BHUTAN CIVIL AVIATION REQUIREMENTS

(BCAR's)

BCAR- General Aviation

(Aeroplanes)

Issue 1

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Note: - For the purpose of assuring compatibility with international safety standards and to fulfil Bhutan's obligations as an ICAO Member State, this BCAR-General Aviation is comparable with ICAO Annex 6 Part II - International General Aviation (Aeroplanes).

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ABBREVIATIONS AND SYMBOLS

Abbreviations

ACAS	-	Airborne collision avoidance system
ADREP	-	Accident/incident reporting
ADS-C	-	Automatic dependent surveillence — contract
AFCS	-	Automatic flight control system
AGA	-	Aerodromes, air routes and ground aids
AIG	-	Accident investigation and prevention
ASIA/PAC	-	Asia/Pacific
ASE	-	Altimetry system error
ATC	-	Air traffic control
ATS	-	Air traffic services
CAT I	-	Category I
CAT II	-	Category II
CAT III	-	Category III
CAT IIIA	-	Category IIIA
CAT IIIB	-	Category IIIB
CAT IIIC	-	Category IIIC
CFIT	-	Controlled flight into terrain
cm	-	Centimetre
CVR	-	Cockpit voice recorder
DA	-	Decision altitude
DA/H	-	Decision altitude/height
DH	-	Decision height
DME	-	Distance measuring equipment
ECAM	-	Electronic centralized aircraft monitor
EFIS	-	Electronic flight instrument system
EGT	-	Exhaust gas temperature
EICAS	-	Engine indication and crew alerting system
ELT	-	Emergency locator transmitter
ELT(AF)	-	Automatic fixed ELT
ELT(AP)	-	Automatic portable ELT
ELT(AD)	-	Automatic deployable ELT
ELT(S)	-	Survival ELT
EPR	-	Engine pressure ratio
EUROCAE	-	European Organization for Civil Aviation Equipment
FDAU	-	Flight data acquisition unit
FDR	-	Flight data recorder
FL	-	Flight level
FM	-	Frequency modulation
ft	-	Foot
g	-	Normal acceleration
GPWS	-	Ground proximity warning system
hPa	-	Hectopascal
IFR	-	Instrument flight rules
IMC	-	Instrument meteorological conditions
INS	-	Inertial navigation systems
kg	-	Kilogram
km	-	Kilometre
km/h	-	Kilometres per hour
kt	-	Knot
m	-	Metre
MDA	-	Minimum descent altitude

MDA/H	-	Minimum descent altitude/height
MDH	-	Minimum descent height
MHz	-	Megahertz
MNPS	-	Minimum navigation performance specifications
NAV	-	Navigation
NM	-	Nautical mile
N1	-	High pressure turbine speed
OCA	-	Obstacle clearance altitude
OCA/H	-	Obstacle clearance altitude/height
OCH	-	Obstacle clearance height
RCP	-	Required communication performance
RNP	-	Required navigation performance
RVR	-	Runway visual range
RVSM	-	Reduced vertical separation minima
SI	-	International System of Units
SICASP	-	Secondary Surveillance Radar Improvements and Collision Avoidance Systems Panel
TLS	-	Target level of safety
TVE	-	Total vertical error
UTC	-	Coordinated universal time
V_D	-	Design diving speed
VFR	-	Visual flight rules
VMC	-	Visual meteorological conditions
V_{S0}	-	Stalling speed or the minimum steady flight speed in the landing configuration
WXR	-	Weather

Symbols

°C	-	Degrees Celsius
%	-	Per cent

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PUBLICATIONS *(referred to in this Part)*

Convention on International Civil Aviation (Doc 7300)

International Regulations for Preventing Collisions at Sea European Organization for Civil Aviation Equipment (EUROCAE) Documents ED55 and ED56A

Policy and Guidance Material on the Economic Regulation of International Air Transport (Doc 9587)

Annexes to the Convention on International Civil Aviation:

Annex 1 — *Personnel Licensing*

Annex 2 — *Rules of the Air*

Annex 3 — *Meteorological Service for International Air Navigation*

Annex 5 — *Units of Measurement to be Used in Air and Ground Operations*

Annex 6 — *Operation of Aircraft*

Part I — *International Commercial Air Transport — Aeroplanes*

Part III — *International Operations — Helicopters*

Annex 8 — *Airworthiness of Aircraft*

Annex 10 — *Aeronautical Telecommunications*

Volume III (Part I — *Digital Data Communication Systems,* Part II — *Voice Communication Systems*)

Volume IV *(Surveillance Radar and Collision Avoidance Systems)*

Annex 11 — *Air Traffic Services*

Annex 12 — *Search and Rescue*

Annex 13 — *Aircraft Accident and Incident Investigation*

Annex 14 — *Aerodromes*

Volume I — *Aerodrome Design and Operations*

Annex 15 — *Aeronautical Information Services*

Annex 16 — *Environmental Protection*

Volume I — *Aircraft Noise*

Annex 18 — *The Safe Transport of Dangerous Goods by Air* Procedures for Air Navigation Services

OPS — Aircraft Operations (Doc 8168)

Volume I — *Flight Procedures*

Volume II — *Construction of Visual and Instrument Flight Procedures*

ATM — Air Traffic Management (Doc 4444)

Protocol Relating to an Amendment to the Convention on International Civil Aviation (*Article 83* bis) (Doc 9318)

Regional Supplementary Procedures (Doc 7030)

Manuals:

Accident/Incident Reporting Manual (ADREP Manual) (Doc 9156)

Airport Services Manual (Doc 9137)

Part 1 — *Rescue and Fire Fighting*

Part 8 — *Airport Operational Services*

Airworthiness Manual (Doc 9760)

Manual of Civil Aviation Medicine (Doc 8984)

Manual on Implementation of a 300 m (1000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574)

Manual on Required Communications Performance (RCP) (Doc 9869)

Manual on Required Navigation Performance (RNP) (Doc 9613)

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CHAPTER 1. - DEFINITIONS

When the following terms are used in this Part for the operation of aeroplanes in domestic and international general aviation, they have the following meanings:

Aerial work. An aircraft operation in which an aircraft is used for specialized services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial advertisement, etc.

Aerodrome. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome operating minima. The limits of usability of an aerodrome for:

a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;
b) landing in precision approach and landing operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the category of the operation;
c) landing in approach and landing operations with vertical guidance, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H); and
d) landing in non-precision approach and landing operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions.

Aeroplane. A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Alternate aerodrome. 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. An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

En-route alternate. An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition while en route.

Destination alternate. An alternate aerodrome to which an aircraft may proceed should it become either impossible or inadvisable to land at the aerodrome of intended landing.

Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.

Altimetry system error (ASE). The difference between the altitude indicated by the altimeter display, assuming a correct altimeter barometric setting, and the pressure altitude corresponding to the undisturbed ambient pressure.

Approach and landing operations using instrument approach procedures. Instrument approach and landing operations are classified as follows:

Non-precision approach and landing operations. An instrument approach and landing which utilizes lateral guidance but does not utilize vertical guidance.

Approach and landing operations with vertical guidance. An instrument approach and landing which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.

Precision approach and landing operations. An instrument approach and landing using precision lateral and vertical guidance with minima as determined by the category of operation.

Note.— Lateral and vertical guidance refers to the guidance provided either by:
a) a ground-based navigation aid; or
b) computer generated navigation data.

Categories of precision approach and landing operations:

Category I (CAT I) operation. A precision instrument approach and landing with a decision height not lower than 60 m (200 ft) and with either a visibility not less than 800 m or a runway visual range not less than 550 m.

Category II (CAT II) operation. A precision instrument approach and landing with a decision height lower than 60 m (200 ft), but not lower than 30 m (100 ft), and a runway visual range not less than 350 m.

Category IIIA (CAT IIIA) operation. A precision instrument approach and landing with:

a) a decision height lower than 30 m (100 ft) or no decision height; and
b) a runway visual range not less than 200 m.

Category IIIB (CAT IIIB) operation. A precision instrument approach and landing with:

a) a decision height lower than 15 m (50 ft) or no decision height; and
b) a runway visual range less than 200 m but not less than 50 m.

Category IIIC (CAT IIIC) operation. A precision instrument approach and landing with no decision height and no runway visual range limitations.

Note.— Where decision height (DH) and runway visual range (RVR) fall into different categories of operation, the instrument approach and landing operation would be conducted in accordance with the requirements of the most demanding category (e.g. an operation with a DH in the range of CAT IIIA but with an RVR in the range of CAT IIIB would be considered a CAT IIIB operation or an operation with a DH in the range of CAT II but with an RVR in the range of CAT I would be considered a CAT II operation).

Commercial air transport operation. An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

Dangerous goods. Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the Technical Instructions or which are classified according to those Instructions.
Note.— Dangerous goods are classified in BCAR Part 18 and ICAO Annex 18, Chapter 3.

DCA. Department of Civil Aviation in Bhutan.

Decision altitude (DA) or ***decision height (DH)***. A specified altitude or height in the precision approach or approach with vertical guidance at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.
Note 1.— Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.
Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In Category III operations with a decision height the required visual reference is that specified for the particular procedure and operation.
Note 3.— For convenience where both expressions are used they may be written in the form "decision altitude/height" and abbreviated "DA/H".

Emergency locator transmitter (ELT). A generic term describing equipment which broadcast distinctive signals on designated frequencies and, depending on application, may be automatically activated by impact or be manually activated. An ELT may be any of the following:

Automatic fixed ELT (ELT(AF)). An automatically activated ELT which is permanently attached to an aircraft.

Automatic portable ELT (ELT(AP)). An automatically activated ELT which is rigidly attached to an aircraft but readily removable from the aircraft.

Automatic deployable ELT (ELT(AD)). An ELT which is rigidly attached to an aircraft and which is automatically deployed and activated by impact, and, in some cases, also by hydrostatic sensors. Manual deployment is also provided.

Survival ELT (ELT(S)). An ELT which is removable from an aircraft, stowed so as to facilitate its ready use in an emergency, and manually activated by survivors.

Flight crew member. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Flight manual. A manual, associated with the certificate of airworthiness, containing limitations within which the aircraft is to be considered airworthy, and instructions and information necessary to the flight crew members for the safe operation of the aircraft.

Flight plan. Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

Flight recorder. Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

Flight time — aeroplanes. 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.

Note.— Flight time as here defined is synonymous with the term "block to block" time or "chock to chock" time in general usage which is measured from the time an aeroplane first moves for the purpose of taking off until it finally stops at the end of the flight.

General aviation operation. An aircraft operation other than a commercial air transport operation or an aerial work operation.

Instrument meteorological conditions (IMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling*, less than the minima specified for visual meteorological conditions.

Note.— The specified minima for visual meteorological conditions are contained in BCAR Part 4 and Chapter 4 of ICAO Annex 2.

Maintenance. The performance of tasks required to ensure the continuing airworthiness of an aircraft, including any one or combination of overhaul, inspection, replacement, defect rectification, and the embodiment of a modification or repair.

Maintenance programme. A document which describes the specific scheduled maintenance tasks and their frequency of completion and related procedures, such as a reliability programme, necessary for the safe operation of those aircraft to which it applies.

Maintenance release. A document which contains a certification confirming that the maintenance work to which it relates has been completed in a satisfactory manner, either in accordance with the approved data and the procedures described in the maintenance organization's procedures manual or under an equivalent system.

Meteorological information. Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.

Minimum descent altitude (MDA) or ***minimum descent height (MDH).*** A specified altitude or height in a non-precision approach or circling approach below which descent must not be made without the required visual reference.

Note 1.— Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.

Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have

made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach the required visual reference is the runway environment.

Note 3.— For convenience when both expressions are used they may be written in the form "minimum descent altitude/height" and abbreviated "MDA/H".

Night. The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise, as may be prescribed by the appropriate authority.

Note.— Civil twilight ends in the evening when the centre of the sun's disc is 6 degrees below the horizon and begins in the morning when the centre of the sun's disc is 6 degrees below the horizon.

Obstacle clearance altitude (OCA) or ***obstacle clearance height (OCH).*** The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.

Note 1.— Obstacle clearance altitude is referenced to mean sea level and obstacle clearance height is referenced to the threshold elevation or in the case of non-precision approaches to the aerodrome elevation or the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. An obstacle clearance height for a circling approach is referenced to the aerodrome elevation.

Note 2.— For convenience when both expressions are used they may be written in the form "obstacle clearance altitude/height" and abbreviated "OCA/H".

Pilot-in-command. The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

Psychoactive substances. Alcohol, opioids, cannabinoids, sedatives and hypnotics, cocaine, other psychostimulants, hallucinogens, and volatile solvents, whereas coffee and tobacco are excluded.

Required communication performance (RCP). A statement of the performance requirements for operational communication in support of specific ATM functions.

Required communication performance type (RCP type). A label (e.g. RCP 240) that represents the values assigned to RCP parameters for communication transaction time, continuity, availability and integrity.

Repair. The restoration of an aeronautical product to an airworthy condition to ensure that the aircraft continues to comply with the design aspects of the appropriate airworthiness requirements used for the issuance of the type certificate for the respective aircraft type, after it has been damaged or subjected to wear.

Required navigation performance (RNP). A statement of the navigation performance necessary for operation within a defined airspace.

Note.— Navigation performance and requirements are defined for a particular RNP type and/or application.

RNP type. A containment value expressed as a distance in nautical miles from the intended position within which flights would be for at least 95 per cent of the total flying time.

Example.— RNP 4 represents a navigation accuracy of plus or minus 7.4 km (4 NM) on a 95 per cent containment basis.

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

State of Registry. The State on whose register the aircraft is entered.

Note.— In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in Policy and Guidance Material on the Economic Regulation of International Air Transport *(Doc 9587).*

Target level of safety (TLS). A generic term representing the level of risk which is considered acceptable in particular circumstances.

Total vertical error (TVE). The vertical geometric difference between the actual pressure altitude flown by an aircraft and its assigned pressure altitude (flight level).

Visual meteorological conditions (VMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling*, equal to or better than specified minima.
Note.— The specified minima are contained in BCAR Part 4 and Chapter 4 of ICAO Annex 2.

*As defined in Annex 2.

CHAPTER 2. APPLICABILITY

This Part is applicable to domestic and international general aviation operations with aeroplanes registered in Bhutan.

Note 1.— BCAR Part 6A is applicable to the operation of aeroplanes by operators authorized to conduct domestic and international commercial air transport operations.

Note 2.— BCAR Part 6C is applicable to domestic and international commercial air transport operations or international general aviation operations with helicopters.

CHAPTER 3. - GENERAL

3.1 The pilot-in-command shall comply with the relevant laws, regulations and procedures of the States in which the aeroplane is operated.

3.2 The pilot-in-command shall be responsible for the safety of all crew members, passengers and cargo on board when the doors are closed. The pilot-in-command shall also be responsible for the operation and safety of the aeroplane from the moment the aeroplane is ready to move for the purpose of taking off until the moment it finally comes to rest at the end of the flight and the engine(s) used as primary propulsion units are shut down.

3.3 If an emergency situation which endangers the safety of the aeroplane or persons necessitates the taking of action which involves a violation of local regulations or procedures, the pilot-in-command shall notify the appropriate local authority without delay. If required by the State in which the incident occurs, the pilot-in-command shall submit a report on any such violation to the appropriate authority of such State; in that event, the pilot-in-command shall also submit a copy of it to the DCA. Such reports shall be submitted as soon as possible and normally within ten days.

3.4 The pilot-in-command shall be responsible for notifying the nearest appropriate authority by the quickest available means of any accident involving the aeroplane resulting in serious injury or death of any person or substantial damage to the aeroplane or property.

Note.— A definition of the term "serious injury" is contained in BCAR Part 13 and ICAO Annex 13, and an explanation of the term "substantial damage" is given in the Accident/Incident Reporting Manual (ADREP Manual) *(Doc 9156).*

3.5 The pilot-in-command should have available on board the aeroplane essential information concerning the search and rescue services in the areas over which it is intended the aeroplane will be flown.

3.6 Dangerous goods.

Note 1.— Provisions for carriage of dangerous goods are contained in BCAR Part 18 and ICAO Annex 18.

Note 2.— Article 35 of the Convention refers to certain classes of cargo restrictions.

3.7 Use of psychoactive substances.

Note.— Provisions concerning the use of psychoactive substances are contained in BCAR Part 1 and ICAO Annex 1, 1.2.7 and BCAR Part 2 and ICAO Annex 2, 2.5.

CHAPTER 4. - FLIGHT PREPARATION AND IN-FLIGHT PROCEDURES

4.1 Adequacy of operating facilities

The pilot-in-command shall not commence a flight unless it has been ascertained by every reasonable means available that the ground and/or water areas and facilities available and directly required for such flight and for the safe operation of the aeroplane are adequate, including communication facilities and navigation aids.

Note.— "Reasonable means" in this paragraph is intended to denote the use, at the point of departure, of information available to the pilot-in-command either through official information published by the aeronautical information services or readily obtainable from other sources.

4.2 Aerodrome operating minima

The pilot-in-command shall not operate to or from an aerodrome using operating minima lower than those which may be established for that aerodrome by the State in which it is located, except with the specific approval of that State.

Note.— It is the practice in some States to declare, for flight planning purposes, higher minima for an aerodrome when nominated as an alternate, than for the same aerodrome when planned as that of intended landing.

4.3 Briefing

4.3.1 The pilot-in-command shall ensure that crew members and passengers are made familiar, by means of an oral briefing or by other means, with the location and the use of:

a) seat belts; and, as appropriate,
b) emergency exits;
c) life jackets;
d) oxygen dispensing equipment; and
e) other emergency equipment provided for individual use, including passenger emergency briefing cards.

4.3.2 The pilot-in-command shall ensure that all persons on board are aware of the location and general manner of use of the principal emergency equipment carried for collective use.

4.4 Aeroplane airworthiness and safety precautions

4.4.1 A flight shall not be commenced until the pilot-in-command is satisfied that:

a) the aeroplane is airworthy, duly registered and that appropriate certificates with respect thereto are aboard the aeroplane;
b) the instruments and equipment installed in the aeroplane are appropriate, taking into account the expected flight conditions;
c) any necessary maintenance has been performed in accordance with Chapter 8;
d) the mass of the aeroplane and centre of gravity location are such that the flight can be conducted safely, taking into account the flight conditions expected;
e) any load carried is properly distributed and safely secured; and
f) the aeroplane operating limitations, contained in the flight manual, or its equivalent, will not be exceeded.

4.4.2 The pilot-in-command should have sufficient information on climb performance with all engines operating to enable determination of the climb gradient that can be achieved during the departure phase for the existing take-off conditions and intended take-off technique.

4.5 Weather reports and forecasts

Before commencing a flight the pilot-in-command shall be familiar with all available meteorological information appropriate to the intended flight. Preparation for a flight away from the vicinity of the place of departure, and for every flight under the instrument flight rules, shall include:

1) a study of available current weather reports and forecasts; and
2) the planning of an alternative course of action to provide for the eventuality that the flight cannot be completed as planned, because of weather conditions.

Note.— The requirements for flight plans are contained in BCAR Part 2 and ICAO Annex 2 — Rules of the Air *and* Procedures for Air Navigation Services — Rules of the Air and Air Traffic Services *(PANS-ATM, Doc 4444).*

4.6 Limitations imposed by weather conditions

4.6.1 Flight in accordance with the visual flight rules

A flight, except one of purely local character in visual meteorological conditions, to be conducted in accordance with the visual flight rules shall not be commenced unless available current meteorological reports, or a combination of current reports and forecasts, indicate that the meteorological conditions along the route, or that part of the route to be flown under the visual flight rules, will, at the appropriate time, be such as to render compliance with these rules possible.

4.6.2 Flight in accordance with the instrument flight rules

4.6.2.1 *When a destination alternate aerodrome is required.* A flight to be conducted in accordance with the instrument flight rules shall not be commenced unless the available information indicates that conditions, at the aerodrome of intended landing and at least one destination alternate will, at the estimated time of arrival, be at or above the aerodrome operating minima.

4.6.2.2 *When no destination alternate aerodrome is required.* A flight to be conducted in accordance with the instrument flight rules to an aerodrome when no alternate aerodrome is required shall not be commenced unless:

a) a standard instrument approach procedure is prescribed for the aerodrome of intended landing; and
b) available current meteorological information indicates that the following meteorological conditions will exist from two hours before to two hours after the estimated time of arrival:
    1) a cloud base of at least 300 m (1000 ft) above the minimum associated with the instrument approach procedure; and

2) visibility of at least 5.5 km or of 4 km more than the minimum associated with the procedure.

4.6.3 Aerodrome operating minima

4.6.3.1 A flight shall not be continued towards the aerodrome of intended landing unless the latest available meteorological information indicates that conditions at that aerodrome, or at least one destination alternate aerodrome, will, at the estimated time of arrival, be at or above the specified aerodrome operating minima.

4.6.3.2 An instrument approach shall not be continued beyond the outer marker fix in case of precision approach, or below 300 m (1000 ft) above the aerodrome in case of non-precision approach, unless the reported visibility or controlling RVR is above the specified minimum.

4.6.3.3 If, after passing the outer marker fix in case of precision approach, or after descending below 300 m (1000 ft) above the aerodrome in case of non-precision approach, the reported visibility or controlling RVR falls below the specified minimum, the approach may be continued to DA/H or MDA/H. In any case, an aeroplane shall not continue its approach-to-land beyond a point at which the limits of the aerodrome operating minima would be infringed.

Note.— Controlling RVR means the reported values of one or more RVR reporting locations (touchdown, mid-point and stop-end) used to determine whether operating minima are or are not met. Where RVR is used, the controlling RVR is the touchdown RVR, unless otherwise specified by State criteria.

4.6.4 Flight in icing conditions

A flight to be operated in known or expected icing conditions shall not be commenced unless the aeroplane is certificated and equipped to cope with such conditions.

4.7 Destination alternate aerodromes

For a flight to be conducted in accordance with the instrument flight rules, at least one destination alternate aerodrome shall be selected and specified in the flight plan, unless:

a) the duration of the flight and the meteorological conditions prevailing are such that there is reasonable certainty that, at the estimated time of arrival at the aerodrome of intended landing, and for a reasonable period before and after such time, the approach and landing may be made under visual meteorological conditions; or
b) the aerodrome of intended landing is isolated and there is no suitable destination alternate aerodrome.

4.8 Fuel and oil supply

4.8.1 A flight shall not be commenced unless, taking into account both the meteorological conditions and any delays that are expected in flight, the aeroplane carries sufficient fuel and oil to ensure that it can safely complete the flight, and, as applicable, the following special provisions are complied with:

4.8.1.1 *Flight in accordance with the instrument flight rules.* At least sufficient fuel and oil shall be carried to allow the aeroplane:

a) *when, in accordance with the exception contained in 4.6.2.2, a destination alternate aerodrome is not required,* to fly to the aerodrome to which the flight is planned and thereafter for a period of 45 minutes; or
b) *when a destination alternate aerodrome is required,* to fly to the aerodrome to which the flight is planned, thence to an alternate aerodrome, and thereafter for a period of 45 minutes.

Note.— Nothing in 4.8 precludes amendment of a flight plan in flight in order to re-plan the flight to another aerodrome, provided that the requirements of 4.8 can be complied with from the point where the flight is re-planned.

4.9 Oxygen supply

The pilot-in-command shall ensure that breathing oxygen is available to crew members and passengers in sufficient quantities for all flights at such altitudes where a lack of oxygen might result in impairment of the faculties of crew members or harmfully affect passengers.

Note.— Guidance on the carriage and use of oxygen is given in Attachment B.

4.10 Use of oxygen

All flight crew members, when engaged in performing duties essential to the safe operation of an aeroplane in flight, shall use breathing oxygen continuously whenever the circumstances prevail for which its supply has been required in 4.9.

4.11 In-flight emergency instruction

In an emergency during flight, the pilot-in-command shall ensure that all persons on board are instructed in such emergency action as may be appropriate to the circumstances.

4.12 Weather reporting by pilots

When weather conditions likely to affect the safety of other aircraft are encountered, they should be reported as soon as possible.

4.13 Hazardous flight conditions

Hazardous flight conditions, other than those associated with meteorological conditions, encountered en route should be reported as soon as possible. The reports so rendered should give such details as may be pertinent to the safety of other aircraft.

4.14 Fitness of flight crew members

The pilot-in-command shall be responsible for ensuring that a flight:

a) will not be commenced if any flight crew member is incapacitated from performing duties by any cause such as injury, sickness, fatigue, the effects of alcohol or drugs; and
b) will not be continued beyond the nearest suitable aerodrome when flight crew members' capacity to perform functions is significantly reduced by impairment of faculties from causes such as fatigue, sickness, lack of oxygen.

4.15 Flight crew members at duty stations

4.15.1 Take-off and landing

All flight crew members required to be on flight deck duty shall be at their stations.

4.15.2 En route

All flight crew members required to be on flight deck duty shall remain at their stations except when their absence is necessary for the performance of duties in connection with the operation of the aeroplane, or for physiological needs.

4.15.3 Seat belts

All flight crew members shall keep their seat belts fastened when at their stations.

4.15.4 Safety harness

When safety harnesses are provided, any flight crew member occupying a pilot's seat should keep the safety harness fastened during the take-off and landing phases; all other flight crew members should keep their safety harnesses fastened during the take-off and landing phases unless the shoulder straps interfere with the performance of their duties, in which case the shoulder straps may be unfastened but the seat belt must remain fastened.

Note.— Safety harness includes shoulder strap(s) and a seat belt which may be used independently.

4.16 Instrument flight procedures

4.16.1 One or more instrument approach procedures designed in accordance with the classification of instrument approach and landing operations shall be approved and promulgated in Bhutan by the DCA to serve each instrument runway or aerodrome utilized for instrument flight operations.

4.16.2 All aeroplanes operated in accordance with instrument flight rules shall comply with the instrument flight procedures approved in Bhutan by the DCA.

Note 1.— Definitions for the classification of instrument approach and landing operations are in Chapter 1.

Note 2.— Information for pilots on flight procedure parameters and operational procedures is contained in PAN-SOPS, Volume I. Criteria for the construction of visual and instrument flight procedures are contained in PANS-OPS, Volume II. Obstacle clearance criteria and procedures used in certain States may differ from PANS-OPS, and knowledge of these differences is important for safety reasons.

4.17 Instruction — general

An aeroplane shall not be taxied on the movement area of an aerodrome unless the person at the controls:

a) has been duly authorized by the owner or in the case where it is leased the lessee, or a designated agent;
b) is fully competent to taxi the aeroplane;
c) is qualified to use the radio telephone if radio communications are required; and
d) has received instruction from a competent person in respect of aerodrome layout, and where appropriate, information on routes, signs, marking, lights, ATC signals and instructions, phraseology and procedures, and is able to conform to the operational standards required for safe aeroplane movement at the aerodrome.

4.18 Refuelling with passengers on board

4.18.1 An aeroplane should not be refuelled when passengers are embarking, on board or disembarking unless it is attended by the pilot-in-command or other qualified personnel ready to initiate and direct an evacuation of the aeroplane by the most practical and expeditious means available.

4.18.2 When refuelling with passengers embarking, on board or disembarking, two-way communications should be maintained by aeroplane intercommunications system or other suitable means between the ground crew supervising the refuelling and the pilot-in-command or other qualified personnel required by 4.18.1.

Note 1.— The provisions of 4.18.1 do not necessarily require the deployment of integral aeroplane stairs or the opening of emergency exits as a prerequisite to refuelling.

Note 2.— Provisions concerning aircraft refuelling are contained in BCAR Part 14 and ICAO Annex 14, Volume I and guidance on safe refuelling practices is contained in the Airport Services Manual *(Doc 9137), Parts 1 and 8.*

Note 3.— Additional precautions are required when refuelling with fuels other than aviation kerosene or when refuelling results in a mixture of aviation kerosene with other aviation turbine fuels, or when an open line is used.

CHAPTER 5. - AEROPLANE PERFORMANCE OPERATING LIMITATIONS

5.1 An aeroplane shall be operated:

a) in compliance with the terms of its airworthiness certificate or equivalent approved document;
b) within the operating limitations prescribed by the DCA; and
c) within the mass limitations imposed by compliance with the applicable noise certification Standards in ICAO Annex 16, Volume I, unless otherwise authorized, in exceptional circumstances for a certain aerodrome or a runway where there is no noise disturbance problem, by the competent authority of the State in which the aerodrome is situated.

5.2 Placards, listings, instrument markings, or combinations thereof, containing those operating limitations prescribed by the DCA for visual presentation, shall be displayed in the aeroplane.

Note.— The Standards of ICAO Annex 8 — Airworthiness of Aircraft, *Parts IIIA and IIIB, apply to all aeroplanes of over 5700 kg maximum certificated take-off mass intended for the carriage of passengers or cargo or mail in international air navigation.*

CHAPTER 6. - AEROPLANE INSTRUMENTS AND EQUIPMENT

Note.— Specifications for the provision of aeroplane communication and navigation equipment are contained in Chapter 7.

6.1 All aeroplanes on all flights

6.1.1 General

In addition to the minimum equipment necessary for the issuance of a certificate of airworthiness, the instruments, equipment and flight documents prescribed in the following paragraphs shall be installed or carried, as appropriate, in aeroplanes according to the aeroplane used and to the circumstances under which the flight is to be conducted. The prescribed instruments and equipment, including their installation, shall be approved or accepted by the DCA.

6.1.2 Instruments

An aeroplane shall be equipped with instruments which will enable the flight crew to control the flight path of the aeroplane, carry out any required procedural manoeuvre, and observe the operating limitations of the aeroplane in the expected operating conditions.

6.1.3 Equipment

6.1.3.1 All aeroplanes on all flights.

6.1.3.1.1 All aeroplanes on all flights shall be equipped with:

a) an accessible first-aid kit;
b) portable fire extinguishers of a type which, when discharged, will not cause dangerous contamination of the air within the aeroplane. At least one shall be located in:
   1) the pilot's compartment; and
   2) each passenger compartment that is separate from the pilot's compartment and not readily accessible to the pilot or co-pilot;
c) 1) a seat or berth for each person aged 2 years or more; and
   2) a seat belt for each seat and restraining belts for each berth;
d) the following manuals, charts and information:
   1) the flight manual or other documents or information concerning any operating limitations prescribed for the aeroplane by the DCA, required for the application of Chapter 5;

2) current and suitable charts for the route of the proposed flight and all routes along which it is reasonable to expect that the flight may be diverted;
3) procedures, as prescribed in BCAR Part 2 and ICAO Annex 2, for pilots-in-command of intercepted aircraft; and
4) visual signals for use by intercepting and intercepted aircraft, as contained in BCAR Part 2 and ICAO Annex 2;

e) spare electrical fuses of appropriate ratings for replacement of those accessible in flight.

6.1.3.1.2 All aeroplanes on all flights should be equipped with the ground-air signal codes for search and rescue purposes.

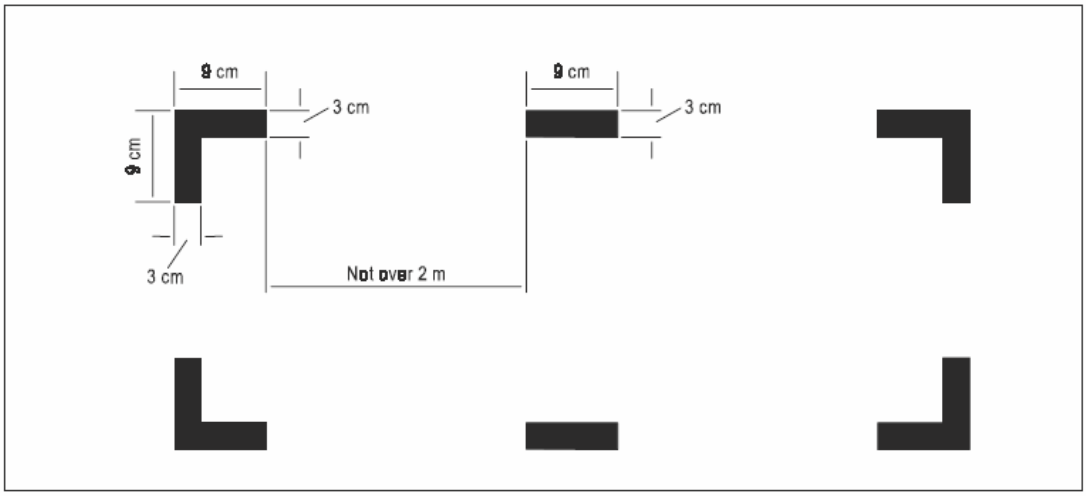
6.1.3.1.3 All aeroplanes on all flights should be equipped with a safety harness for each flight crew member seat.
Note.— Safety harness includes shoulder strap(s) and a seat belt which may be used independently.

6.1.4 Marking of break-in points

6.1.4.1 If areas of the fuselage suitable for break-in by rescue crews in an emergency are marked on an aeroplane, such areas shall be marked as shown below (see figure following). The colour of the markings shall be red or yellow, and if necessary they shall be outlined in white to contrast with the background.

6.1.4.2 If the corner markings are more than 2 m apart, intermediate lines 9 cm x 3 cm shall be inserted so that there is no more than 2 m between adjacent markings.

Note.— This Standard does not require any aeroplane to have break-in areas.



MARKING OF BREAK-IN POINTS (see 6.1.4)

6.2 All aeroplanes operated as VFR flights

6.2.1 All aeroplanes when operated as VFR flights shall be equipped with:
a) a magnetic compass;
b) an accurate timepiece indicating the time in hours, minutes and seconds;
c) a sensitive pressure altimeter;
d) an airspeed indicator; and
e) such additional instruments or equipment as may be prescribed by the appropriate authority.

6.2.2 VFR flights which are operated as controlled flights should be equipped in accordance with 6.6.

6.3 All aeroplanes on flights over water

6.3.1 Seaplanes

All seaplanes for all flights shall be equipped with:

a) one life jacket, or equivalent individual floatation device, for each person on board, stowed in a position readily accessible from the seat or berth;
b) equipment for making the sound signals prescribed in the International Regulations for Preventing Collisions at Sea, where applicable;
c) one anchor;
d) one sea anchor (drogue), when necessary to assist in manoeuvring.

Note.— "Seaplanes" includes amphibians operated as seaplanes.

6.3.2 Landplanes

6.3.2.1 Single-engined aeroplanes.

All single-engined landplanes when flying en route over water beyond gliding distance from the shore should carry one life jacket or equivalent individual floatation device for each person on board, stowed in a position easily accessible from the seat or berth of the person for whose use it is provided.

Note.— "Landplanes" includes amphibians operated as landplanes.

6.3.3 All aeroplanes on extended flights over water

All aeroplanes when operated on extended flights over water shall be equipped with:

a) when the aeroplane may be over water at a distance of more than 93 km (50 NM) away from land suitable for making an emergency landing:
— one life jacket or equivalent individual floatation device for each person on board, stowed in a position easily accessible from the seat or berth of the person for whose use it is provided;
b) when over water away from land suitable for making an emergency landing at a distance of more than 185 km (100 NM), in the case of single-engined aeroplanes, and more than 370 km (200 NM), in the case of multi-engined aeroplanes capable of continuing flight with one engine inoperative:
1) life-saving rafts in sufficient numbers to carry all persons on board, stowed so as to facilitate their ready use in emergency, provided with such lifesaving equipment including means of sustaining life as is appropriate to the flight to be undertaken; and
2) equipment for making the pyrotechnical distress signals described in BCAR Part 2 and ICAO Annex 2.

6.4 All aeroplanes on flights over designated land areas

Aeroplanes when operated across land areas which have been designated by the State concerned as areas in which search and rescue would be especially difficult shall be equipped with such signalling devices and life-saving equipment (including means of sustaining life) as may be appropriate to the area overflown.

6.5 All aeroplanes on high altitude flights

6.5.1 All aeroplanes intended to be operated at high altitudes shall be equipped with oxygen storage and dispensing apparatus capable of storing and dispensing the oxygen supplies required in 4.9.

6.5.2 Aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1990

Pressurized aeroplanes intended to be operated at flight altitudes at which the atmospheric pressure is less than 376 hPa shall be equipped with a device to provide positive warning to the flight crew of any dangerous loss of pressurization.

6.5.3 Aeroplanes for which the individual certificate of airworthiness is first issued before 1 January 1990

Pressurized aeroplanes intended to be operated at flight altitudes at which the atmospheric pressure is less than 376 hPa should be equipped with a device to provide positive warning to the flight crew of any dangerous loss of pressurization.

6.6 All aeroplanes operated in accordance with the instrument flight rules

All aeroplanes when operated in accordance with the instrument flight rules or when the aeroplane cannot be maintained in a desired attitude without reference to one or more flight instruments, shall be equipped with:

a) a magnetic compass;
b) an accurate timepiece indicating the time in hours, minutes and seconds;
c) a sensitive pressure altimeter;
Note.— Due to the long history of misreadings, the use of drum-pointer altimeters is not recommended.
d) an airspeed indicating system with a means of preventing malfunctioning due to either condensation or icing;
e) a turn and slip indicator;
f) an attitude indicator (artificial horizon);
g) a heading indicator (directional gyroscope);
Note.— The requirements of e), f) and g), 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.
h) means of indicating whether the supply of power to the gyroscopic instruments is adequate;
i) a means of indicating in the flight crew compartment the outside air temperature;
j) a rate-of-climb and descent indicator; and
k) such additional instruments or equipment as may be prescribed by the appropriate authority.

6.7 All aeroplanes when operated at night

All aeroplanes, when operated at night, shall be equipped with:

a) all the equipment specified in 6.6;
b) the lights required by ICAO Annex 2 for aircraft in flight or operating on the movement area of an aerodrome;
Note.— Specifications for lights meeting the requirements of BCAR Part 2 and ICAO Annex 2 for navigation lights are contained in the Appendix. The general characteristics of lights are specified in BCAR Part 8 and ICAO Annex 8. Detailed specifications for lights meeting the requirements of BCAR Part 2 and ICAO Annex 2 for aircraft in flight or operating on the movement area of an aerodrome are contained in the Airworthiness Manual *(Doc 9760).*
c) a landing light;
d) illumination for all flight instruments and equipment that are essential for the safe operation of the aeroplane;
e) lights in all passenger compartments; and
f) an electric torch for each crew member station.

6.8 All aeroplanes complying with the noise certification Standards in ICAO Annex 16, Volume I

An aeroplane shall carry a document attesting noise certification.

Note.— The attestation may be contained in any document, carried on board, approved by the DCA.

6.9 Aeroplanes required to be equipped with ground proximity warning systems (GPWS)

6.9.1 Intentionally left blank.

6.9.2 From 1 January 2007, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 kg or authorized to carry more than nine passengers, shall be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.9.3 All turbine-engined aeroplanes of a maximum certificated take-off mass of 5700 kg or less and authorized to carry more than five but not more than nine passengers should be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.9.4 All piston-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 kg or authorized to carry more than nine passengers should be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

6.9.5 A ground proximity warning system shall provide automatically a timely and distinctive warning to the flight crew when the aeroplane is in potentially hazardous proximity to the earth's surface.

6.9.6 A ground proximity warning system shall provide, as a minimum, warnings of at least the following circumstances:

a) excessive descent rate;
b) excessive altitude loss after take-off or go-around; and
c) unsafe terrain clearance.

6.10 Flight recorders

Note 1.— Flight recorders comprise two systems, a flight data recorder and a cockpit voice recorder.

Note 2.— Combination recorders (FDR/CVR) can only be used to meet the flight recorder equipage requirements as specifically indicated in this Part.

Note 3.— Detailed guidance on flight recorders is contained in Attachment A.

6.10.1 Flight data recorders — types

6.10.1.1 A Type I flight data recorder shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation.

6.10.1.2 A Type II flight data recorder shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power and configuration of lift and drag devices.

6.10.1.3 The use of engraving metal foil flight data recorders is not permitted.

6.10.1.4 The use of analogue flight data recorders using frequency modulation (FM) should not be permitted.

6.10.1.4.1 The use of photographic film flight data recorders is not permitted.

6.10.1.5 Intentionally left blank.

6.10.1.5.1 All aeroplanes which utilize data link communications and are required to carry a CVR, shall record on a flight recorder, all data link communications to and from the aeroplane. The minimum recording duration shall be equal to the duration of the CVR, and shall be correlated to the recorded cockpit audio.

6.10.1.5.2 Sufficient information to derive the content of the data link communications message, and, whenever practical, the time the message was displayed to or generated by the crew shall be recorded.

Note.— Data link communications include, but are not limited to, automatic dependent surveillance — contract (ADS-C), controller-pilot data link communications (CPDLC), data link-flight information services (D-FIS) and aeronautical operational control (AOC) messages.

6.10.1.6 All aeroplanes of a maximum certificated take-off mass over 5700 kg, required to be equipped with a flight data recorder and a cockpit voice recorder, may alternatively be equipped with two combination recorders (FDR/CVR).

6.10.1.7 A Type IA flight data recorder shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation. The parameters that satisfy the requirements for a Type IA flight data recorder are listed in the paragraphs below. The parameters without an asterisk (*) are mandatory parameters which shall be recorded. In addition, the parameters designated by an asterisk (*) shall be recorded if an information data source for the parameter is used by aeroplane systems or the flight crew to operate the aeroplane.

6.10.1.7.1 The following parameters satisfy the requirements for flight path and speed:
- Pressure altitude
- Indicated airspeed or calibrated airspeed
- Air – ground status and each landing gear air-ground sensor when practicable
- Total or outside air temperature
- Heading (primary flight crew reference)
- Normal acceleration
- Lateral acceleration
- Longitudinal acceleration (body axis)
- Time or relative time count
- Navigation data*: drift angle, wind speed, wind direction, latitude/longitude
- Groundspeed*
- Radio altitude*

6.10.1.7.2 The following parameters satisfy the requirements for attitude:
- Pitch attitude
- Roll attitude
- Yaw or sideslip angle*
- Angle of attack*

6.10.1.7.3 The following parameters satisfy the requirements for engine power:
- Engine thrust/power: propulsive thrust/power on each engine, cockpit thrust/power lever position
- Thrust reverse status*
- Engine thrust command*
- Engine thrust target*
- Engine bleed valve position*
- Additional engine parameters*: EPR, N1, indicated vibration level, N2, EGT, TLA, fuel flow, fuel cut-off lever position, N3

6.10.1.7.4 The following parameters satisfy the requirements for configuration:
- Pitch trim surface position
- Flaps*: trailing edge flap position, cockpit control selection

– Slats*: leading edge flap (slat) position, cockpit control selection
– Landing gear*: landing gear, gear selector position
– Yaw trim surface position*
– Roll trim surface position*
– Cockpit trim control input position pitch*
– Cockpit trim control input position roll*
– Cockpit trim control input position yaw*
– Ground spoiler and speed brake*: ground spoiler position, ground spoiler selection, speed brake position, speed brake selection
– De-icing and/or anti-icing systems selection*
– Hydraulic pressure (each system)*
– Fuel quantity*
– AC electrical bus status*
– DC electrical bus status*
– APU bleed valve position*
– Computed centre of gravity*

6.10.1.7.5 The following parameters satisfy the requirements for operation:
– Warnings
– Primary flight control surface and primary flight control pilot input: pitch axis, roll axis, yaw axis
– Marker beacon passage
– Each navigation receiver frequency selection
– Manual radio transmission keying and CVR/FDR synchronization reference
– Autopilot/autothrottle/AFCS mode and engagement status*
– Selected barometric setting*: pilot, first officer
– Selected altitude (all pilot selectable modes of operation)*
– Selected speed (all pilot selectable modes of operation)*
– Selected mach (all pilot selectable modes of operation)*
– Selected vertical speed (all pilot selectable modes of operation)*
– Selected heading (all pilot selectable modes of operation)*
– Selected flight path (all pilot selectable modes of operation)*: course/DSTRK, path angle
– Selected decision height*
– EFIS display format*: pilot, first officer
– Multi-function/engine/alerts display format*
– GPWS/TAWS/GCAS status*: selection of terrain display mode including pop-up display status, terrain alerts, both cautions and warnings, and advisories, on/off switch position
– Low pressure warning*: hydraulic pressure, pneumatic pressure
– Computer failure*
– Loss of cabin pressure*
– TCAS/ACAS (traffic alert and collision avoidance system/airborne collision avoidance system)*
– Ice detection*
– Engine warning each engine vibration*
– Engine warning each engine over temperature*
– Engine warning each engine oil pressure low*
– Engine warning each engine over speed*
– Wind shear warning*
– Operational stall protection, stick shaker and pusher activation*
– All cockpit flight control input forces*: control wheel, control column, rudder pedal cockpit input forces
– Vertical deviation*: ILS glide path, MLS elevation, GNSS approach path
– Horizontal deviation*: ILS localizer, MLS azimuth, GNSS approach path

– DME 1 and 2 distances*
– Primary navigation system reference*: GNSS, INS, VOR/DME, MLS, Loran C, ILS
– Brakes*: left and right brake pressure, left and right brake pedal position
– Date*
– Event marker*
– Head up display in use*
– Para visual display on*

Note 1.— Parameter requirements, including range, sampling, accuracy and resolution, as contained in the Minimum Operational Performance Specification (MOPS) document for Flight Recorder Systems of the European Organization for Civil Aviation Equipment (EUROCAE) or equivalent documents.

Note 2.— The number of parameters to be recorded will depend on aeroplane complexity. Parameters without an (*) are to be recorded regardless of aeroplane complexity. Those parameters designated by an (*) are to be recorded if an information source for the parameter is used by aeroplane systems and/or flight crew to operate the aeroplane.

6.10.2 Flight data recorders — duration Types I and II flight data recorders shall be capable of retaining the information recorded during at least the last 25 hours of their operation.

6.10.3 Flight data recorders — aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1989

6.10.3.1 All aeroplanes of a maximum certificated take-off mass of over 27000 kg shall be equipped with a Type I flight data recorder.

6.10.3.2 All aeroplanes of a maximum certificated take-off mass of over 5700 kg up to and including 27000 kg should be equipped with a Type II flight data recorder.

6.10.4 Flight data recorders — aeroplanes for which the individual certificate of airworthiness is first issued after 1 January 2005

All aeroplanes of a maximum certificated take-off mass of over 5700 kg shall be equipped with a Type IA flight data recorder.

6.10.5 Cockpit voice recorders — aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1987

Note.— Cockpit voice recorder performance requirements are as contained in the Minimum Operational Performance Specifications (MOPS) document for Flight Recorder Systems of the European Organization for Civil Aviation Equipment (EUROCAE) or equivalent documents.

6.10.5.1 All aeroplanes of a maximum certificated take-off mass of over 27000 kg shall be equipped with a cockpit voice recorder, the objective of which is the recording of the aural environment on the flight deck during flight time.

6.10.5.2 All aeroplanes of a maximum certificated take-off mass of over 5700 kg up to and including 27000 kg should be equipped with a cockpit voice recorder, the objective of which is the recording of the aural environment on the flight deck during flight time.

6.10.6 Cockpit voice recorders — duration

6.10.6.1 A cockpit voice recorder shall be capable of retaining the information recorded during at least the last 30 minutes of its operation.

6.10.6.2 A cockpit voice recorder, installed in aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1990, should be capable of retaining the information recorded during at least the last two hours of its operation.

6.10.6.3 A cockpit voice recorder, installed in aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the individual certificate of airworthiness is first issued after

1 January 2003, shall be capable of retaining the information recorded during at least the last two hours of its operation.

6.10.7 Flight recorders — construction and installation

Flight recorders shall be constructed, located and installed so as to provide maximum practical protection for the recordings in order that the recorded information may be preserved, recovered and transcribed. Flight recorders shall meet the prescribed crashworthiness and fire protection specifications.

Note. — Industry crashworthiness and fire protection specifications can be found in documents such as the European Organization for Civil Aviation Equipment (EUROCAE) documents ED55 and ED56A.

6.10.8 Flight recorders — operation

6.10.8.1 Flight recorders shall not be switched off during flight time.

6.10.8.2 To preserve flight recorder records, flight recorders shall be de-activated upon completion of flight time following an accident or incident. The flight recorders shall not be re-activated before their disposition as determined in accordance with BCAR Part 13 and ICAO Annex 13.

Note 1.— The need for removal of the flight recorder records from the aircraft will be determined by the investigation authority in the State conducting the investigation with due regard to the seriousness of an occurrence and the circumstances, including the impact on the operation.

Note 2.— The pilot-in-command's responsibilities regarding the retention of flight recorder records are contained in 6.10.9.

6.10.9 Flight recorder records

The pilot-in-command shall ensure, to the extent possible, in the event the aeroplane becomes involved in an accident or incident, the preservation of all related flight recorder records, and if necessary the associated flight recorders, and their retention in safe custody pending their disposition as determined in accordance with BCAR Part 13 and ICAO Annex 13.

6.10.10 Flight recorders — continued serviceability

Operational checks and evaluations of recordings from the flight data and cockpit voice recorder systems shall be conducted to ensure the continued serviceability of the recorders.

Note.— Procedures for the inspections of the flight data and cockpit voice recorder systems are given in Attachment A.

6.11 Mach number indicator

All aeroplanes with speed limitations expressed in terms of Mach number shall be equipped with a Mach number indicator.

Note.— This does not preclude the use of the airspeed indicator to derive Mach number for ATS purposes.

6.12 Emergency locator transmitter (ELT)

Applicable until 30 June 2008

6.12.1 All aeroplanes for which the individual certificate of airworthiness is first issued after 1 January 2002, operated on long-range over-water flights as described in 6.3.3 b) and when operated on flights over designated land areas as described in 6.4, shall be equipped with one automatic ELT.

6.12.2 All aeroplanes operated on extended flights over water as described in 6.3.3 b) and when operated on flights over designated land areas as described in 6.4 shall be equipped with one automatic ELT.

6.12.3 All aeroplanes should carry an automatic ELT.

6.12.4 ELT equipment carried to satisfy the requirements of 6.12.1, 6.12.2 and 6.12.3 shall operate in accordance with the relevant provisions of ICAO Annex 10, Volume III.

Applicable from 1 July 2008

6.12.5 All aeroplanes should carry an automatic ELT.

6.12.6 Except as provided for in 6.12.7, from 1 July 2008, all aeroplanes shall be equipped with at least one ELT of any type.

6.12.7 All aeroplanes for which the individual certificate of airworthiness is first issued after 1 July 2008 shall be equipped with at least one automatic ELT.

6.12.8 ELT equipment carried to satisfy the requirements of 6.12.5, 6.12.6 and 6.12.7 shall operate in accordance with the relevant provisions of ICAO Annex 10, Volume III.

Note.— The judicious choice of numbers of ELTs, their type and placement on aircraft and associated floatable life support systems will ensure the greatest chance of ELT activation in the event of an accident for aircraft operating over water or land, including areas especially difficult for search and rescue. Placement of transmitter units is a vital factor in ensuring optimal crash and fire protection. The placement of the control and switching devices (activation monitors) of automatic fixed ELTs and their associated operational procedures will also take into consideration the need for rapid detection of inadvertent activation and convenient manual switching by crew members.

6.13 Aeroplanes required to be equipped with a pressure-altitude reporting transponder

6.13.1 From 1 January 2003, unless exempted by the DCA, all aeroplanes shall be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provisions of ICAO Annex 10, Volume IV.

6.13.2 All aeroplanes should be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provisions of ICAO Annex 10, Volume IV.

Note.— The provisions in 6.13.1 and 6.13.2 are intended to support the effectiveness of ACAS as well as to improve the effectiveness of air traffic services. Effective dates for carriage requirements of ACAS are contained in ICAO Annex 6, Part I, 6.18.1 and 6.18.2. The intent is also for aircraft not equipped with pressure-altitude reporting transponders to be operated so as not to share airspace used by aircraft equipped with airborne collision avoidance systems. To this end, exemptions from the carriage requirement for pressure-altitude reporting transponders could be given by designating airspace where such carriage is not required.

6.14 Aeroplanes required to be equipped with an airborne collision avoidance system (ACAS II)

6.14.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15000 kg, or authorized to carry more than 30 passengers, for which the individual airworthiness certificate is first issued after 24 November 2005, should be equipped with an airborne collision avoidance system (ACAS II).

6.14.2 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15000 kg, or authorized to carry more than 30 passengers, for which the individual airworthiness certificate is first issued after 1 January 2007, shall be equipped with an airborne collision avoidance system (ACAS II).

6.14.3 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 kg but not exceeding 15000 kg, or authorized to carry more than 19 passengers, for

which the individual airworthiness certificate is first issued after 1 January 2008, should be equipped with an airborne collision avoidance system (ACAS II).

6.15 Microphones

All flight crew members required to be on flight deck duty should communicate through boom or throat microphones below the transition level/altitude.

CHAPTER 7. - AEROPLANE COMMUNICATION AND NAVIGATION EQUIPMENT

7.1 Communication equipment

7.1.1 An aeroplane to be operated in accordance with the instrument flight rules or at night shall be provided with radio communication equipment. Such equipment shall be capable of conducting two-way communication with those aeronautical stations and on those frequencies prescribed by the DCA.

Note.— The requirements of 7.1.1 are considered fulfilled if the ability to conduct the communications specified therein is established during radio propagation conditions which are normal for the route.

7.1.2 When compliance with 7.1.1 requires that more than one communication equipment unit be provided, each shall be independent of the other or others to the extent that a failure in any one will not result in failure of any other.

7.1.3 An aeroplane to be operated in accordance with the visual flight rules, but as a controlled flight, shall, unless exempted by the appropriate authority, be provided with radio communication equipment capable of conducting two-way communication at any time during flight with such aeronautical stations and on such frequencies as may be prescribed by the appropriate authority.

7.1.4 An aeroplane to be operated on a flight to which the provisions of 6.3.3 or 6.4 apply shall, unless exempted by the appropriate authority, be provided with radio communication equipment capable of conducting two-way communication at any time during flight with such aeronautical stations and on such frequencies as may be prescribed by the appropriate authority.

7.1.5 The radio communication equipment required in accordance with 7.1.1 to 7.1.4 shall provide for communication on the aeronautical emergency frequency 121.5 MHz.

7.1.6 For flights in defined portions of airspace or on routes where an RCP type has been prescribed, an aeroplane shall, in addition to the requirements specified in 7.1.1 to 7.1.5:

a) be provided with communication equipment which will enable it to operate in accordance with the prescribed RCP type(s); and
b) be authorized by the DCA for operations in such airspace.

Note.— Information on RCP and associated procedures, and guidance concerning the approval process, are contained in the Manual on Required Communications Performance (RCP*) (Doc 9869)*. This document also contains references to other documents produced by States and international bodies concerning communication systems and RCP.*

7.2 Navigation equipment

7.2.1 An aeroplane shall be provided with navigation equipment which will enable it to proceed:

a) in accordance with the flight plan; and
b) in accordance with the requirements of air traffic services;

except when, if not so precluded by the appropriate authority, navigation for flights under the visual flight rules is accomplished by visual reference to landmarks at least every 110 km (60 NM).

7.2.2 For flights in defined portions of airspace or on routes where an RNP type has been prescribed, an aeroplane shall, in addition to the requirements specified in 7.2.1:

a) be provided with navigation equipment which will enable it to operate in accordance with the prescribed RNP type(s); and

b) be authorized by the DCA for operations in such airspace.

Note.— Information on RNP and associated procedures, and guidance concerning the approval process, are contained in the Manual on Required Navigation Performance (RNP) *(Doc 9613). This document also contains a comprehensive list of references to other documents produced by States and international bodies concerning navigation systems and RNP.*

7.2.3 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, minimum navigation performance specifications (MNPS) are prescribed, an aeroplane shall be provided with navigation equipment which:

a) continuously provides indications to the flight crew of adherence to or departure from track to the required degree of accuracy at any point along that track; and

b) has been authorized by the DCA for MNPS operations concerned.

Note.— The prescribed minimum navigation performance specifications and the procedures governing their application are published in Regional Supplementary Procedures *(Doc 7030).*

7.2.4 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, a reduced vertical separation minimum (RVSM) of 300 m (1000 ft) is applied between FL 290 and FL 410 inclusive, an aeroplane:

a) shall be provided with equipment which is capable of:
   1) indicating to the flight crew the flight level being flown;
   2) automatically maintaining a selected flight level;
   3) 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
   4) automatically reporting pressure-altitude; and

b) shall be authorized by the DCA for operation in the airspace concerned.

7.2.5 Prior to granting the RVSM approval required in accordance with 7.2.4 b), the DCA shall be satisfied that:

a) the vertical navigation performance capability of the aeroplane satisfies the requirements specified in ICAO Appendix 2;

b) the operator has instituted appropriate procedures in respect of continued airworthiness (maintenance and repair) practices and programmes; and

c) the operator has instituted appropriate flight crew procedures for operations in RVSM airspace.

Note.— An RVSM approval is valid globally on the understanding that any operating procedures specific to a given region will be stated in the operations manual or appropriate crew guidance.

7.2.6 The DCA, shall ensure that, in respect of those aeroplanes mentioned in 7.2.4, adequate provisions exist for:

a) receiving the reports of height-keeping performance issued by the monitoring agencies established in accordance with ICAO Annex 11, 3.3.4.1; and

b) taking immediate corrective action for individual aircraft, or aircraft type groups, identified in such reports as not complying with the height-keeping requirements for operation in airspace where RVSM is applied.

7.2.7 Intentionally left blank.

7.2.8 The aeroplane shall be sufficiently provided with navigation equipment to ensure that, in the event of the failure of one item of equipment at any stage of the flight, the remaining equipment will enable the aeroplane to navigate in accordance with 7.2.1 and where applicable 7.2.2, 7.2.3 and 7.2.4.

Note 1.— This requirement may be met by means other than the duplication of equipment.
Note 2.— Guidance material relating to aircraft equipment necessary for flight in airspace where RVSM is applied is contained in the Manual on Implementation of a 300 m (1000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive *(Doc 9574).*

7.2.9 On flights in which it is intended to land in instrument meteorological conditions, an aeroplane shall be provided with radio equipment capable of receiving signals providing guidance to a point from which a visual landing can be effected. This equipment shall be capable of providing such guidance for each aerodrome at which it is intended to land in instrument meteorological conditions and for any designated alternate aerodromes.

*In preparation.

CHAPTER 8. - AEROPLANE MAINTENANCE

Note 1.— For the purpose of this chapter "aeroplane" includes: powerplants, propellers, components, accessories, instruments, equipment and apparatus including emergency equipment.
Note 2.— Guidance on continuing airworthiness requirements is contained in the Airworthiness Manual *(Doc 9760).*

8.1 Responsibilities

8.1.1 The owner of an aeroplane, or in the case where it is leased, the lessee, shall ensure that:

a) the aeroplane is maintained in an airworthy condition;
b) the operational and emergency equipment necessary for the intended flight is serviceable;
c) the Certificate of Airworthiness of the aeroplane remains valid; and
d) the maintenance of the aeroplane is performed in accordance with a maintenance programme acceptable to the DCA.

8.1.2 The aeroplane shall not be operated unless it is maintained and released to service under a system acceptable to the DCA.

8.1.3 When the maintenance release is not issued by an approved maintenance organization, the person signing the maintenance release shall be licensed in accordance with BCAR Part 1 and/or ICAO Annex 1.

8.2 Maintenance records

8.2.1 The owner shall ensure that the following records are kept for the periods mentioned in 8.2.2:

a) the total time in service (hours, calendar time and cycles, as appropriate) of the aeroplane and all life limited components;
b) the current status of compliance with all mandatory continuing airworthiness information;
c) appropriate details of modifications and repairs;
d) the time in service (hours, calendar time and cycles, as appropriate) since last overhaul of the aeroplane or its components subject to a mandatory overhaul life;
e) the current status of the aeroplane's compliance with the maintenance programme; and
f) the detailed maintenance records to show that all requirements for signing a maintenance release have been met.

8.2.2 The records referred to in 8.2.1 a) to e) shall be kept for a minimum period of 90 days after the unit to which they refer has been permanently withdrawn from service, and the records in 8.2.1 f) for a minimum period of one year after the signing of the maintenance release.

8.2.3 The lessee of an aeroplane shall comply with the requirements of 8.2.1 and 8.2.2, as applicable, while the aeroplane is leased.

Note.— Maintenance records or related documents, other than a valid certificate of airworthiness, need not be carried in the aeroplane during international flights.

8.3 Continuing airworthiness information

The owner of an aeroplane over 5700 kg maximum certificated take-off mass, or in the case where it is leased, the lessee, shall, as prescribed by the DCA, ensure that the information resulting from maintenance and operational experience with respect to continuing airworthiness, is transmitted as required by ICAO Annex 8, Part II, 4.2.3 f) and 4.2.4.

8.4 Modifications and repairs

All modifications and repairs shall comply with airworthiness requirements acceptable to the DCA. Procedures shall be established to ensure that the substantiating data supporting compliance with the airworthiness requirements are retained.

8.5 Maintenance release

8.5.1 A maintenance release shall be completed and signed, as prescribed by the DCA, to certify that the maintenance work performed has been completed satisfactorily.

8.5.2 A maintenance release shall contain a certification including:

a) basic details of the maintenance carried out;
b) date such maintenance was completed;
c) when applicable, the identity of the approved maintenance organization; and
d) the identity of the person or persons signing the release.

CHAPTER 9. - AEROPLANE FLIGHT CREW

9.1 Qualifications

9.1.1 The pilot-in-command shall ensure that the licences of each flight crew member have been issued or rendered valid by the DCA, and are properly rated and of current validity, and shall be satisfied that flight crew members have maintained competence.

Note.— Information for pilots on flight procedure parameters and operational procedures is contained in PANS-OPS, Volume I. Criteria for the construction of visual and instrument flight procedures are contained in PANS-OPS, Volume II. Obstacle clearance criteria and procedures used in certain States may differ from PANS-OPS, and knowledge of these differences is important for safety reasons.

9.1.2 The pilot-in-command of an aeroplane equipped with an airborne collision avoidance system (ACAS II) shall ensure that each flight crew member has been appropriately trained to competency in the use of ACAS II equipment and the avoidance of collisions.

Note 1.— Procedures for the use of ACAS II equipment are specified in PANS-OPS, *Volume I. ACAS II Training Guidelines for Pilots are provided in PANS-OPS, Volume I, Attachment A to Part VIII.*

Note 2.— Appropriate training, to the satisfaction of the DCA, to competency in the use of ACAS II equipment and the avoidance of collisions may be evidenced, for example, by:

a) possession of a type rating for an aeroplane equipped with ACAS II, where the operation and use of ACAS II are included in the training syllabus for the type rating; or

b) possession of a document issued by a training organization or person approved by the DCA to conduct training for pilots in the use of ACAS II, indicating that the holder has been trained in accordance with the guidelines referred to in Note 1; or

c) a comprehensive pre-flight briefing by a pilot who has been trained in the use of ACAS II in accordance with the guidelines referred to in Note 1.

9.2 Composition of the flight crew

The number and composition of the flight crew shall not be less than that specified in the flight manual or other documents associated with the certificate of airworthiness.

APPENDIX 1. - LIGHTS TO BE DISPLAYED BY AEROPLANES

(Note.— See Chapter 6)

1. Terminology

When the following terms are used in this Appendix, they have the following meanings:

Angles of coverage.

a) Angle of coverage A is formed by two intersecting vertical planes making angles of 70 degrees to the right and 70 degrees to the left respectively, looking aft along the longitudinal axis to a vertical plane passing through the longitudinal axis.

b) Angle of coverage F is formed by two intersecting vertical planes making angles of 110 degrees to the right and 110 degrees to the left respectively, looking forward along the longitudinal axis to a vertical plane passing through the longitudinal axis.

c) Angle of coverage L is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the aeroplane, and the other 110 degrees to the left of the first, when looking forward along the longitudinal axis.

d) Angle of coverage R is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the aeroplane, and the other 110 degrees to the right of the first, when looking forward along the longitudinal axis.

Horizontal plane. The plane containing the longitudinal axis and perpendicular to the plane of symmetry of the aeroplane.

Longitudinal axis of the aeroplane. A selected axis parallel to the direction of flight at a normal cruising speed, and passing through the centre of gravity of the aeroplane.

Making way. An aeroplane on the surface of the water is ‘‘making way’’ when it is under way and has a velocity relative to the water.

Under command. An aeroplane on the surface of the water is ‘‘under command’’ when it is able to execute manoeuvres as required by the International Regulations for Preventing Collisions at Sea for the purpose of avoiding other vessels.

Under way. An aeroplane on the surface of the water is ‘‘under way’’ when it is not aground or moored to the ground or to any fixed object on the land or in the water.

Vertical planes. Planes perpendicular to the horizontal plane.

Visible. Visible on a dark night with a clear atmosphere.

2. Navigation lights to be displayed in the air

Note.— The lights specified herein are intended to meet the requirements of ICAO Annex 2 for navigation lights.

As illustrated in Figure 1, the following unobstructed navigation lights shall be displayed:

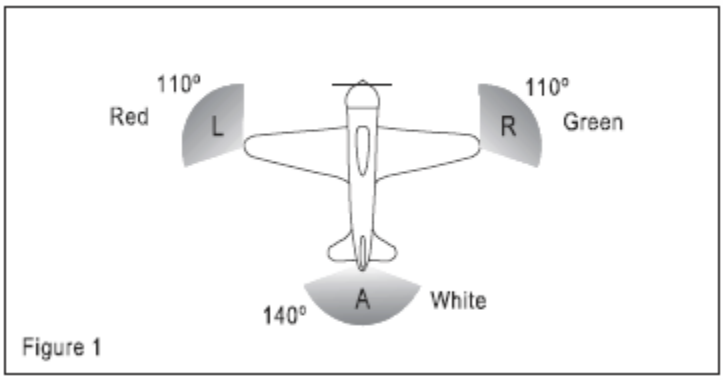


Figure 1

a) a red light projected above and below the horizontal plane through angle of coverage L;
b) a green light projected above and below the horizontal plane through angle of coverage R;
c) a white light projected above and below the horizontal plane rearward through angle of coverage A.

3. Lights to be displayed on the water

3.1 General

Note.— The lights specified herein are intended to meet the requirements of ICAO Annex 2 for lights to be displayed by aeroplanes on the water.

The International Regulations for Preventing Collisions at Sea require different lights to be displayed in each of the following circumstances:

a) when under way;
b) when towing another vessel or aeroplane;
c) when being towed;
d) when not under command and not making way;
e) when making way but not under command;
f) when at anchor;
g) when aground.

The lights required by aeroplanes in each case are described below.

3.2 When under way

As illustrated in Figure 2, the following appearing as steady unobstructed lights:

a) a red light projected above and below the horizontal through angle of coverage L;
b) a green light projected above and below the horizontal through angle of coverage R;
c) a white light projected above and below the horizontal through angle of coverage A; and
d) a white light projected through angle of coverage F.

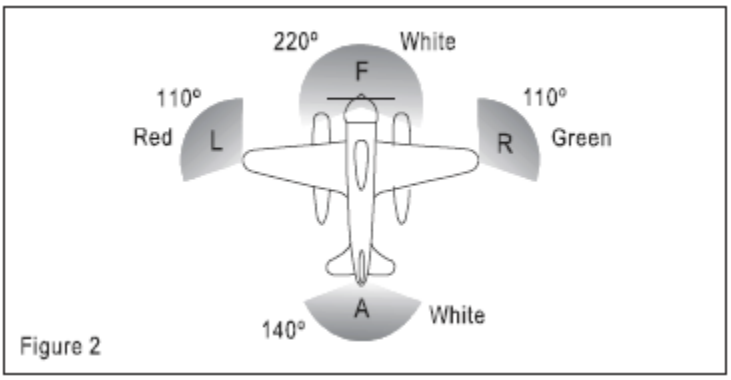


Figure 2

The lights described in a), b) and c) should be visible at a distance of at least 3.7 km (2 NM). The light described in d) should be visible at a distance of 9.3 km (5 NM) when fitted to an aeroplane of 20 m or more in length or visible at a distance of 5.6 km (3 NM) when fitted to an aeroplane of less than 20 m in length.

3.3 When towing another vessel or aeroplane

As illustrated in Figure 3, the following appearing as steady, unobstructed lights:

a) the lights described in 3.2;
b) a second light having the same characteristics as the light described in 3.2 d) and mounted in a vertical line at least 2 m above or below it; and
c) a yellow light having otherwise the same characteristics as the light described in 3.2 c) and mounted in a vertical line at least 2 m above it.

3.4 When being towed

The lights described in 3.2 a), b) and c) appearing as steady, unobstructed lights.

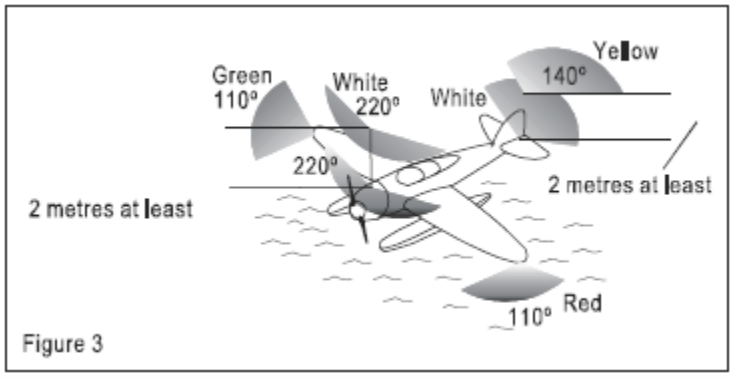


Figure 3

3.5 When not under command and not making way

As illustrated in Figure 4, two steady red lights placed where they can best be seen, one vertically over the other and not less than 1 m apart, and of such a character as to be visible all around the horizon at a distance of at least 3.7 km (2 NM).

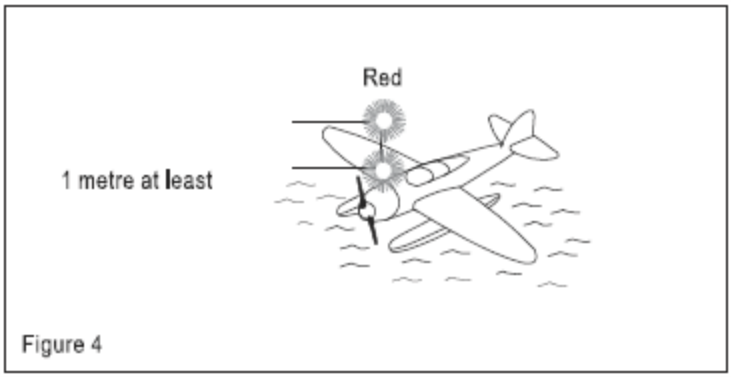


Figure 4

3.6 When making way but not under command

As illustrated in Figure 5, the lights described in 3.5 plus the lights described in 3.2 a), b) and c).

Note.— The display of lights prescribed in 3.5 and 3.6 is to be taken by other aircraft as signals that the aeroplane showing them is not under command and cannot therefore get out of the way. They are not signals of aero-planes in distress and requiring assistance.

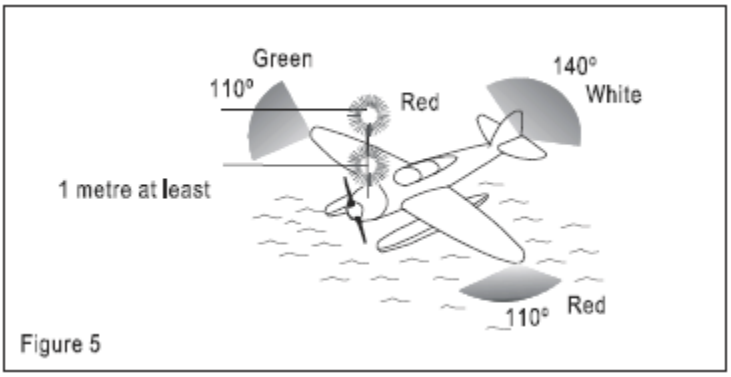


Figure 5

3.7 When at anchor

a) If less than 50 m in length, where it can best be seen, a steady white light (Figure 6), visible all around the horizon at a distance of at least 3.7 km (2 NM).

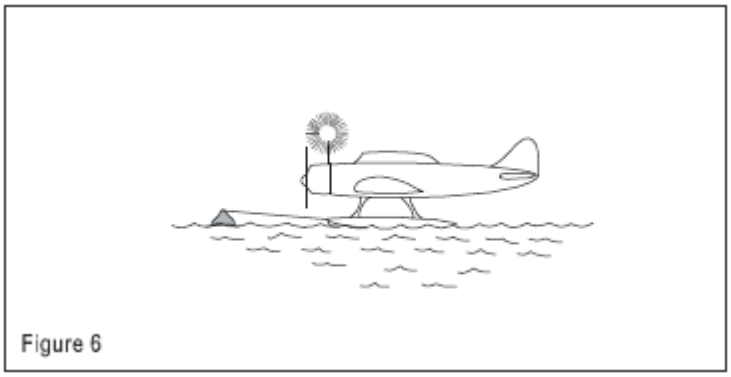


Figure 6

b) If 50 m or more in length, where they can best be seen, a steady white forward light and a steady white rear light (Figure 7) both visible all around the horizon at a distance of at least 5.6 km (3 NM).

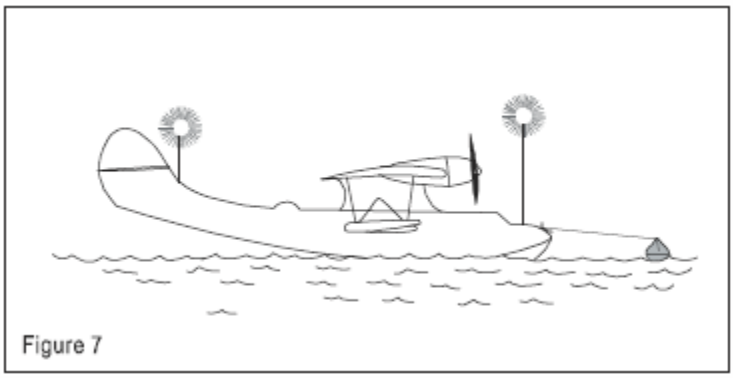


Figure 7

c) If 50 m or more in span a steady white light on each side (Figures 8 and 9) to indicate the maximum span and visible, so far as practicable, all around the horizon at a distance of at least 1.9 km (1 NM).

Less than 50 metres in length; 50 metres or more in span

Figure 8

50 metres or more in length; 50 metres or more in span

Figure 9

3.8 When aground

The lights prescribed in 3.7 and in addition two steady red lights in vertical line, at least 1 m apart so placed as to be visible all around the horizon.

APPENDIX 2. - ALTIMETRY SYSTEM PERFORMANCE REQUIREMENTS FOR OPERATIONS IN RVSM AIRSPACE

(Note.— See Chapter 7, 7.2.5)

1. In respect of groups of aeroplanes that are nominally of identical design and build with respect to all details that could influence the accuracy of height-keeping performance, the height-keeping performance capability shall be such that the total vertical error (TVE) for the group of aeroplanes shall have a mean no greater than 25 m (80 ft) in magnitude and shall have a standard deviation no greater than $28 - 0.013z^2$ for $0 \leq z \leq 25$ when z is the magnitude of the mean TVE in metres, or $92 - 0.004z^2$ for $0 \leq z \leq 80$ where z is in feet. In addition, the components of TVE shall have the following characteristics:

a) the mean altimetry system error (ASE) of the group shall not exceed 25 m (80 ft) in magnitude;

b) the sum of the absolute value of the mean ASE and of three standard deviations of ASE shall not exceed 75 m (245 ft); and

c) the differences between cleared flight level and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft), and in addition, the decrease in the frequency of differences with increasing difference magnitude shall be at least exponential.

2. In respect of aeroplanes for which the characteristics of the airframe and altimetry system fit are unique and so cannot be classified as belonging to a group of aeroplanes encompassed by paragraph 1, the height-keeping performance capability shall be such that the components of the TVE of the aeroplane have the following characteristics:

a) the ASE of the aeroplane shall not exceed 60 m (200 ft) in magnitude under all flight conditions; and

b) the differences between the cleared flight level and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft), and in addition, the decrease in the frequency of differences with increasing difference magnitude shall be at least exponential.

ATTACHMENT A. - FLIGHT RECORDERS

Supplementary to 6.10

Introduction

The material in this Attachment concerns flight recorders intended for installation in aeroplanes engaged in domestic and international air navigation. Flight recorders comprise two systems — a flight data recorder and a cockpit voice recorder. Flight data recorders are classified as Type I and Type II depending upon the number of parameters to be recorded.

1. Flight data recorder (FDR)

1.1 General requirements

1.1.1 The recorder is to record continuously during flight time.

1.1.2 The recorder container is to:

a) be painted a distinctive orange or yellow colour;

b) carry reflective material to facilitate its location; and

c) have securely attached an automatically activated underwater locating device.

1.1.3 The recorder is to be installed so that:

a) the probability of damage to the recording is minimized. To meet this requirement it should be located as far aft as practicable. In the case of pressurized aeroplanes it should be located in the vicinity of the rear pressure bulkhead;

b) it receives its electrical power from a bus that provides the maximum reliability for operation of the recorder without jeopardizing service to essential or emergency loads; and

c) there is an aural or visual means for pre-flight checking that the recorder is operating properly.

1.2 Parameters to be recorded

1.2.1 *Type I flight data recorder*. This recorder will be capable of recording, as appropriate to the aeroplane, at least the 32 parameters in Table A-1. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

1.2.2 *Type II flight data recorder*. This recorder will be capable of recording, as appropriate to the aeroplane, at least the first 15 parameters in Table A-1. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

1.3 Additional information

1.3.1 The measurement range, recording interval and accuracy of parameters on installed equipment is usually verified by methods approved by the appropriate certificating authority.

1.3.2 The manufacturer usually provides the national certificating authority with the following information in respect of the flight data recorder:

a) manufacturer's operating instructions, equipment limitations and installation procedures;

b) parameter origin or source and equations which relate counts to units of measurement; and

c) manufacturer's test reports.

1.3.3 Documentation concerning parameter allocation, conversion equations, periodic calibration and other serviceability/maintenance information should be maintained by the operator. The documentation must be sufficient to ensure that accident investigation authorities have the necessary information to read out the data in engineering units.

2. Cockpit voice recorder (CVR)

2.1 General requirements

2.1.1 The recorder is to be designed so that it will record at least the following:

a) voice communication transmitted from or received in the aeroplane by radio;

b) aural environment on the flight deck;

c) voice communication of flight crew members on the flight deck using the aeroplane's interphone system;

d) voice or audio signals identifying navigation or approach aids introduced in the headset or speaker;

e) voice communication of flight crew members using the passenger address system, if installed; and

f) digital communications with ATS, unless recorded by the flight data recorder.

2.1.2 The recorder container is to:

a) be painted a distinctive orange or yellow colour;

b) carry reflective material to facilitate its location; and

c) have securely attached an automatically activated underwater locating device.

2.1.3 To aid in voice and sound discrimination, microphones in the cockpit are to be located in the best position for recording voice communications originating at the pilot and co-pilot stations and voice communications of other crew members on the flight deck when directed to those stations. This can best be achieved by wiring suitable boom microphones to record continuously on separate channels.

2.1.4 The recorder is to be installed so that:

a) the probability of damage to the recording is minimized. To meet this requirement it should be located as far aft as practicable. In the case of pressurized aeroplanes it should be located in the vicinity of the rear pressure bulkhead;

b) it receives its electrical power from a bus that provides the maximum reliability for operation of the recorder without jeopardizing service to essential or emergency loads;

c) there is an aural or visual means for pre-flight checking of the recorder for proper operation; and

d) if the recorder has a bulk erasure device, the installation should be designed to prevent operation of the device during flight time or crash impact.

2.2 Performance requirements

2.2.1 The recorder will be capable of recording on at least four tracks simultaneously. To ensure accurate time correlation between tracks, the recorder is to record in an in-line format. If a bi-directional configuration is used, the in-line format and track allocation should be retained in both directions.

2.2.2 The preferred track allocation is as follows:

Track 1 — co-pilot headphones and live boom microphone

Track 2 — pilot headphones and live boom microphone

Track 3 — area microphone

Track 4 — time reference plus the third and fourth crew member's headphone and live microphone, if applicable.

Note 1.— Track 1 is located closest to the base of the recording head.
Note 2.— The preferred track allocation presumes use of current conventional magnetic tape transport mechanisms, and is specified because the outer edges of the tape have a higher risk of damage than the middle. It is not intended to preclude use of alternative recording media where such constraints may not apply.

2.2.3 The recorder, when tested by methods approved by the appropriate certificating authority, will be demonstrated to be suitable for the environmental extremes over which it is designed to operate.

2.2.4 Means will be provided for an accurate time correlation between the flight data recorder and the cockpit voice recorder.

Note.— One method of achieving this is by superimposing the FDR time signal on the CVR.

2.3 Additional information

2.3.1 The manufacturer usually provides the national certificating authority with the following information in respect of the cockpit voice recorder:

a) manufacturer's operating instructions, equipment limitations and installation procedures; and

b) manufacturer's test reports.

3. Inspections of flight data and cockpit voice recorder systems

3.1 Prior to the first flight of the day, the built-in test features on the flight deck for the CVR, FDR and Flight Data Acquisition Unit (FDAU), when installed, should be monitored.

3.2 Annual inspections should be carried out as follows:

a) the readout of the recorded data from the FDR and CVR should ensure that the recorder operates correctly for the nominal duration of the recording;

b) the analysis of the FDR should evaluate the quality of the recorded data to determine if the bit error rate is within acceptable limits and to determine the nature and distribution of the errors;

c) a complete flight from the FDR should be examined in engineering units to evaluate the validity of all recorded parameters. Particular attention should be given to parameters from sensors dedicated to the FDR. Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;

d) the readout facility should have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals;

e) an annual examination of the recorded signal on the CVR should be carried out by replay of the CVR recording. While installed in the aircraft the CVR should record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards; and

f) where practicable, during the annual examination, a sample of in-flight recordings of the CVR should be examined for evidence that the intelligibility of the signal is acceptable.

3.3 Flight recorder systems should be considered unserviceable if there is a significant period of poor quality data, unintelligible signals, or if one or more of the mandatory parameters is not recorded correctly.

3.4 A report of the annual inspection should be made available on request to the DCA for monitoring purposes.

3.5 Calibration of the FDR system:

a) the FDR system should be re-calibrated at least every five years to determine any discrepancies in the engineering conversion routines for the mandatory parameters, and to ensure that parameters are being recorded within the calibration tolerances; and

b) when the parameters of altitude and airspeed are provided by sensors that are dedicated to the FDR system, there should be a re-calibration performed as recommended by the sensor manufacturer, or at least every two years.

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Table A-1
Parameters for Flight Data Recorders

Serial number	Parameter	Measurement range	Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)
1	Time (UTC when available, otherwise elapsed time)	24 hours	4	±0.125% per hour
2	Pressure-altitude	–300 m (–1 000 ft) to maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)
3	Indicated airspeed	95 km/h (50 kt) to max V_{S0} *(Note 1)* V_{S0} to 1.2 V_D *(Note 2)*	1	±5% ±3%
4	Heading	360°	1	±2°
5	Normal acceleration	–3 g to +6 g	0.125	±1% of maximum range excluding datum error of ±5%
6	Pitch attitude	±75°	1	±2°
7	Roll attitude	±180°	1	±2°
8	Radio transmission keying	On-off (one discrete)	1	
9	Power on each engine *(Note 3)*	Full range	1 (per engine)	±2%
10	Trailing edge flap or cockpit control selection	Full range or each discrete position	2	±5% or as pilot's indicator
11	Leading edge flap or cockpit control selection	Full range or each discrete position	2	±5% or as pilot's indicator
12	Thrust reverser position	Stowed, in transit, and reverse	1 (per engine)	
13	Ground spoiler/speed brake selection	Full range or each discrete position	1	±2% unless higher accuracy uniquely required
14	Outside air temperature	Sensor range	2	±2°C
15	Autopilot/auto throttle/AFCS mode and engagement status	A suitable combination of discretes	1	
Note.— The preceding 15 parameters satisfy the requirements for a Type II FDR.				
16	Longitudinal acceleration	±1 g	0.25	±1.5% max range excluding datum error of ±5%
17	Lateral acceleration	±1 g	0.25	±1.5% max range excluding datum error of ±5%
18	Pilot input and/or control surface position-primary controls (pitch, roll, yaw) *(Note 4)*	Full range	1	±2° unless higher accuracy uniquely required
19	Pitch trim position	Full range	1	±3% unless higher accuracy uniquely required
20	Radio altitude	–6 m to 750 m (–20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)
21	Glide path deviation	Signal range	1	±3%
22	Localizer deviation	Signal range	1	±3%
23	Marker beacon passage	Discrete	1	
24	Master warning	Discrete	1	

Serial number	Parameter	Measurement range	Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)
25	NAV 1 and 2 frequency selection *(Note 5)*	Full range	4	As installed
26	DME 1 and 2 distance *(Notes 5 and 6)*	0 – 370 km	4	As installed
27	Landing gear squat switch status	Discrete	1	
28	GPWS (ground proximity warning system)	Discrete	1	
29	Angle of attack	Full range	0.5	As installed
30	Hydraulics, each system (low pressure)	Discrete	2	
31	Navigation data (latitude/longitude, ground speed and drift angle) *(Note 7)*	As installed	1	As installed
32	Landing gear or gear selector position	Discrete	4	As installed

Note.— The preceding 32 parameters satisfy the requirements for a Type I FDR.

Notes.—

1. V_{S_0} stalling speed or minimum steady flight speed in the landing configuration.
2. V_D design diving speed.
3. Record sufficient inputs to determine power.
4. For aeroplanes with conventional control systems "or" applies. For aeroplanes with non-mechanical control systems "and" applies. In aeroplanes with split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately.
5. If signal available in digital form.
6. Recording of latitude and longitude from INS or other navigation system is a preferred alternative.
7. If signals readily available.

If further recording capacity is available, recording of the following additional information should be considered:

a) operational information from electronic display systems, such as electronic flight instrument systems (EFIS), electronic centralized aircraft monitor (ECAM) and engine indication and crew alerting system (EICAS). Use the following order of priority:

   1) parameters selected by the flight crew relating to the desired flight path, e.g. barometric pressure setting, selected altitude, selected airspeed, decision height, and autoflight system engagement and mode indications if not recorded from another source;

   2) display system selection/status, e.g. SECTOR, PLAN, ROSE, NAV, WXR, COMPO-SITE, COPY, ETC.;

   3) warnings and alerts;

   4) the identity of displayed pages for emergency procedures and checklists;

b) retardation information including brake application for use in the investigation of landing overruns and rejected take-offs; and

c) additional engine parameters (EPR, N1, EGT, fuel flow, etc.).

ATTACHMENT B. - CARRIAGE AND USE OF OXYGEN

Supplementary to 4.9

Introduction

The performance of crew members and the well-being of passengers during flights at such altitudes where a lack of oxygen might result in impairment of faculties are of major concern. Research conducted in altitude chambers or by exposure to mountain elevations indicates that human tolerance could be related to the altitude concerned and the exposure time. The subject is dealt with in detail in the *Manual of Civil Aviation Medicine* (Doc 8984). In the light of the above and to further assist the pilot-in-command in providing the oxygen supply intended by 4.9 of this Part, the following guidelines, which take into account the requirements already established in ICAO Annex 6, Part I, are considered relevant.

1. Oxygen supply

1.1 A flight to be operated at altitudes at which the atmospheric pressure in personnel compartments will be less than 700 hPa should not be commenced unless sufficient stored breathing oxygen is carried to supply:

a) all crew members and at least 10 per cent of the passengers for any period in excess of 30 minutes that the pressure in compartments occupied by them will be between 700 hPa and 620 hPa; and

b) all crew members and passengers for any period that the atmospheric pressure in compartments occupied by them will be less than 620 hPa.

1.2 A flight to be operated with a pressurized aeroplane should not be commenced unless a sufficient quantity of stored breathing oxygen is carried to supply all crew members and passengers, as is appropriate to the circumstances of the flight being undertaken, in the event of loss of pressurization, for any period that the atmospheric pressure in any compartment occupied by them would be less than 700 hPa. In addition, when an aeroplane is operated at flight altitudes at which the atmospheric pressure is less than 376 hPa, or which, if operated at flight altitudes at which the atmospheric pressure is more than 376 hPa and cannot descend safely within four minutes to a flight altitude at which the atmospheric pressure is equal to 620 hPa, there shall be no less than a 10-minute supply for the occupants of the passenger compartment.

2. Use of oxygen

2.1 All flight crew members, when engaged in performing duties essential to the safe operation of an aeroplane in flight, should use breathing oxygen continuously whenever the circumstances prevail for which its supply has been indicated to be necessary in 1.1 or 1.2.

2.2 All flight crew members of pressurized aeroplanes operating above an altitude where the atmospheric pressure is less than 376 hPa should have available at the flight duty station a quick donning type of mask which will readily supply oxygen upon demand.

Note.— Approximate altitudes in the Standard Atmosphere corresponding to the values of absolute pressure used in the text are as follows:

Absolute pressure	Metres	Feet
700 hPa	*3 000*	*10 000*
620 hPa	*4 000*	*13 000*
376 hPa	*7 600*	*25 000*

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