusts, exceed 28 km/h (15kt);
- When the tailwind component, including gusts, exceed 9 km/h (5kt); and
- When wind shear 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 150m (500ft) 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 120m (400ft) and obstacle clearance of at least 90m (300ft) 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 240m (800ft) 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 operations manual. The settings are to take account of engine anti-icing where applicable.
- Procedures are not to be used in conditions where wind shear warning exists, or the presence of wind shear 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 5NM from the threshold of the runway of intended landing, 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 stabilised 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:

V2 + 20km/h to 40km/h (10 to 20kt).

The noise abatement procedure is not to be initiated at less than 240m (800ft) above the aerodrome elevation.

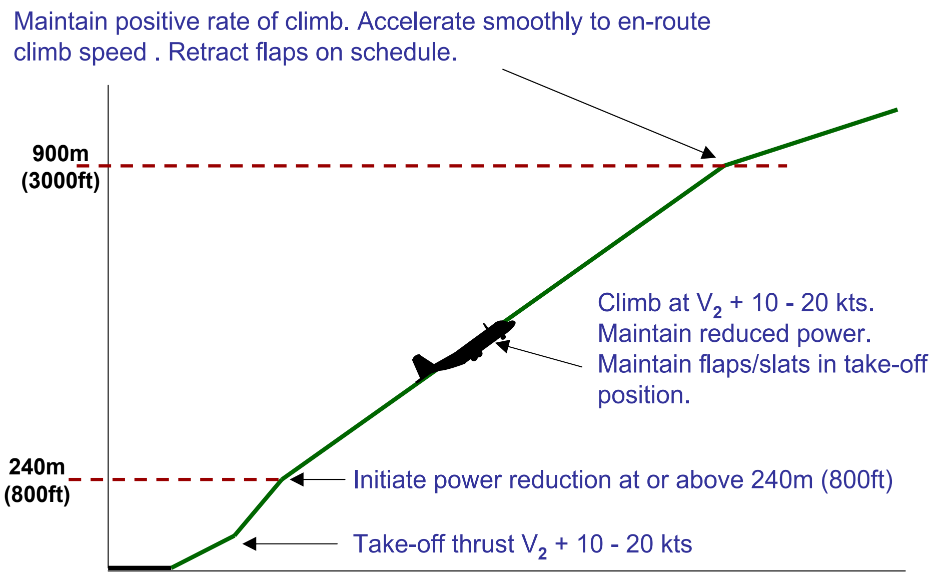


Figure 10.1 Noise Abatement Take-Off Climb
Example of a Procedure Alleviating Noise Close to the Aerodrome (NADP 1)

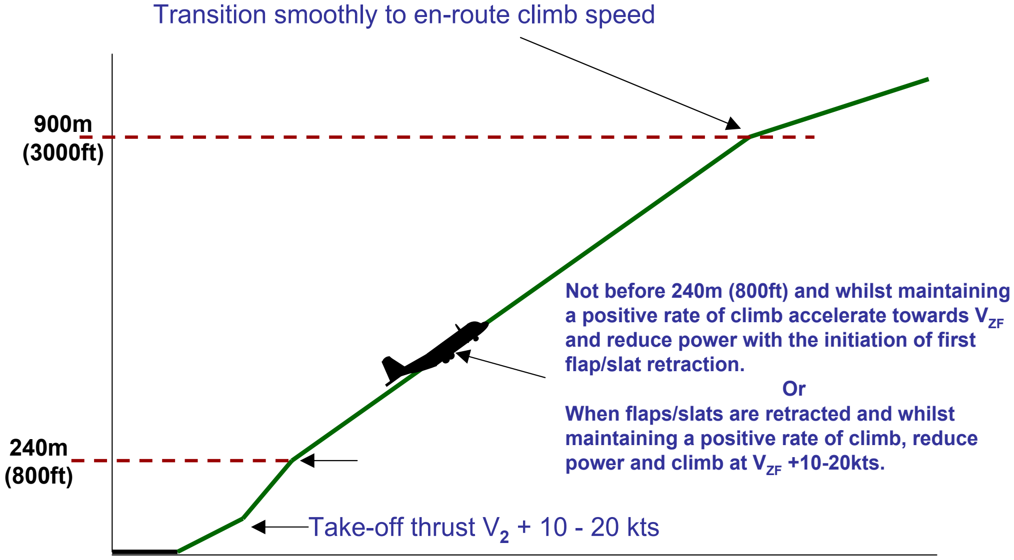


Figure 10.2 Noise Abatement Take-Off Climb
Example of a Procedure Alleviating Noise Distant from the Aerodrome (NADP 1)

Approach Procedures
During any approach procedure which involves noise abatement, the aeroplane is to be in the final landing configuration:

- At point 5 nm from the threshold of the landing runway, or

- At any point after passing the outer marker, whichever is earlier, and excessive rates of descent shall not be required.

Additionally, no turns on to final approach will be required which will, in the case of a visual approach, not permit a period of stabilisation prior to crossing the threshold of the landing runway, or in the case of an instrument approach, permit the aeroplane to be established on final approach before 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 reduced drag be delaying the extension of flaps and undercarriage until the final stages of approach. These techniques result in a higher that normal gear down and flap selected) approach speeds. The limiting factors affecting the choice of runway are also applicable to limiting noise abatement approaches. Where specific flight paths are required to be followed for approaches, lead-in lights (as discussed in Air Law - Aerodrome Lighting) are to be provided.

Landing Procedures
In any noise abatement procedure, there shall not be any limitation on the use of reverse thrust. The use of a displaced landing runway threshold is only to be used for noise abatement if aircraft noise is sufficiently reduced and the remaining runway distance is sufficient for all operational requirements.

Stabilised Approach
A modern procedure that is widely used is the stabilised approach. In this case, the aeroplane descends from the lowest holding altitude (LHA) in the arrival stack and adopts a 300ft/nm rate of descent that is maintained all the way to the runway threshold. This minimises 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 approached made in an operation, amounts to a significant economy.

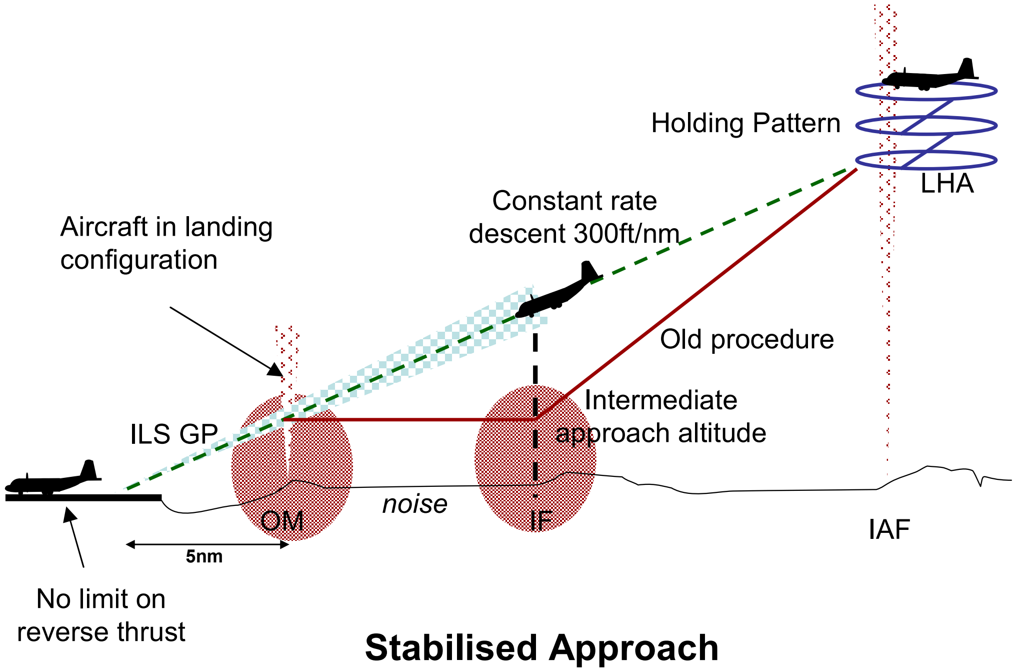


Figure 10.3

CHAPTER ELEVEN

FIRE AND SMOKE

CONTENTS

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 (check lists). 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 operations manual for abnormal and emergency operations whilst action specific checklists may either be verbatim extracts from the operations manual or extracts or annexes from the aircraft manual. In any case, such emergency drill action check lists 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 taxying? 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 to 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 check list 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 minimise 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 (bromochlorodifluoro-methane, 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 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

Table 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. The following types of extinguisher may be carried in aeroplanes:

Name of Extinguisher	Colour of Container	Use
Halon 1211 - BCF	Green	General - common use including hydrocarbon fires
Water	Red	Domestic fires

Table 11.2 Types of Fire

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.

AUTOMATIC TOILET FIRE EXTINGUISHERS

Each toilet waste bin is protected against fire by a heat activated fire extinguisher. The extinguishant can be either CO2 or water.

FIRE DETECTION SYSTEMS

Fire detection system work by either detecting smoke or heat.

- Smoke detection systems involve the use of either electro-optical systems whereby the sensing head detects a reduction in voltage across a photo-electric cell caused by the interruption of a beam of light by smoke, or an ionised gas detection system similar in operation to a domestic smoke detector where the presence of ionised gas (a result of the combustion process) is detected by a sensing cell.

- Heat detection systems rely on the effect of heat to produce a physical change in a material altering the electrical conduction characteristics of an electrical circuit. There are two types of circuit; either resistive or capacitive.

In either type of detection system, the system must include a functional check to test the integrity of the system prior to enabling the system.

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 and/or goggles are provided together with the normal oxygen system which has the facility to select 'Emergency' whereby a positive pressure is applied to the oxygen mask preventing the ingress of smoke. Specific drills will be detailed in the operations manual and will be type dependant.

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**. The compartment volume is not greater than 1000 cu M; any fire occurring will be completely contained; means exists to exclude smoke, flames and noxious gasses from the cabin; the effects of heat on other parts of the aeroplane have been considered.
- **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 on smoke in an aeroplane will be defined in the operations manual.

CREW PROTECTIVE BREATHING EQUIPMENT (PBE)

Pressurised aeroplanes with maximum take-off mass exceeding 5700kg or having approved passenger seating configuration of more than 19 seats, 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 JAR-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 5700kg 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. 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 taxying after reducing to safe speed. It is therefore essential that other speed reducing methods are maintained (don't 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 taxying 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. What colour is a Halon 1211 – BCF fire extinguisher?

   a. Red.
   b. Green.
   c. Black.
   d. Blue.

5. On what type of fire in an aeroplane can you use a CO_2 extinguisher?

   a. Any fire on the flight deck.
   b. Only electrical fires on the flight deck.
   c. Brake fires.
   d. Electrical fires (but not on the flight deck).

6. 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.

7. 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.

8. 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.

9. 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

10. 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.

11. A crash axe and/or crow bar 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 5700Kg and 10 or more passenger seats. c.
    With a max take-off mass of 5700Kg and 9 passenger seats.
    d. That are carrying more than 200 passengers.

12. 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. B
2. A
3. C
4. B
5. D
6. A
7. B
8. A
9. A
10. D
11. B
12. C

CHAPTER TWELVE

PRESSURISATION FAILURE

Contents

PRESSURISATION FAILURE

The failure of the pressurisation 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 pressurised 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 pressurisation 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 pressurised and the outside air pressure are not equalised 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 pressurisation system cannot overcome the loss of pressure caused by a normally controllable vent/opening in the pressure hull; i.e. a leaking pressure seal, a not fully closed pressure relief valve or an inadequacy (failure) in the pressurisation system. In a normal system, once the cabin pressure reaches 10,000ft (700mb) the altitude warning horn will sound (an intermittent ‘beep’). Prior to this, physiological changes will be noticed by crew and passengers.

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 following table describes the requirement for supplemental oxygen as required by CS-OPS 1.770.

1. All occupants of flight deck seats on duty	Entire flight time when the cabin pressure exceeds 13,000ft and entire flight time when cabin pressure exceeds 10,000ft but does not exceed 13,000ft 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 25,000ft (note 2) (ii) 2 hours for aeroplanes certificated to fly at altitudes more than 25,000ft (note 3)
3. All required cabin crew Members	Entire flight time when cabin pressure altitude exceeds 13,000ft but not less than 30 minutes (note 2), and entire flight time when cabin pressure altitude is greater than 10,000ft but does not exceed 13,000ft after the first 30 minutes at these altitudes.
4. 100% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 15,000ft but in no case less than 10 minutes (note 4).
5. 30% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 14,000ft but does not exceed 15,000ft
6. 10% of passengers (note 5)	Entire flight time when the cabin pressure altitude exceeds 10,000ft but does not exceed 14,000ft after the first 30 minutes at these altitudes.

Table 12.0: 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 10,000ft in 10 minutes followed by 20 minutes at 10,000ft.*

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 000ft in 10 minutes followed by 110 minutes at 10 000ft. 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 15,000ft 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 pressurised 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 000ft 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 000ft.
    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 000ft in 10 minutes.
    d. A supply for 10% of passengers whilst the cabin pressure is over 13 000ft.

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 pressurisation 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 pressurised 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 depressurisation 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 depressurisation, 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 pressurisation 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. C
2. B
3. D
4. B
5. A
6. D

CHAPTER THIRTEEN

WINDSHEAR AND MICROBURST

Contents

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 (cumulo-nimbus 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.

Where an aeroplane encounters an abrupt decrease in headwind component or an increase in tail wind 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.

Entering a down draught 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 up-draught 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
- Raise the nose to check descent
- Co-ordinate power and pitch

Be prepared to carry out a missed approach rather than risk landing from a de-stabilised approach.

In a microburst situation, the combination of increasing headwind followed by a downdraught, followed by increasing tail wind 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.

QUESTIONS

1. What is meant by 'Low Altitude Wind shear'?

   a. Turbulence at or below FL50.
   b. A sudden change in wind direction at any altitude below 2000ft.
   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 wind shear 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 wind shear 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' wind shear?

   a. The wind velocity to vary with both altitude and horizontal displacement from a datum.
   b. Initially an up draught causing the aeroplane to rise uncontrollably, and subsequently a down draught 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 wind shear 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, wind shear can also be found in the vicinity of hills and structures. Where particularly would wind shear in this instance be found?

   a. Up wind and above the hills or structures.
   b. In the lee of hills and structures but well above the ground.
   c. Down wind 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 head wind or an increase in tail wind; apply full power.
   c. Incipient engine failure (ignore instruments); lower the nose to gain airspeed.
   d. Local clear air turbulence; reduce speed to VRA 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 wind shear 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. Cumulo-nimbus clouds.
    3. Sudden rain squalls.
    4. Gust front activity (rising dust clouds).
    5. Unexpected wind shear.
    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. C
2. A
3. C
4. D
5. A
6. C
7. A
8. B
9. D
10. A

CHAPTER FOURTEEN

WAKE TURBULENCE

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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 wing span 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 effects disperse and the localised effect of the vortex spreads and looses 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 wing span 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 moves tangentially at about 300 ft/sec from the track of the aircraft (in still air) this decays to an average sideways speed of 5kts.

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 down wind vortex will be assisted in the outwards dispersal. If the crosswind component is 5 kts, the upwind vortex will remain effectively stationery 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 is generated by the down-wash of the main rotor where it is 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 7,000 Kg
Light	7,000 Kg or less

Table 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 300m (1,000ft) below, or
- both aircraft are using the same runway or parallel runways separated by less than 760m, or

➢ an aircraft is crossing behind another aircraft at the same altitude or less than 300m(1,000ft) 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

Table 14.2 ICAO Wake Turbulence Separation Standard for Landing

The separation standard for departure is as follows:

Leading Aircraft	Following Aircraft	Minimum Spacing at the time the aircraft are Airborne
Heavy	Medium	2 minutes
Light		
Departing from the same position		
Medium	Light	
Heavy (full length take-off)		
Medium	Light	
Departing from an intermediate point on the same runway		
Medium	Light	3 minutes

Table 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 1000ft 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 characterised 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 V1; when speed is lower than VAT+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 5kts.
   b. With a crosswind, the down wind vortex is stationary and the upwind vortex moves away from the centre line at approx 5kts.
   c. With a crosswind, the up wind vortex is stationary and the down wind vortex moves towards the centre line at approx 5kts.
   d. With a crosswind, both vortices move away from the centre line in the up wind direction at approx 5kts.

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 wind shear.
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 categorises aeroplanes with a max gross take off mass of 138 000kg 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 750m:

    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 5nm 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 1 000ft 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 5nm 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. B
2. D
3. A
4. B
5. A
6. C
7. A
8. D
9. C
10. C
11. D
12. B
13. B
14. C
15. A
16. A
17. B
18. B

CHAPTER FIFTEEN

SECURITY

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SECURITY

Security in civil aviation has been the subject of national and international law including ICAO conferences. Such law and requirements are designed to prevent unauthorised 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 minimise 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 the operator) is to submit a report without delay to the designated local authority and the authority in the state of the operator. As part of the procedures to minimise the opportunities for unlawful interference, operators are to ensure that all aeroplanes carry a checklist for the procedure for searching an aeroplane for concealed weapons or other dangerous devices.

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 pilot-in-command shall either acknowledge (reply) or not reply at all.

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 defined procedure exist, then the aeroplane should be flown at altitudes which differ from normal cruising levels by 1000 ft (above FL290) or by 500 ft (below FL 290).

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.

Each state is required to establish regulations to prevent the carriage of weapons which could be used in any attempt at unlawful interference. Weapons may be carried on board aircraft by law enforcement officers and other authorised persons acting in the discharge of their duty, providing it is done so in accordance with the regulations of the states involved.

In order to prevent unauthorised access to the flight crew compartment, the access door shall be capable of being locked from within the compartment. With effect from 12 Mar 2000, this door and the bulkhead between the flight deck and the cabin are to be designed to minimise penetration by small arms fire and grenade shrapnel.

When a bomb is suspected to be on board an aeroplane it is imperative that the fact is communicated. If the bomb is suspected by the aircrew, every effort is to be made to contact ATC and/or the operator. Where the information comes from a source on the ground, the aircrew are to be alerted. Operators, via company communications system, can alert specific aircraft by the use of pre-arranged code-words. The subsequent actions will be determined by the nature of the device. General procedures, that will attempt to limit the effect of the device should an explosion ensue, should be followed. These will be detailed in the type specific operations manual and/or associated documents. Such measures may include, albeit with safety considerations paramount, moving the device to a designated 'least-risk bomb' location in the aeroplane and covering it in as much 'padding' as possible. (With effect from 12 March 2000 design of aeroplanes is to include a designated least-risk bomb location). Control of the pressurisation system may be necessary if it suspected that the device is barometric pressure sensitive. In any event, crew training programmes will enable the crew to tackle the situation as best they may, and every means should be employed to ensure an expeditious diversion to the nearest suitable aerodrome.

QUESTIONS

1. Who is responsible for instigating training programmes, the aim of which is to minimise 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 check list.
    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. In the event of an act of unlawful interference, which of the following is the correct procedure to be taken by the pilot in command?

    a. Squawk 7700 if the situation requires and continue the flight as per the ATC clearance received if possible.
    b. Squawk 7500 and broadcast a warning to ATC and other traffic on 121.500MHz or the frequency in use whilst maintaining the flight as cleared.
    c. Squawk 7500 (or 7700 if required) and broadcast a warning if the situation forces deviation from the cleared flight plan.
    d. If forced to deviate from flight plan, climb or descend to altitudes that differ from the normal cruising altitudes by 1000ft.

6. 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.

7. As of March 2000, the construction of the flight deck door connecting to the passenger compartment is to be:

   a. Impenetrable to gunfire.
   b. Bombproof.
   c. Lockable.
   d. Designed to minimise penetration by grenade shrapnel.

8. ICAO requires that states establish procedures to prevent the carriage of weapons that can be used in unlawful interference. Circumstances do exist where weapons may be carried. These are:

   a. In accordance with the regulations by law enforcement personnel in the discharge of their duty.
   b. By passengers if special permission has been obtained and the weapons are unloaded
   c. By members of the crew over areas of known terrorist activity.
   d. For sporting purposes but must be stowed in the personal belongings of passengers.

9. 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. C
2. A
3. B
4. D
5. C
6. A
7. D
8. A
9. D

CHAPTER SIXTEEN

EMERGENCY AND PRECAUTIONARY LANDINGS

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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 operations manual (type specific) to cater for the situation of an emergency landing or ditching.

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. However, if the surface wind is over 35/40 kts wave height may well exceed 10 ft on top of the swell height and it may prove beneficial to land into wind in this case. 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, which should have automatically deployed from the wings with automatic inflation.

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 the operations manual (Part B section 11 - Emergency Evacuation Procedures).

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. Deputising 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 down wind.
   c. land into the swell but into wind.
   d. land into wind regardless of the swell direction if the wind speed is over 20kts.

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 10kts.
   b. Reduce the approach angle to 1.5deg (150 ft per mile), add 15kts 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 minimise 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.	A
2.	C
3.	B
4.	D
5.	D
6.	C
7.	A
8.	C
9.	D
10.	A
11.	C
12.	B
13.	C
14.	A

CHAPTER SEVENTEEN

FUEL JETTISON

Contents

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 CS25. 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 born 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. If possible, it is recommended that fuel jettison should be carried out either over the sea, or above 10 000 ft agl. Exceptionally (for safety considerations), fuel may be jettisoned above 7 000 ft agl in winter and above 4 000 ft agl in summer. If is unavoidable (overriding safety requirement), fuel may be jettisoned anywhere. In all cases ATC is to be informed before commencing jettisoning.

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 authorised 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 000ft.
   b. Over the sea, or over land above 10 000ft agl.
   c. Anywhere and at any height if unavoidable in an emergency.
   d. Over the sea, or over land above 4000ft in summer or 7000ft 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. 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. A
2. A
3. A
4. C
5. D
6. A
7. D
8. B

CHAPTER EIGHTEEN

TRANSPORT OF DANGEROUS GOODS BY AIR

Contents

TRANSPORT OF DANGEROUS GOODS BY AIR

ICAO Annex 18 details the international Standard 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 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 associates with a related to the transport by air of dangerous goods (not necessarily occurring onboard 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 jeopardises 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 authorisation 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 of gas or produce a corrosive substance.

Operator A person, organisation or enterprise engages 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 authorised 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 hospitalisation 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 9248), 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.

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 Instruction. 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 .

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 operations manual (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 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

In order to prevent the recurrence of incidents and accidents concerning dangerous goods, States are required to establish a procedure for investigating and reporting findings of such investigations specifically where the transit of goods from one state to another is concerned. The format of the required report is in the Technical Instructions. Any such report must be submitted no later than 72 hours following the incident/accident.

HAZARD CLASSES OF DANGEROUS GOODS

Class 1 Explosives.

Class 2 Gases.

Class 3 Flammable Liquids.

Class 4 Flammable Solids

Class 5 Oxidizing Substances and Organic Peroxide.

Class 6 Toxic and Infectious Substances.

Class 7 Radioactive Material.

Class 8 Corrosives.

Class 9 Miscellaneous Dangerous Goods.

DANGEROUS GOODS THAT MAY BE CARRIED BY PASSENGERS OR CREW

- Alcoholic beverages.
- Non-radioactive medicinal or toilet articles.
- Safety matches or a lighter (no refills).
- Hydrocarbon gas-powered hair curler (no refills).
- Small carbon dioxide gas cylinders for mechanical limbs.
- Radioisotopic cardiac pacemakers.
- Small medicinal thermometer containing mercury if in its own protective case.

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 Organisation.
   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. Which of the following correctly identifies a 'unit load device'?

   a. Any type of freight container used for dangerous goods.
   b. Any device used to secure a load/pallet to the floor of an aeroplane.
   c. Any type of freight container, pallet with a net, or pallet with a net over an igloo.
   d. The method by which individual units of dangerous goods are loaded into aeroplanes.

5. Define 'Proper Shipping Name':

   a. The correct (internationally accepted) description of the method by which goods are carried between states.
   b. The registered address of the consignment destination.
   c. The name to be used to describe a particular item or substance in all shipping documents and notifications and, where appropriate, on packaging.
   d. The full name and ICAO identity of the airline or freight company/agent responsible for compliance with the regulations.

6. Which of the following correctly identifies 'the operation by which articles or substances are enveloped in wrappings and/or enclosed in packaging or otherwise secured'?

   a. Boxing.
   b. Packaging.
   c. Packing.
   d. Wrapping.

7. 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).

8. 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.

9. If an item which is excluded from the provisions is carried as a replacement (eg a replacement O2 bottle for a patient) it must be classified as dangerous goods.

   a. True.
   b. False.
   c. Class 7.
   d. Class 1.

10. 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.

11. Who is responsible for ensuring that dangerous goods offered for carriage by air are properly classified, packed and labelled correctly and that the correct documentation has been completed?

   a. The Commander.
   b. The Operator.
   c. The Shipper.
   d. The Authority of the State of Departure.

12. The requirements for packaging and labelling are to be found in:

   a. The Technical Instructions.
   b. The Operations Manual.
   c. ICAO Annex 18.
   d. JAR Ops 1.1215.

13. 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.

14. 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 authorised by the authority.
    d. Yes, provided they are non toxic.

15. 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.

16. Certain items and goods are prohibited from carriage by air. For instance, non safety matches, clear reservoir lighters, aerosol containers and certain chemical/medical preparations are widely available. Where is information concerning such items to be published/displayed for the benefit of passengers?

    a. In the aeroplane.
    b. On the packaging of the item.
    c. At the point of purchase of such items within the aerodrome complex.
    d. On tickets/ticket jackets, where tickets are sold, at the check-in desk, in the departure lounge, at luggage check-in areas.

17. Where an aeroplane is carrying dangerous goods and suffers an in-flight emergency:

    a. The Commander is to contact the Operator by whatever means and request instructions
    b. The Operator is to inform the Authority of the State in which the emergency has occurred that the aeroplane is carrying dangerous goods.
    c. The Commander is to inform the crash/rescue services on the Fire Frequency and advise what special handling is required.
    d. The Commander is to ask ATC to arrange for a landing at a remote aerodrome or parking on a remote site, where the effects of contamination/pollution may be limited.

18. Operators are to establish Dangerous Goods training programmes. Where are details of the training required, published?

    a. In the Operations Manual.
    b. In the Training Manual.
    c. In ICAO Annex 18.
    d. In the Technical Instructions.

ANSWERS

1. D
2. A
3. B
4. C
5. C
6. C
7. B
8. D
9. A
10. B
11. C
12. A
13. A
14. A
15. B
16. D
17. B
18. D

CHAPTER NINETEEN

CONTAMINATED RUNWAYS

Contents

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 or 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 in 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 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 may be maintained between the runway and the tyre has been lost, the application of brakes 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). If using the value bar it is equivalent to: 1 bar = 14.7 psi.

BRAKING ACTION

From data collected from operations on compacted snow and ice, an assessment table has been produced to relate to a measured braking co-efficient 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 Co-efficient	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

Table 19.1 Braking Action Code

CO-EFFICIENT OF FRICTION

In terms of assessment of braking action and the exchange of information relating to it between ATC and the pilot, the co-efficient of braking on wet runway is a factor of the difference between the non-torque limited braking and the torque limited co-efficient. 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. From data gathering and experimental observation it has been found that as groundspeed increase the difference between torque limited and non-torque limited braking effect increases. At a ground speed of 1 kt, the difference is effectively zero, whereas at 100 kts the difference is a factor of 0.5, and at 160 kts the curve flattens out at about 0.4. The implication being that if an assessment of braking action is equal to or better than 0.4, as the aeroplane decelerates the braking effect will get better. It will be appreciated that only one condition can exist where braking action can be directly related to experimental data and that is where a dry runway is concerned. Thus braking action is reported relative to braking on a dry runway.

For runways contaminated by standing water, slush or loose snow, a wheel braking co-efficient of friction of 0.25 of that for a dry runway (μBDRY) should be assumed at speeds equal and below 0.9 times to aquaplaning speed and 0.05μBDRY above that. For runways covered by compacted snow 0.2μBDRY should be assumed, and for runways covered in wet ice 0.05μBDRY should be assumed.

PERFORMANCE CONSIDERATIONS

In any calculation of take-off and landing performance where braking efficiency is a factor, the effect of a reduced braking co-efficient must be taken into account. Likewise the depth of contaminant will affect acceleration (induced drag). The actual application of factoring is covered fully in the performance syllabus. Operators are required under JAR-OPS to ensure that where a runway is likely to be wet or contaminated at the time of arrival, the landing distance available is at least 115% of the landing distance required. The factor may be reduced if the aeroplane flight manual includes specific additional information about landing distances on wet or contaminated runways. During operations in heavy rain, the ingress of water into air intakes of turbine engines can cause power fluctuation and even flame out in excessive conditions. In order to prevent a catastrophic power failure, continuous ignition should be selected.

SNOWTAM BRAKING INFORMATION

On a SNOWTAM information is given concerning the friction measurements on each third of the runway. The information is displayed at field H of the snowtam. This may take the form of either two digits indicating the actual coefficient or a single digit indicating the estimated braking action. The following are examples of actual 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 1mm 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 - Taxyways 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 publised see item T. Item T. Decribe 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 3mm 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 3mm 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 3mm.
   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. 60mm.
   b. 15mm.
   c. 10mm.
   d. 3mm.

6. If a runway is contaminated with wet snow, slush or water, the depth that will preclude operations is:

   a. 60mm.
   b. 15mm.
   c. 10mm.
   d. 3mm.

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 (lbs/sq in).
b. The tyre pressure (Bars) divided by nine.
c. Nine times the square root of the tyre pressure (lbs/sq in).
d.The square root of the tyre pressure (Bars) multiplied by nine.

9. One Bar (barometric pressure unit) is equal to:

a. 14.7psi.
b. 28.82 in Hg.
c. 29.92 lbs/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 co-efficient of braking effect (<0.25 - >0.40).
d. The co-efficient 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. The co-efficient of braking that reflects the braking action that is considered normal on a wet runway is:

a. 0.40μBDry.
b. 0.25μBDry.
c. 0.1μBDry.
d. 0.05μBDry.

12. Where operations from contaminated runways have been approved, JAR OPS requires performance calculations to be enhanced to cater for the reduced braking efficiency. The factor to be applied is:

a. Landing distance available is at least 115% of landing distance required.
b. Landing distance available is at least 1.5 x landing distance required.
c. Landing distance required must be at least 115% of landing distance available.
d. Runway length must be a minimum of 115% of the landing distance required.

13. 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.

14. In a SNOWTAM information is given concerning friction measurements (braking co-efficient x 100) in which field of the message?

    a. F.
    b. G.
    c. H.
    d. N.

ANSWERS

1.	B
2.	D
3.	A
4.	D
5.	A
6.	B
7.	B
8.	C
9.	A
10.	C
11.	B
12.	A
13.	D
14.	C

CHAPTER TWENTY

REVISION QUESTIONS

Contents

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. 25 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. 50nm from land.
    b. 100nm from land.
    c. 300nm from land.
    d. 400nm from land.

6. Where is the Minimum Equipment List?

    a. Appended to the Aeroplane Flight Manual.
    b. In the Operations Manual
    c. In the Maintenance Documents.
    d. In the Operations Room.

7. Aeroplanes with a take-off mass greater than 5700kg shall be fitted with an independent automatically operated emergency power supply to operate and illuminate the artificial horizon for:

    a. 15mins.
    b. 30mins.
    c. 60mins.
    d. 2hrs.

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 predicted destination or, at an aerodrome of alternate destination, 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 or better than the 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 depressurisation.
    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 depressurisation.

11. Information concerning evacuation procedures can be found in the:

    a. Operation manual.
    b. Flight manual.
    c. Journey logbook.
    d. Operational flight plan.

12. Where is the general information about the carriage of dangerous goods to be found?

    a. Operations Manual.
    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 airplane fails while you are still parked. The reference document you use to decide on the procedure to follow is the:

    a. Operation manual's chapter 'Abnormal and Emergency procedures'.
    b. Flight manual.
    c. JAR OPS.
    d. Minimum equipment list.

16. When don't you 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 less 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 crewmembers required to be at their stations?

    a. Take-off and landing.
    b. Throughout the flight.
    c. At all times other than take-off and landing.
    d. As specified in the operations manual.

18. When are flight crew allowed to leave their stations?

    a. In the performance of their duties.
    b. At any time specified by the operations manual.
    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. When must a radiation indicator be carried?

    a. For flights above 29,000ft.
    b. For flights above 39,000ft.
    c. For flights above 49,000ft.
    d. For flights above 59,000ft.

21. 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.

22. 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.

23. 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.

24. Who is to ensure safe handling of flights?

    a. The Operator.
    b. The Authority.
    c. The State of Registration.
    d. The operations officer.

25. Destination alternate for a turbojet – what is the required fuel overhead?

    a. 30 minutes at cruise speed.
    b. 30 minutes at 1500’ in standard conditions.
    c. 2 hours at 1500’ in standard conditions.
    d. 30 minutes at endurance speed.

26. 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.

27. Following an indication of an unserviceability whilst taxying to the holding point, what do you consult first?

    a. Flight manual.
    b. Operator.
    c. State of registration.
    d. MEL.

28. Above what altitude are quick-donning masks required?

    a. 25,000ft
    b. 15,000ft
    c. 10,000ft
    d. 32,000ft

29. What is the oxygen requirement for the crew and 100% of the passengers in an unpressurised aircraft?

    a. 10,000ft.
    b. 11,000ft.
    c. 12,000ft.
    d. 13,000ft.

30. 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.

31. What is the requirement for the carriage of life rafts?

    a. 30mins or 120nm whichever is less.
    b. 50nm from land.
    c. 120mins or 400nm whichever is less.
    d. 60mins flying time at the one engine out cruise speed.

32. 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.

33. The JAR-OPS document is based on:

a. Federal Aviation Requirements. (FAR).
b. A JAA guide line.
c. Rules of the Air.
d. ICAO Appendix (sic) 6.

34. 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.

35. 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.

36. On board a pressurised 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 depressurisation, throughout the flight period, during which the pressure altitude is greater than:

a. 11,000ft.
b. 10,000ft.
c. 12,000ft.
d. 13,000ft.

37. A modern aircraft must be provided with a flight data recorder when its certified take-off gross weight is greater than:

a. 27,000kg.
b. 5,700kg.
c. 20,000kg.
d. 14,000kg.

38. Who provides the operations personnel with the operations manual 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.

39. 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.

40. Who compiles the MEL and where does it go?

a. The manufacturer and in the Flight Manual.
b. The manufacturer and in the Operations Manual.
c. The operator and in the Flight Manual.
d. The operator and in the Operations Manual.

41. On an NDB approach with an MDH of 360' and a required RVR of 1500m and a reported RVR of 2500m, when can you start an approach; ie 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 360'.
d. When the cloud base report is received.

42. Where is permanent approval for the carriage of dangerous goods given

a. Certificate of Airworthiness.
b. Aircraft registration.
c. Air Operator's Certificate.
d. Insurance certificate.

43. How far away can a take-off alternate be for a 2-engined aeroplane?

a. 60mins at one engine cruise speed.
b. 60mins at normal cruise speed.
c. 120mins at one engine cruise speed.
d. 120mins at normal cruise speed.

44. Who issues and updates the MEL?

a. The authority.
b. The designer.
c. The manufacturer.
d. The operator.

45. 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.

46. A Flight Data Recorder is required in aeroplanes over:

a. 20,000kg.
b. 5,700kg.
c. 10,000kg.
d. 7,000kg.

47. 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.

48. 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.

49. 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.

50. If there is unauthorised use of equipment that affects the aeroplane's system, the commander:

    a. May authorise its use for take-off and landing.
    b. Must not authorise its use.
    c. May authorise its use for the whole flight.
    d. May authorise its use at his discretion.

51. 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.

52. Following an electrical failure, the emergency lighting unit must provide illumination for:

    a. 90 sec.
    b. 5 min.
    c. 10 min.
    d. 30 in.

53 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.

54. 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.

55. When does a pilot apply the limitations of the MEL.

    a. At parking before commencement of taxi.
    b. Prior to take-off.
    c. At any time in flight.
    d. Any time up to coming to a complete stop and applying the parking brake.

56. All aeroplanes which individual certificates of airworthiness were issued after 1 January 1989 must be fitted with a flight data recorder when their maximum certificated take-off mass is greater than:

a. 20,000kg.
b. 27,000kg.
c. 5,700kg.
d. 14,000kg.

57. The operator shall include in the operations manual a minimum equipment list 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.

58. 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 1,500 ft.
b. 45 minutes at holding flight speed at 1,500 ft.
c. 30 minutes at cruising speed.
d. 45 minutes at cruising speed.

59. 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 operations manual.
b. the manufacturer, and it is inserted in the operations manual.
c. the operator, and it is appended in the flight manual.
d. the manufacturer, and it is appended to the flight manual.

60. 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.

61. 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.

62. 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.

63. What manuals are to be carried?

    a. Operations Manual in toto.
    b. Company instructions for all flight crew.
    c. All those specified in the Certificate of Airworthiness.
    d. Relevant parts of the ops manual and AFM.

64. 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.

65. 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.

66. 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.

67. The first part of JAR-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.

68. After an incident, the FDR recordings must be kept for:

    a. 30 days.
    b. 60 days.
    c. 90 days.
    d. 120 days.

69. Coverage of permanently illuminated white light's at the rear of the aircraft is:

    a. 140°.
    b. 70°.
    c. 110°.
    d. 220°.

70. The first part of the JAR 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.

71. 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.

72. 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.

73. 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.

74. What is the system minimum for an NDB approach?

a. 200ft.
b. 250ft.
c. 300ft.
d. 350ft.

75. 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. 1600m.
b. 2400m.
c. 1500m.
d. 3600m.

76. What are the circling minimum visibility and MDH for a Cat B aeroplane?

a. 1600m, 400ft.
b. 1600m, 500ft.
c. 1500m, 450ft.
d. 1500m, 600ft.

77. According to JAR OPS 1.430, Airfield Operating Minima, the lowest MDH using ILS (LLZ only), VOR, NDB, SRA no glide path?

a. NDB – MDH 300ft.
b. VOR – MDH 250ft.
c. ILS (LLZ only) – MDH 200ft.
d. VOR/DME – MDH 300ft.

78. What is the minimum RVR for a CAT IIIC approach?

a. No minimum.
b. 50m.
c. 75m.
d. 100m.

79. 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.

80. What is the minimum required RVR for CAT IIIB operations?

a. 100m.
b. 75m.
c. 150m.
d. 200m.

81. What is the minimum visibility for a Cat A aircraft during a circling approach?

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

82. A category II precision approach (CAT II) is an approach with:

a. A decision height of at least 100ft.
b. No decision height.
c. A decision height of at least 200ft.
d. A decision height of at least 50ft.

83. When can special VFR be commenced?

a. Visibility greater than 1500m.
b. Greater than 3km vis.
c. Visibility no more than 3000m.
d. Greater than 5km vis.

84. What is V_{AT}?

a. V_{SO} x 1.3.
b. V_{S1G} x 1.3.
c. The lesser of V_{SO} or $V_{SIG.}$
d. V_{SO} x 1.23.

85. According to JAR-OPS 1.430 (Aerodrome Operating Minima) a Category IIIA approach has a Decision Height of less than 100 feet and a minimum RVR (Runway Visual Range) of:

a. 200m.
b. 250m.
c. 300m.
d. 230m.

86. What is the take-off RVR limit for a Cat A aeroplane, when high intensity centreline lights and edge lights are on and the crew is IFR qualified and approved?

a. 150m if threshold RVR is available.
b. 150m.
c. 200m.
d. 250m.

87. When is MDH referenced to the threshold as opposed to the aerodrome elevation?

a. The threshold is more than 2m above the ARP.
b. The threshold is less than 2m above the ARP.
c. The threshold is less than 2m below the ARP.
d. The threshold is more than 2m below the ARP.

88. What are the threshold speeds for a Cat D aeroplane?

a. 121 – 140kts.
b. 131 – 155kts.
c. 141 – 165kts.
d. 145 – 160kts.

89. What is the minimum horizontal visibility for a Cat D aircraft on a circling approach?
a. 1500m.
b. 1600m.
c. 2400m.
d. 3600m.

90. What is DH used for?

a. Visual manoeuvring.
b. Circling to land.
c. Precision approaches.
d. Non-precision approaches.

91. A category I precision approach (CAT I) is an approach which may be carried out with a runway visual range of at least:

a. 550m.
b. 350m.
c. 800m.
d. 500m.

92. When establishing an instrument approach procedure, 5 aircraft categories according to their speed at the threshold (Vat) 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.

93. JAR 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 250m at least.
    b. Special VFR flights are not commenced when visibility is less than 3km.
    c. For conducted VFR flights in airspace B, horizontal distance from clouds is 1000m at least.
    d. For conducted VFR flights in airspace E, flight visibility at and above 3050m (10000ft) is 5km at least (clear of cloud).

94. The Cat I minimum decision height is:

    a. No decision height.
    b. 50 feet.
    c. 100 feet.
    d. 200 feet.

95. What is the Cat IIIA RVR minimum?

    a. 50m.
    b. 100m.
    c. 200m.
    d. 250m.

96. The minimum visibility for a Cat C aeroplane on a circling approach is:

    a. 2400m.
    b. 2500m.
    c. 2600m.
    d. 2700m.

97. Aircraft are categorised according to their threshold speeds, multiplied by a factor. What aircraft category corresponds to a range of speeds 141kts – 165kts?

    a. B.
    b. E.
    c. D.
    d. C.

98. An aeroplane is starting a non-precision approach with an MDH of 250ft and minimum visibility of 800 metres. 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 800m.
    b. When all 3 RVRs are greater than 800m.
    c. When the met viz is greater than 800m. RVR is for precision approaches only.
    d. When threshold RVR is greater than 800m.

99. 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.

100. JAR 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 250m at least.
b. for conducted VFR flights in airspace E, flight visibility at and above 3.050m.(10,000 ft) is 5 km at least (clear of cloud).
c. special VFR flights are not commenced when visibility is less than 3 km.
d. for conducted VFR flights in airspace B, horizontal distance from clouds is 1,000m at least.

101. A category D aeroplane can carry out a circling approach only if the meteorological visibility is higher than or equal to:

a. 1,500m.
b. 1,600m.
c. 2,400m.
d. 3,600m.

ANSWERS

1	B	21	A	41	B	61	A	81	A
2	C	22	C	42	C	62	C	82	A
3	C	23	D	43	A	63	D	83	B
4	A	24	A	44	D	64	C	84	A
5	A	25	B	45	B	65	D	85	A
6	B	26	C	46	B	66	B	86	C
7	B	27	D	47	D	67	B	87	D
8	C	28	A	48	B	68	B	88	C
9	D	29	D	49	B	69	A	89	D
10	A	30	A	50	B	70	B	90	C
11	A	31	C	51	C	71	A	91	A
12	A	32	B	52	C	72	A	92	D
13	A	33	D	53	B	73	A	93	B
14	D	34	D	54	B	74	C	94	D
15	D	35	A	55	D	75	C	95	C
16	A	36	B	56	C	76	B	96	A
17	A	37	B	57	D	77	A	97	C
18	A	38	C	58	A	78	A	98	D
19	A	39	A	59	A	79	B	99	D
20	C	40	D	60	D	80	B	100	C
								101	D